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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

Pastoral Network Paper 11a

January 1981

NEWSLETTER

1. Together with this Newsletter I am sending you five other papers. Paper 11b, by Lucas Ayuko, is about organisation structures and ranches in Kenya. The Kenyan Government has, over many years, tried a number of different approaches to pastoral development and Ayuko's paper both records the history of some of these approaches and the thinking that lay behind them. Paper 11c, by Brendan Halpin, makes proposals for a new approach to the provision of animal health and related services to pastoral people. The approach, which in this paper is sketched only in principle and in outline, is already being implemented in some countries; for example on a small scale in some mountainous regions in Iran (See Pastoral Network Paper 3c para. 2.28), and in the range areas of Ethiopia using a cadre of "Veterinary Scouts" appointed by pastoral communities. I would be most grateful to anyone with actual experience of the type of schemes proposed in Halpin's paper if they would write a paper for the pastoral network about it.

2. Paper 11d is by Thadis Box and describes his impressions, after a short visit to China, of pastoralism in that country. I have been trying for some time to get an article on Chinese pastoralism from a Chinese source; the effort has, I hope only temporarily, run into the sands and I have pressed Thadis Box very hard to provide a note on his impressions instead. With reluctant modesty he has now done so. I would still like to get at least one further paper on Chinese pastoralism. See also paragraph 5 below.

3. In Paper 11e Sid Meadows and Judy White write on cattle herd structures in Kenya's pastoral rangelands and on the implications of these structures for the supply of young male cattle to the rest of the Kenya economy. Network members will remember an earlier network paper (7d) in which these two authors discussed the history of herd size and sales from the pastoral herd of Kajiado District in Kenya. In paper 11f Judy White discusses the paper (Pastoral Network 10c) by Alan Low on the estimation and interpretation of pastoralists' price responsiveness which was

sent out in Series 10.

4. Activities of the Network

In recent months I have been carrying out a (desk-bound, but overseas) review of World Bank livestock projects in Tropical Africa. As a consequence it has not been possible to organise any lunch-time meetings here in ODI. It is hoped to recommence these early in 1981.

5. Pastoralism in Centrally-Planned Central Asia

I am woefully ignorant on the subject of present-day pastoralism (i.e. livestock keeping under extensive conditions on natural forage) in the Central Asian areas of the USSR, Mongolia and China. The following represent the extent of my reading:

USSR

ILO 1967 Report on the interregional study tour and seminar on the sedentarisation of nomadic populations in the Soviet Socialist Republics of Kazakhastan and Kirgizia - Geneva - mimeographed.

FAO 1970 Group Fellowship Study Tour on Settlement in Agriculture of Nomadic, Semi Nomadic and Other Pastoral People Rome.

Wolfgang Weissleden (ed) 1978 The Nomadic Alternative, Mouton Publishers, The Hague, (papers by Monogarova and others).

USSR 1977 Integrated desert development and desertification control in the Turkmenian SSR (case study for the UN Conference on Desertification).

MONGOLIA

Humphrey C. 1978 "Pastoral nomadism in Mongolia; the role of herdsmen's cooperatives in a national economy" Development and Change Vol. 9 No. 1.

Rosenberberg D. 197- "Negdel Development:- sociocultural perspective" Mongolian Studies 197-.

FAO 1978 The Mongolian People's Republic Final Report (in the series for the International Scheme for the Coordination of Dairy Development and the International Meat Development Scheme). Unpublished report.

Lattimore O. 1962 Nomads and Commissars: Mongolia revisited Oxford University Press.

CHINA

China reconstructs Various articles in this monthly magazine.

China 1977 China: Control the Desert and Great Pastures Case study for the UN Conference on Desertification (Document A/Conf. 74/17).

China 1977 Harness the Sand and Transform the Gobi Case study for the UN Conference on Desertification (Document A/Conf.74/16).

I have spelled out the references in some detail in case some other investigator has not got even as far as I have, and would like

some help. I should be most grateful for any further references in English or French languages on the subject of pastoralism in these Central Asian countries - particularly on matters of land-use, animal management, organisations and institutions, marketing and consumption patterns.

6. Recent/forthcoming meetings

a) The IUAES Commission on Nomadic People, in collaboration with the Institute of Development Studies of Nairobi, held a conference on "The Future of Pastoral Peoples" in Nairobi for a week in early August 1980. There were about 60 participants, mainly social scientists, and some 25 papers were discussed. The proceedings are expected to be published under the auspices of IDRC Canada shortly.

b) The Third International Goat Conference will take place in Tuscon Arizona from 10th - 15th January 1982. All enquiries should go to Kent Leach, P.O. Box 1808, Scottsdale AZ 85252 U.S.A. Those wishing to present papers at the conference should submit titles and names of authors to Dr George F.W. Haenlein, Department of Animal Science, University of Delaware, Newark DE 19711 U.S.A. by 30 January 1981.

7. Recent forthcoming pastoral publications

The following recent/forthcoming publications appear to me to be of general importance with reference to pastoral development, either because of the width of their coverage or because they raise issues in a specific context which could profitably be raised in other pastoral contexts. The list below is not in any particular order.

a) Mark Pearson Settlement of Pastoral Nomads: a case study of the New Halfa Irrigation Scheme in Eastern Sudan, Development Studies Occasional Paper No 5, University of East Anglia (U.K.) 1980. About 60 pages.

b) Gunnar Haaland (ed) Problems of Savannah Development: the Sudan case, Department of Social Anthropology, Bergen, Occasional Paper No. 19, 1980. About 200 Pages, contains papers by Haaland (2), Abdel Ghaffar M. Ahmed, Mustafa Abdel Rahman Mustafa, Leif Manger, Mohammed H. Saeed and Abdel Rahman Abakar/David Pool (joint).

c) R.L.McCown, G.Haaland, and C.de Haan, "The Interaction between cultivation and livestock production in semi-arid Africa" in Ecological Studies Vol 34 (1979), pp 297-332.

d) Richard Hogg, "Pastoralism and Impoverishment: the case of the Isiolo Boran of Northern Kenya" Disasters Vol 4.3. (1980) pp 299-31

e) J. Bellakhdar "Medicine traditionelle et toxicologie ouest-sahariennes" Editions Techniques Nord-Africains, Rabat, 1978. About 360 pages.

f) Institute for Development Anthropology The Workshop on pastoralis and African Livestock Development Agency for International Developme (A.I.D.) Program Evaluation Report No.4, 1980. About 80 papers. This is the report of the Harper's Ferry Workshop which I reported in Pastoral Network Paper 9a, paragraph 2a.

g) ILCA (International Livestock Centre for Africa) ILCA Bulletin No. 4 June 1979. 12 pages. Contains sections on:- The world market for dairy projects; milk supply problems in Tropical Africa; milk production potential in the Highlands of East Africa.

h) ILCA ILCA Bulletin No.5, September 1979. 15 pages. Contains sections on:- the world market for beef and mutton; non-tariff barriers facing beef trade and their impact on exports from Tropical Africa; the Botswana Economy.

i) ILCA ILCA Bulletin No 6, December 1979. 19 pages. Contains sections on:- the potential of Tropical Africa in by products for animal feeds; the Nigerian economy agriculture and the livestock sector.

j) ILCA ILCA Bulletin No.7. March 1980. Contains sections on:- small ruminant production in the world; small ruminant production in Tropical Africa; the ILCA research programmes on small ruminants.

k) ILCA ILCA Bulletin No 8, June 1980. Issue dedicated to the report on a workshop on the design and implementation of pastoral development projects for Tropical Africa. Also available in French language edition.

l) Brian Spooner and Lee Horne (eds) "Cultural and ecological perspectives for the Turan program, Iran" Special edition of Expedition (University Museum Magazine of the University of Pennsylvania). Vol 22.3 (1980). About 50 pages. Seven articles report on a comprehensive interdisciplinary ecological research program in an area in north-east Iran vulnerable to desertification.

m) Stephen Sandford Keeping an Eye on TGLP, Working Paper No 31 of the National Institute of Development and Cultural Research (NIR) Botswana. About 80 pages. Discusses the main issues impeding the Botswana Government's Tribal Grazing Lands Policy (TGLP) and makes recommendations about research and monitoring in respect of the policy.

n) John Staatz The Economics of cattle and meat marketing in Ivory Coast Monograph 11 of the program on livestock production and marketing in the Entente States of West Africa, 1979. (Obtainable from US-AID, Bureau for Africa, Office of Development Resources (AFR/DR) New State Department Building, Washington DC, U.S.A.). About 590 pages. Also available in French language edition.

o) L. Herman The livestock and meat marketing system in Upper Volta; an evaluation of economic efficiency 1979. (Obtainable in the same way as (n) above). Also available in French language edition.

p) K. Shapiro (ed) Livestock production and marketing in the Entente States of West Africa: Summary Report* 1979 or 1980. (Obtainable in the same way as (n) above). Also in French edition.

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* This is an important document which summarises reports by Staatz and Herman mentioned at (n) and (o) above and by Delgado and Eddy mentioned at items (b) and (c) in paragraph 4 of Network Paper 10a. This is only the second recommendation about any publication that I have made in five years of this Network.

q) Raymond Crotty Cattle economics and development Commonwealth Agricultural Bureau, 1980. About 250 pages. "This book is concerned with the contribution of cattle (including buffaloes) to economic welfare and development. It is especially concerned with explaining the poor contribution of cattle to these objectives in less developed countries" (From the publisher's blurb).

r) Michael J. Casimir, R.P. Winter and Bernt Glantz "Nomadism and remote sensing: animal husbandry and the sage-brush community in a nomad area in western Afghanistan" Journal of Arid Environments (1980) 3, pp 231-254.

s) ILCA Trypanotolerant livestock in West and Central Africa (Vol. I General Study; Vol. II Country studies covering 18 countries). ILCA Monograph No. 2 1979.

t) P. PayIore and J.A. Mabbutt Desertification: World Bibliography update 1976-80 Office of Arid Lands Studies, University of Arizona. About 200 pages.

8. Other publications by Network Members

Network members frequently draw my attention to publications which they have written or in which they have been closely concerned but which do not fulfill the criteria set out at the start of paragraph 7. So far I have declined to mention such publications in these Newsletters. On a trial basis I now propose to alter this policy and to include in the newsletter (under the heading of this paragraph) such publications; this may be of service to both authors and potential readers among network members. If, however, too many publications appear eligible for this category I shall not be able to continue the service.

This list below is not in a particular order.

a) Albert Sasson "Development of Forest Resources in tropical regions" in Impact of Science on Society; Vol 30-3. 1980 pp 211-216.
b) Katsuyoshi Fukui and David Turton (eds) Warfare among East African Herders, Senri Ethnological Studies No.3, National Museum of Ethnology, Osaka, Japan, 1979. About 230 pages.
c) E.H.Gilbert, D.W.Norman, F.E.Winch Farming Systems Research: critical appraisal MSU (Michigan State University) Rural Developmen Paper No.6, 1980. About 140 pages.

9. Help Please - Evaluation of A.A.U.

In early 1981 the work of the ODI's Agricultural Administration Unit (of which I and the publication of the Pastoral Network are part) will be evaluated by an outside team. This evaluation will both look backwards at what we have done and forwards to what we should do and whether we should be funded to do it. It is possible that the evaluators may write to a sample of members of the Pastoral Network soliciting their views. I should be most grateful if Pastoral Network members approached in this way would reply speedily to the evaluators so that the views of network members can be taken into account in the evaluators' report.

10. Effective date of Newsletter

The effective date of this Newsletter is 5 December 1980.

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

Pastoral Network Paper 11b
January 1981

ORGANIZATION, STRUCTURES AND RANCHES IN KENYA[1/]

by

Lucas J. Ayuko[2/]

I INTRODUCTION

LIVESTOCK MANAGEMENT SYSTEMS

1.01 Livestock management systems in range areas of Kenya can be grouped under two broad headings: pastoral, which is subsistence oriented, and commercial, which is cash economy oriented. The grouping, however, is dependent to a large extent on land tenure and social custom.

1/ This paper was first presented at a workshop convened in February 1980 by the International Livestock Centre for Africa. The subject of the workshop was the design and implementation of pastoral development projects for Tropical Africa.

2/ Range Management Division, Ministry of Livestock Development, P O Box 68228, Nairobi.

The Pastoral System

1.02 It is generally accepted from historical events that until the beginning of the present century there had been a balance between land resources and livestock/wildlife numbers in the range areas. This balance was achieved through inherent traditional grazing systems (wet and dry season grazing) which (a) in very arid zones, do not follow any kind of periodic pattern and are as irregular as the rains themselves, (b) in tropical marginal zones, have seasonal rhythm - movements, often over long distances, which take place between zones with complementary climates, and (c) on mountain regions and their arid fringes, are restricted to areas with greatly differing climatic conditions which are found side by side at different altitudes.

1.03 However, in the 1940s it had become obvious that the balance had since been altered following improved animal health services and amiable relations between pastoral tribes. The shift in balance was reflected in the increased human population and livestock numbers resulting in overstocking, overgrazing and resource degradation. By 1945 it was obvious to the colonial administration that the only way to achieve some results in developing the pastoral sector of agriculture was to start with the land tenure problem. The task was entrusted to the African Land Development Organization (ALDEV) established in 1945. During the period 1946 to 1962, ALDEV emphasised settlement, reconditioning and utilisation of African land in the high potential areas. In range areas, it specifically established grazing fees per head of cattle to cover recurrent expenditure. The organization also established African District Council ranches on which immature steers were fattened. The ALDEV Board of 1962 recorded the following observation:

> "Finally, despite the developments which have taken place, there is enormous potential for agricultural production still undeveloped in the African lands. Probably less than 10% of the land is producing to full capacity. The energies of the independent Kenya of the future will have to be directed towards this huge developed potential, if the problems of ever-increasing population are to be solved."(1)

The Commercial System

1.04 This management system started with the European settlement in Kenya in 1902. The greater effort in agriculture at the time was, naturally, directed towards tropical plantation crops; they were capable of yielding quicker and more certain financial returns. A few farmers, however, began almost immediately experimenting with sheep and cattle. They soon encountered serious disease problems. These became more and more diverse as they were studied and researched, leading to the establishment of a Division of Veterinary Services around 1910 (Veterinary Department in 1938) to control the major epizootic diseases.

II REVIEW OF RANCH ORGANIZATION STRUCTURES

BACK TO THE LAND

2.01 With the coming of independence in 1963, the back-to-the-land philosophy started and *wananchi**were urged to go back to the land. To assist them large settlement schemes were started to resettle people from high-density population areas, and efforts were made to plan the present land use which, for range areas, necessitated the establishment of a range programme in 1966. The programme was to cover the existing commercial ranching lands (which had already been allocated on title and brought under development); the subsistence range lands, entrusted to local authorities (County Councils); and the unoccupied and unallocated state lands, mainly in Coast Province.

2.02 The Kenya Livestock Development Project of 1968 was the basis of the programme and it provided funds for the development and establishment of the various ranching organization structures; commercial, cooperative societies, company and individual ranches in the high-potential range areas, and group ranches and grazing blocks in pastoral areas.

2.03 It had been proven during the 1950s that a very good standard of farming could be built both in the high-potential and range areas. The government and people of independent Kenya had only to decide and agree on the standard to be maintained. Secondly, good land use was impossible without a considerable capital development through loans rather than grants, and without the good will of the people themselves, backed up by the use of legal sanctions. Thirdly, agricultural production, especially in the high-potential areas, had taken a great leap forward with the implementation of the Swynnerton plan in 1955, which entailed registration and consolidation of smallholdings, combined with a credit system and soil conservation.

PRE-INDEPENDENCE GRAZING SCHEMES AND RANCHES

2.04 Kenya has been rather fortunate in that it has had long-time experience with local structures for both commercial and subsistence livestock production. For example, sincere and concerted efforts were made by the government between 1946 and 1963 to bring about the development of the range resource. In Kajiado District, part of Masailand, more than £43,000 was spent on grazing schemes and over £800,000 on grazing schemes and demonstration ranches. One such demonstration ranch is discussed later in this paper.

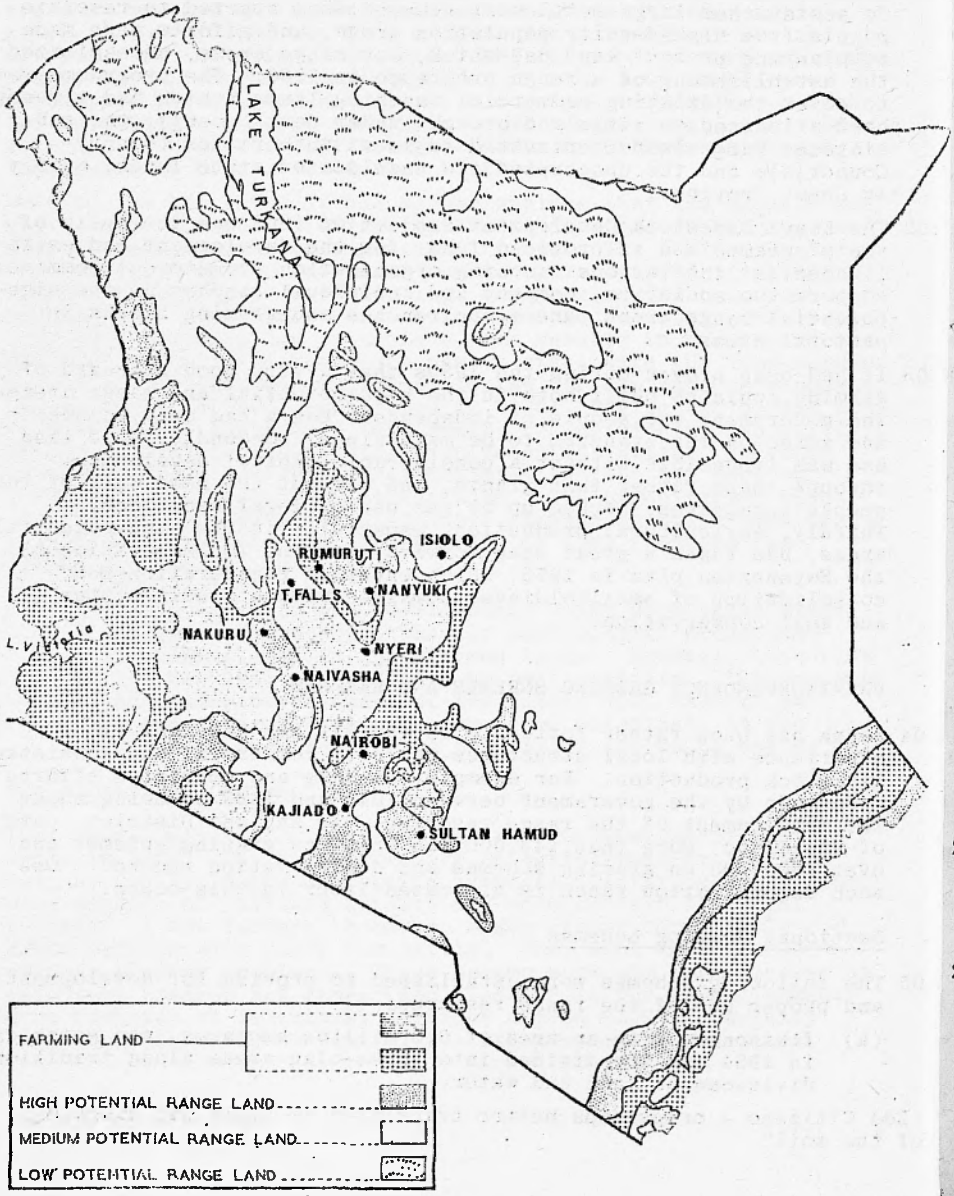
Sectional Grazing Schemes

2.05 The following schemes were established to provide for development and proper use of the range resource:

(a) Ilkisongo, with an area of 0.5 million hectares, was established in 1954 and sub-divided into three clan areas along traditional divisions of land and water.

* (Ed) Citizens - or perhaps better translated as "sons and daughters of the soil".

Map of Kenya showing Ecological classifications for Rangeland



Cartographic Unit — Range Management 1974

(b) Loodokilani, with an area of 0.8 million hectares, was established in 1959 and sub-divided into 10 grazing areas or blocks, but these did not conform to clan areas.

(c) Matapato, with an area of 0.4 million hectares, was established in 1957 and sub-divided into blocks.

A simple system of grazing management, based on the traditional movement of livestock between wet and dry weather areas was adapted for each area of block. The administration of each scheme was under the jurisdiction of a technical officer, assisted by a Grazing Committee of approximately 12 members selected from the elders within the scheme. Each committee member acted in a dual capacity as an advisor to the technical officer and as an official responsible for the enforcement of grazing regulations.

2.06 A special stock market was established for the schemes to provide a destocking outlet. But, although approximately 750 head of cattle passed through the market monthly, the records indicated that livestock numbers actually increased during the operation of the schemes.

Konza Demonstration Ranch

2.07 This 8,870 hectare unit was established in 1946. The objective was (a) to demonstrate the results of grazing management in improving the carrying capacity of the land and the productivity of the cattle, (b) to demonstrate improvement of stock by selection and breeding, and (c) to conduct experiments on pasture improvement. The management of the unit included: construction of a perimeter wire fence; drilling of three boreholes and installation of a dip; sub-division of the unit into four fenced paddocks; and spending of more than £13,000 in developing the unit. The requirements on the part of the ten families (settlers) of 90 persons, selected by the elders of the Section in 1949 and owning 1,400 head of cattle, were that they would dip their cattle weekly, give prophylactic inoculations, follow a rotational plan of grazing, and restrict livestock to the prescribed numbers. A manager was in residence on the ranch from the start until 1958.

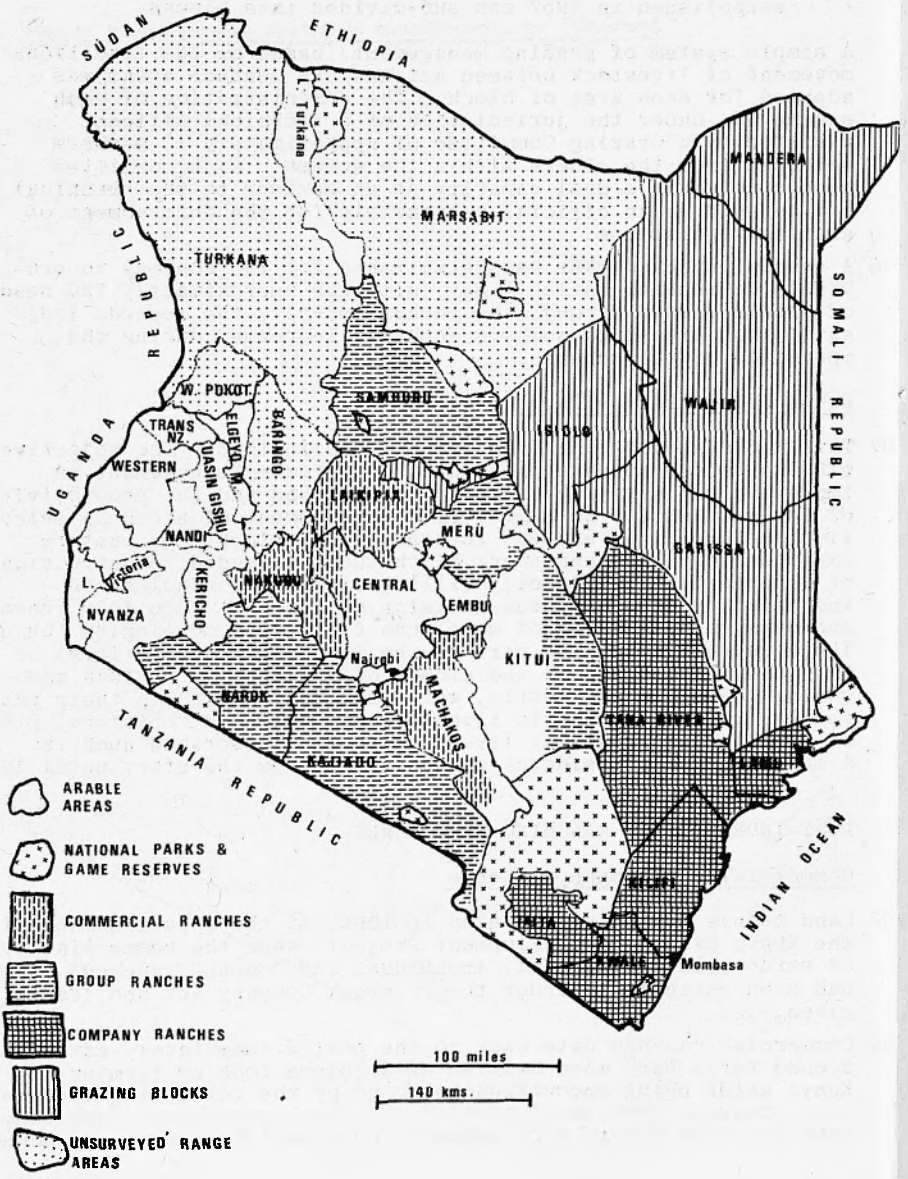
POST-INDEPENDENCE RANCHING STRUCTURES

Commercial and company ranches

2.08 Land tenure forms that existed in 1966, at the establishment of the Kenya Livestock Development Project, were the commercial type of structures (commercial, individual and company ranches). These had been established under the relevant Company Act and leases given.

2.09 Commercial ranches date back to the period immediately after the Second World War, when British ex-soldiers took up farming in Kenya after being encouraged to do so by the colonial government. They occupy a very small part of the total range area, but they have achieved a very high standard of animal husbandry and economy.

RANGE AND RANCH DEVELOPMENT AREAS



2.10 Company ranches are production enterprises in which land is leased from the government by a number of shareholders. Capital investment can be in the form of cattle (valued and cash is used to purchase shares) or cash. Assets are collectively owned, and management is by a paid ranch manager and ranch support staff. Shareholders elect a Board of Directors and they may also elect a Managing Director to work with the Manager. Membership is limited to 50 shareholders, thus excluding many people from participation in development. The form was selected for the more economically motivated livestock producers who are more readily agreeable to part with their livestock, are not willing to take part in the day-to-day operations of the ranch, and are, therefore, content to let paid management look after the business for them. A compromise later emerged in the form of a Directed (Agricultural) Company. The articles of association give a place on the Board of Directors to the local Range Officer, who has a veto in decision making. The share capital holding is limited to 20% per individual, but members can subscribe fractions of a single share so that many more than 50 shareholding individuals can become members.

Individual Ranch

2.11 At the same time that grazing schemes were being established in Masailand during the 1950s, there was also a growing trend in Kajiado district towards sub-division of the range resource into individual ranches and farms. In range areas, requests were for individual ranches of up to 800 hectares, and these were seen as appropriate enterprises to supplement the farming operations. For example, the first individual to be allocated such a ranch in 1956 operated his ranch so successfully, by keeping his livestock numbers within the acceptable carrying capacity, that during the drought in 1961, he suffered only a very small loss in his herd of 200 head compared to the drastic losses suffered by the ordinary Masai pastoralist.

Group Ranch

2.12 The pastoral societies, having been considered conservative and unwilling to lose the identity of their stock in cooperative society or company ranches, had to be provided with a new system of land title and ranch organization. The result was the evolution of the group ranch type of development. Group ranches are production enterprises in which a group of people who jointly have freehold title to land, collectively maintain agreed stocking levels, herd their livestock collectively and yet continue to own them as individuals. Membership in the group is based on kinship and traditional land rights. The objective is to establish a system which will allow the modernisation or modification of livestock husbandry and still preserve many of the features of the old traditional way of life, for obvious reasons: not to cause too great a break with the past, and so avoid social frictions and allow for the people's subsistence. An official Registrar of Group Representatives was appointed under the Land (Group Representatives)

Act 1968, and empowered to incorporate group ranches and generally regulate the whole group movement. The Representatives, made up of a Committee, undertakes the management of the ranch, employing paid managers as necessary, assisted by Ministry of Livestock range extension staff.

Cooperative Society Ranch

2.13 Whereas previously it had been assumed that a prerequisite to cooperative ranch development was the surrender of individual ownership of livestock to the corporate organization formed (be it a company or a cooperative society), it was later discovered that this condition was not mandatory. A cooperative society ranch could be formed and made responsible for negotiations for issue of leasehold tenure, development of the leasehold area, and provision of water and other facilities for its members, but not necessarily owning any livestock on its own account. It was, therefore, agreed that members of a cooperative society would be free to own and manage their individual herds under the overall supervision and within the broad policies of the elected ranch committee, and in turn the members would pay to the cooperative fees for water, dipping and other improvements on a per livestock head basis to enable loan repayments to be effected.

2.14 Thus, the concept of the Service Cooperative Society in the ranching sector came into being. It is worth noting that the Cooperative Societies which existed at that time were mainly crop and livestock by-products societies. They were mainly responsible for providing facilities for marketing of their individual members' products (e.g. milk, hides and skins, etc.). Livestock production cooperative societies were not yet in operation. Later, the concept of the Service Cooperative Society ranch was modified to enable it to operate under the Cooperative Society by-laws, and to enable ranch members to buy shares in the society thus removing from themselves the burden of herding their individual herds within the society if they did not wish to do so.

2.15 Cooperative society ranches date back to the early 1960s and are mainly concentrated in Machakos and Kitui District. They are run and managed according to the Cooperative Society by-laws and government Cooperative Officers have a lot of say on management, record keeping and accounts of the society. Membership is by the subscription of share capital, which varies from society to society, but the amount varies from about £1 to £50 per share. A relatively high capital contribution is sometimes necessary so that a member and his family can make their living from the society.

Grazing Block Development

2.16 In the more arid areas of the north, the formalization of occupancy was not accorded high priority, in spite of the

acknowledgement that there is a correlation between formal land tenure occupancy and more effective resource management. Because of the very arid nature of the ecology, resulting in productivity being confined largely to grazing systems based on nomadism, and livestock being restricted severely by the environment, range management units were of necessity to be more extensive, and certainly not less than 300,000 hectares in size. Thus the concept of grazing blocks development came into being. Grazing blocks are, therefore, production enterprises for the more arid range conditions in the Ecological Zone Six. The development of these areas is not through credit operations, but by direct grant investment. Development plans are based on pre-investment surveys, taking account of ecological, hydrological and economic criteria, including sociological studies. This approach, of establishing traditional pastoral areas where lack of any grouping between people and land prevents the establishment of useful development units through the process of land adjudication, was found to be more appropriate.

III PRE-DEVELOPMENT INFORMATION REQUIRED

PROBLEM ANALYSIS

3.01 The approach to the establishment of pastoral structures for livestock production should not be any different from the approach used to establish structures for commercial livestock production; the approach should start with detailed problem analysis of land potential and condition. Land-use planning should terminate with an acceptable land classification into ecological zones, and work with detailed ecological land-units, taking into consideration land potential and its present condition.

3.02 Consideration should also be given to the human factor; ethnic grouping, culture and social structure, and the existing land tenure and traditional land-use systems which are acceptable. The understanding of subsistence and the preferred diet will determine the system of livestock production and assist in determining the modifications necessary to the traditional grazing system, to meet the level of development planning required. The understanding of the social status that results from herd structure will assist in developing increased off-takes and markets. Land tenure will identify and confirm the rights of the people to their land, and land titles will serve as security against development loans and, in case of mismanagement, facilitate legal action that can be applied effectively.

3.02 Whereas pastoral tribes had been granted little security of tenure on their lands, high-potential areas had legislations which allowed the issue of title in the name of a registered

company or cooperative society. In Kenya, legislation was, therefore, enacted as a pre-development requirement to allow the adjudication of group rights and the issue of land title to "group representatives", as the previous legislation allowed the issue of titles only in the name of a registered company or cooperative society.

3.04 The next issue to be analysed concerns livestock and livestock marketing. Information on livestock distribution and herd composition (made up of goats, sheep, cattle and camels) is necessary for proper planning of livestock development programmes in pastoral areas. Marketing facilities will need to be adequate to move, quarantine, market, and process livestock in the numbers and time required. Secondly, the types and quantities of livestock supply must conform to demand. A decision has to be reached at a very early stage of planning the programme on whether the demand is for local or export market, or both.

3.05 The one single item that is very much in demand but lacking in range lands is adequate, drinkable water for both human beings and livestock. It is also the most expensive single item of development in range lands, because the level of potential for its development is very low; not very many sources capable of development are readily available, nor are the natural sources like permanent springs and rivers. Water development on most of the structures discussed above run at K£250,000 on average for a 20,000 hectare unit. Where surface water development potential is almost nil and planning has to be based on the development of underground water, the cost is even more prohibitive. The availability of developable water sites will also reflect on the range resource improvement practices; if the sites are few, livestock distribution will be poor, resulting in overgrazing of areas accessible to permanent watering points, and under-utilisation of areas inaccessible from water.

3.06 A different approach to planning livestock programmes will be needed in those countries with sizeable herds of wildlife. In this case, range lands have to cater for both livestock and wild ungulates. The planning takes into consideration such factors as carrying capacity of the wildlife population, their watering requirements, disease associated with wildlife, compensations for damages by wildlife etc. On the other hand, the planning could take into account the benefits which would accrue from the tourism industry (viewing and hunting) and by-products of wildlife harvesting. The ultimate objective is for the planning to assume a degree of compatibility between wildlife and livestock.

3.07 Lastly, information will also be required on sources and forms of finance and other inputs (education, communications and community requirements).

THE DEVELOPMENT PROGRAMME

3.08 The need for and availability of trained staff will necessitate the establishment of training programmes at all levels - formal and informal - to provide staff to implement the programme. This will require identification of sources and procurement of development finance. Few governments of developing countries have the capability for funding livestock development programmes. Substantial credit has therefore to be negotiated with international monetary organisations.

3.09 Pre-development surveys of the total resource is essential as these provide information to be used for the production of development plans for each development unit. Surveys could be either broad-scale land-use or detailed surveys, and could include data on human and livestock populations. To provide long-term monitoring of range conditions and trends, permanent study plots can be established in each of the main land units.

3.10 Implementation of the approved development programme should, as far as possible, be based on economic and ecological criteria; avoid the policy of compulsion with penalties for breach of management practices; be based, as much as possible, on advice and persuasion, together with demonstration of more efficient methods of resource management and stock husbandry; and be based on a structure with necessary powers to implement approved development plans, provide management expertise, and advise local people, committee members and other responsible leaders on how best to follow resource management plans.

3.11 Research is important but it should be adapted to the objectives of development. It could cover grassland ecology, grazing management, bush control, disease control, livestock improvement and wildlife management. As the implementation of the development programme progresses, research could be directed to the study of the effect of development as affected by environment, animals, human beings, and vegetation.

IV EXPERIENCES WITH RANCH ORGANIZATION STRUCTURES

CONSERVATISM OF PASTORALISTS

4.01 In the past, much emphasis was given to the alleged ultra-conservatism of the pastoral peoples; their reluctance to adapt to the social and economic changes taking place among their agricultural neighbours; their reluctance to adopt more sophisticated methods of animal husbandry; and their reluctance to sell their livestock.

4.02 While all the pastoral groups in Kenya may not be quickly responding to cultural change, the experience is that there

is now a general acceptance of dipping programmes, formal land tenure, the need to improve herds through purchase of better bulls and immature steers, planned sales of steers and some cull cows (especially among Masai), the need to count livestock, and, to some extent, acceptance of established quotas for the purpose of planning development and production potential, and acceptance of artificial insemination schemes.

4.03 According to Mol (2) "the idea of self-imposed, total isolation from the outside world is insupportable; and so is the notion that the Masai have no interest in modern technology ...". The experience is that whenever the technology is related to cattle and other livestock, which are still largely the basis of Masai economy and culture, the import is welcome. Disease control structures are well established in Masailand and the Masai themselves have helped to build them. Masai are adaptable, are by no means ultra-conservative, and definitely not rock solid against change in their centuries-old semi-nomadic pastoral lifestyle. It all depends on the form of change proposed, how the process of change is applied, when it is applied and to what age group, and what benefits the Masai will get out of it.

4.04 The politicians, some of them of Masai tribe, are urging an end to the moran 1/ system - the message is, there are no wars to be fought, no cattle to be rustled from neighbours and not much future for a warrior system, which is already dying of boredom. But the warrior system still remains part of Masai culture and society and they know that without an alternative to this system, they would probably lose almost everything - their identity, integrity, land and wealth (livestock). They have, therefore, learned to accept change, but strictly at their own pace and under their own control. They have learnt, sometimes through bitter experience, that when they are moved, as was done in 1904, the imposed change has rarely worked to their advantage; it almost inevitably amounts to loss of land, disruption of the cattle economy, and a threat to the security of existence of entire communities.

PASTORAL STRUCTURES

Group Ranches

4.05 According to Mol, for any development from outside the pastoral areas to be implemented with any chance of success, members of the development agency must understand some of the respective pastoral language and the traditional power structure within each division; the senior elders to consult, the individuals in the younger age groups (the present Masai age group is called *ilterekeyia*), who are generally more 'progressive' than the senior elders and are more likely to be persuasive and willing to accelerate change after they assume control. But even with

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1/ (Ed) The moran are the warrior grade within the Masai age-set system.

the *ilterekeyia* on the development agency's side, it is reckoned that the process of persuasion towards the objectives will still be slow, because the Masai are still cautious, apprehensive and circumspect in endless discussions when change is proposed. Of course, it happens eventually, but only if initiated and directed by the senior elders themselves, if they realise the advantages due to them as the result of development, and if the change does not entail a radical departure from the established culture of *il-oshon* (collective land ownership) to private holdings. The Masai word for group ranch is *olokeri* (a small thorn-fenced enclosure outside the family kraals) and a pen for calves and sick cattle is called *olekeri loo lasho*. Mol observes that "if the Masai had accepted the social concept of these ranches as permanent human settlements, they would have used words like *enkutoto* (a locality) or *elatia* (a neighbourhood) - it is not surprising that the Kenya government's major development initiative in Masailand - the formal demarcation of most of Masailand into individual and group-owned ranches - has run into difficulties"; e.g., shortage of funds, lack of management expertise on the ranches, cultural problems, and the general risk of the more sophisticated, more educated and more enterprising people benefiting at the expense of the Masai as the result of the sub-division of land into ranch units. He, however, notes with satisfaction that "the Masai responded more positively at first to the economic benefits of the ranch schemes ... the group ranches are a move in the right direction ... it is possible that they will eventually be fully accepted ... and that this will forestall the loss of further Masai land".

4.06 Interestingly enough, other experiences do not find the foregoing antagonistic nor contradictory to the government's major development initiative in pastoral Masailand. Firstly, the issue of the definition of a "group ranch" must have come up in the initial stages of planning the grazing schemes described earlier and during the establishment of group ranches. The social concept of the group ranch is very well emphasised by Pratt (3) that "the importance of the form of social organisation within the society cannot be over-emphasised. In particular, the identification of basic social groupings and their territorial rights is fundamental to the effective application of all control and development measures". The original planners of development in Masailand were definitely aware of the term *elatia* because "Kajiado Masailand comprises a number of 'Sections' which form distinct social and territorial units and which themselves can be divided into smaller units, or *elatia* ..."

4.07 Since the terms *olokeri* and *olekeri loo lasho* do not seem to have been used during the planning stage, it can be assumed that initial planners used the term *elatia*, as a matter of course, to mean group ranches. Also, "legislation was enacted to allow the adjudication of group rights and issue of land titles to 'group representatives' (a group being defined as a tribe, section, clan or family)". This would further support the point that "the social concept" of the ranches as permanent human settlements is equated with group ranches, and the term 'group' was not meant

to be anything else but *elatia*. After all, "the Masai responded more positively at first", not necessarily to the economic benefits of the ranch schemes, but to "the social concept of these ranches as permanent human settlements". Secondly, the problems or difficulties which were apparent soon after the scheme started, should be accepted as normal constraints in most developments and not seen as contradictions against group ranches. In this case, (a) funds were available but only for the priority areas which had already been surveyed and earmarked for initial development. It should be appreciated that, even if funds were available for the development of all the group units in Masailand, the necessity for pre-development planning would not have allowed the use of these funds simultaneously; (b) management expertise on the ranches was available in the form of seconded government technical officers and assistants. But ranch members, having chosen to care for their livestock individually, did not see the need for managers. They refused to release funds from ranch loans to be used to construct simple accommodation for management staff, or to be used to purchase transport, although funds had been approved and included in their loans for such items; (c) cultural problems have been difficult to overcome in the past but substantial changes are now taking place.

4.08 In another recent article in a local newspaper (4) by an independent observer, it is noted that (a) the idea of mixed farming is not taken seriously but again this is no longer resisted, (b) the Masai men and women are taking normal occupations alongside other Kenyan tribes, (c) big strides have been made during the past 15 years of Kenya's independence and the Masai have seen the benefit of keeping fewer healthier breed of cattle ... sales of livestock have now been a regular feature ... and several schools have been opened at central points.

4.09 Konza Demonstration ranch should have been a success, but it was not - at least not as far as the original objectives were concerned: (a) wire fences were rendered unserviceable by game animals and by 1955 the wire and posts had been removed, (b) the families refused to honour some of the commitments and particularly the one in respect of stock numbers; the cattle population increased from the original 1,400 to 2,300 head by 1954 and attempts to impose reductions were resisted and finally led to 4 families leaving the ranch with 666 head of their cattle. The remaining 6 families, having agreed at first not to exceed a maximum of 1,700 head, had increased their herds to 2,441 by 1958. Finally came the drought of 1961 which left the ground bare, forcing all the families to leave. The scheme was taken over by new members in 1964 and is now operated as a cooperative society ranch under the Kenya Livestock Development Project.

4.10 Nevertheless, Konza ranch made a real contribution to pastoral livestock production in the absence of past experiences, although it failed in its objective. The contribution which was brought into sharp focus, included the values and problems of permanent settlements, disease control, improved range and animal husbandry practices and their dependence on proper range

use. Perhaps the greatest experience was the futility of range development in the absence of enough pre-development information and lack of control over stock numbers. The lesson in fencing should also be obvious to anyone proposing heavy investments in fences in areas of heavy game concentration. Interestingly enough, despite all these experiences, some of the post-independence schemes continue to carry these scars of development.

4.11 Anthropologists and sociologists contend that insufficient attention was given to sociological considerations at the time of initial planning of development schemes. But the planners contend that possibly too great a reliance was placed on the outcome of the discussions between technical officers and Masai people when planning the schemes and group ranches. The politicians and other educated people (many of them Masai themselves) continued to lend their support to the programme - including land and group ranch registrations - giving encouragement to technical officers to proceed.

4.12 It would be fair to say that every consideration was given to features that would conform as nearly as possible to traditional grazing use when establishing the schemes. The major constraint then and now is still lack of effective control of livestock numbers but, although the schemes ceased to function in 1961 due to drought, they helped to plant "the seed of change" in the minds of Masai and greatly contributed to the change in their attitude during the change-over from grazing schemes to group ranches.

4.13 Historically, the Masai have displayed all the attributes of a typical pastoral society whose management systems have related exclusively to meeting their own subsistence requirements from the herds and flocks. This dependence on livestock by-products is considered the major reason for over-stocking and over-grazing in pastoral areas, including established group and individual ranches. In a study by Meadows and White (5), whose objective was "to gain an impression of whether non-traditional foods were becoming important in Masai diet", it was found that there have, in recent years, been innovations which inevitably will have some impact on management attitudes of the pastoral people. The group ranch programme is encouraging sedentarisation and with it some realisation that each group's range resource is finite. Sahiwal bulls have been introduced in some parts of the country and specifically on organised ranches, which has led to much improved milk yields. Another point relates to commercial sales of cattle from Kajiado district. In the early 1950s, sales were very low, actually less than 5,000 head of cattle per year. In 1950 offtake was still low at less than 1% but, because of government involvement with group ranches in Masailand, the offtake rose to 4.5% between 1966 and 1972, and to 8% (51,000 head per year) between 1973-77.[1/]

1/ It is not possible to be precise about the extent to which the rises to 4.5% and 8% were because of government involvement with group ranches.

4.14 Finally, the cash expenditure and cash needs of the Masai in the district are encouraging. In 1977, a total of K£568,750 was spent on foodstuffs (maize meal, sugar, rice, tea, fats and oils, and salt) and a total of K£1,089,000 on drinks (soft drinks and beer). In analysis the Masai spent K£24 per head on purchased items of food and drink in 1977 (K£8.25 on food and K£15.79 on drinks).

Grazing Blocks

4.15 The Grazing Block Development programme includes demarcation of large units which are sub-divided for grazing management purposes and development of appropriate firebreaks (also used as roads) and watering facilities using grant money. It has so far lowered stock mortality rates, increased milk production, and produced awareness in the local people to appreciate organised grazing systems to conserve both grazing and water. Extension officers, in response to livestock owners' awareness, have established stock registers to monitor changes in stock numbers, stock ownership, and herd composition in each grazing block, and the producers have also agreed to meet the cost of operation and maintenance of water facilities.

Commercial Structures

4.16 These do not necessarily specialise in beef production, as there are also dairy herds on some of the ranches based on imported blood, especially of Ayrshire and Friesian. Some ranches have sheep flocks as well as cattle; meat breeds or Merinos for wool, and land is also cropped on a small scale and occasionally irrigated for arable production; cereals and fodder crops. The basic cattle management system includes running animals in herds of up to 250 head according to age and sex; fencing land on better ranches into paddocks of 200-400 hectares, each paddock having permanent watering facilities, rotational grazing which leads to more uniform utilisation of the grass, control of bush encroachment which is sometimes the most serious single problem in the ranching area, and disease control which includes a regular dipping schedule and routine inoculations against the most prevalent and common diseases.

4.17 A flourishing commercial ranching industry is a supplier of high quality meat, a source of management expertise, and a source of breeding stock for the up-coming ranches, and provides a demonstration effect on pastoralists. Some of the constraints in company ranches include the inability of the members to raise the required equity contribution equivalent to 20% of the loan in cash or material before the loan is advanced, lack of immature steers for the ranches to operate economically, beef prices not being as high as the ranchers would want to absorb their overhead costs, lack of managerial ability, and lack of titles as security for loans.

Cooperative Society Ranches

4.18 Being surrounded by areas of high human population and very limited grazing areas, cooperative ranches have been invaded at times by illegal graziers, some of which are the very members of the society. When such illegal grazing has resulted in prosecutions in a court of law and fines being imposed, the culprits have resorted to theft of wire fencing, cattle, and damage to watering infrastructures. The administrative arrangements for the ranches are made by an elected management committee composed of the Chairman, Secretary and Treasurer. The committee is responsible for the efficient running of the ranch, through a hired ranch manager and ranch support staff. A local official of the Cooperative Department is an ex-officio member of the management committee, but without the right to vote. Auditing account books is the responsibility of the Registrar of Cooperative Societies.

LEGISLATION

4.19 The original grazing schemes of the 1950s derived their legality from the African District Councils Ordinance No. 12 of 1950 and the Masai African District Council Grazing Control by-laws of 1955. The latter conferred broad powers upon the Livestock Officer in charge of a scheme, including the powers to determine the families approved by the elders to graze livestock in the schemes, the number of animals each is to be allowed to graze and the area to be grazed. Violators of the by-laws were subject to a fine not exceeding Kf50 or to imprisonment for a period not exceeding six months, or to a combination of both. There was no provision in the by-laws for right of appeal from decisions of the Livestock Officer. Politically, however, it was not possible to enforce the stringent regulations. Direct de-stocking was not acceptable to the people and to enforce it would have resulted in non-establishment of the schemes.

4.20 After independence, the need to tackle the problems pertaining exclusively to pastoral people, occupying and herding their cattle in Trust Land and herding in State Land illegally, became more urgent. The consensus, from the beginning, was that the pastoral peoples living in Trust Land areas had the same constituional right to be able to proceed to private ownership of their land through the issue of title deed as did farmers; and that adjudication of the range lands, wholly on an individual basis, would result in non-violable ranching units. The logical approach was, therefore, that of mounting an adjudication programme which allowed for multiple ownership of relatively extensive rangeland units.

4.21 It was discovered, however, that this was not legally possible, and if the proposed range development programme were to be implemented, both new legislation and modification of existing laws required to be enacted. After protracted discussions with the Attorney General's Chambers and the Departments of Lands, Land Adjudication, Survey of Kenya, and others, the Land

Adjudication Act and the Land (Group Representatives) Act were introduced in June 1968. The acts enable homogenous groups of people jointly to be given clear title to their Trust Land areas, while at the same time continuing in ownership of their flocks and herds. A Department of Group Representatives was created in the Ministry of Lands and Settlement to oversee the Groups' administrative and legal performances.

V GENERAL CONCLUSION

5.01 A range development policy, which requires pastoralists' participation and cooperation, must consequently look for approaches in which the national interests and people's needs and interests coincide. Kenya's experience shows that there is a whole range of project types which could be applied for pastoral development. The success, therefore, in terms of the national objectives and of the pastoralists' objectives, depends on choosing the projects which are best suited to the conditions in a given location at a given time, and on changing them as conditions change.

5.02 Pastoral developments discussed in this paper are not suited to all range areas; the poorest rangelands would seem to benefit from nomadic grazing which is of the most economic use, and individual or group ranches would be accepted in the high potential grazing areas, with populations exposed to much outside influence. A systematic approach, which tries to define the various stages in ranch development, is of more value. The transformation of pastoral societies into modern ranch communities must be seen in the context of time, and planners are expected to define the proper conditions which will make a set of development measures worthwhile. The presently prevailing local structures, as described in this paper, cannot be seen as a final system but are subject to some change over time, depending on the development policy chosen and the level of modification of the pastoral system reached. For example, there is a provision for the group ranches to subdivide at some later stage of development if such a subdivision is deemed beneficial to development. But a real solution to the development of pastoral areas can come only through the absorption of larger parts of the pastoral population into the non-nomadic majority of the nation. "Historians today can establish evidence that pastoralists have given up their nomadic way of life again and again throughout history, whenever the circumstances have forced them to do so. It may well be that we are again approaching such a historical period. Our task is to be prepared and to offer the opportunity for such changes." (6)

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THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

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VETS - BAREFOOT AND OTHERWISE

by

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1. Not so many years ago, the whole question of animal production in pastoral areas of Africa hinged on the likelihood of animal survival. Pandemics of highly damaging and easily-recognisable diseases occurred almost annually and both the pastoralist and the Government officer recognised that these were the menace above all other constraints upon the whole existence of the pastoral people. The animal owners for their part took the only measure they could to alleviate the effects of such disasters, and so kept over-large herds in the hope that a few head would escape the next pestilence. At the same time veterinary scientists were working on active preventive measures against these diseases. In many cases useful vaccines were elaborated, and over the years these were improved so that they became safer, more protective and easier to store, transport and administer. So the concept of a "Vaccination Campaign" was born.

2. When once the naturally conservative pastoralists risked the adoption of vaccination they usually became quite enthusiastic, and many campaigns have been successful. None more so, of course, than the great action against rinderpest carried on under the name of the JP15 campaign of the Organisation of African Unity. This was the first ever international vaccination campaign designed to eradicate any disease, human or animal, pre-dating the smallpox campaign of WHO by nearly a decade. And this laid the foundations for further international co-operation in disease control.

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3. This campaign was a great success, and the shocking scourge of rinderpest is now found only in very small groups of cattle. These foci are being stamped out by the national animal health services. Unfortunately, however, the advances made in preventive veterinary medicine and their application to animal owners' problems was not matched by any parallel advance or even apparent interest in the other components which affect the pastoralists' life: in range development, forage cultivation, animal management, water supply or marketing. All these subjects are now at last receiving the attention that they have long deserved, and one hopes that improvements in them will meet with success. In the meantime more animals have survived. But if all the relevant disciplines had been successfully involved at an early stage, there is no doubt that the supply of meat in the developing lands would now be much better than it is and that the present fear of overstocking of the rangelands would be less.

4. Now however there is a need not only for international schemes but also for local measures, for a completely new approach to the problems of animal health in pastoral areas. Recently one has noticed a tendency for project planners to evoke the idea of "A Vaccination Campaign" almost as an act of sympathetic magic, as though the threat of vaccine administration would scare away all disease-producing organisms and parasites. Would that this were so! But vaccination is no panacea. There will of course continue to be a need for vaccines in certain areas, against some diseases and at certain times of greatest risk. But vaccines are usually tailor-made to fit the existing disease risk and the type of animal concerned; to fit the situation which exists at the present time and not in some other period when conditions were different; and moreover to suit a situation which is probably peculiar to the project area, not a general situation described in some textbook (all textbooks must perforce be general).

5. Many of the great lethal epidemics are now under control, or are well on the way to it. These periodic events are clear and apparent sources of economic loss; the pastoralist himself could identify and report them, and the measures to be taken in the way of quarantines, restrictions of movement and other controls have been understood by all, whether in the veterinary departments or not. In some countries the restrictive measures are now no longer properly enforced - but that is another matter.

6. But the next 'layer' of disease prevalence is not so easily recognisable. Illness due to the various respiratory diseases, to insect- and tick-borne parasites and viruses, the parasites of the blood and those of the gut, the diseases of deficiency, all need proper identification and, when once identified, a system of prevention. Prevention rather than cure, because it is usually not an economic success to cure a sick animal, at least in the pastoral scene where each head of cattle or small ruminant is of low individual productivity. Indeed, even in the highly intensive livestock industry of the 'developed' nations, treatment is difficult to justify; by the time it is manifestly needed, economic loss may already be irreversible.

7. Often, animal diseases can be prevented or their economic effects lessened by alterations to the environment and system of husbandry. A look at the medicine cupboard on a "developed" farm often gives a measure of the farmer's skill and knowledge of animal husbandry.

The skilled man needs few medicines - the ignorant man flies to the drug cupboard for an antibiotic, knowing nothing better to do. Even where active medication is found to be necessary, this should be based on a strategic pattern rather than on the tactical application of remedies to sick animals. For example, in some types of worm infestation one or two doses of a suitable anti-worm medicine given at specific times, perhaps at the beginning and middle of the rainy season, may suffice to keep susceptible animals in the herd free enough of worm parasites to grow well. (They should not be made so free of parasites that they will have no resistence to a future attack.) To dose more often, or at the wrong time, to dose the inappropriate age group, to use the incorrect worm medicine for the actual infestation, all these merely waste valuable medicaments, falsely reassure the pastoralist and thus lose his trust, and have no beneficial effect on production whatsoever. Yet I recently came across one project which was planning four-weekly dosing against worms throughout the year, dry season as well as wet. What a waste of money and time!

8. It is thus not possible to lay down hard-and-fast rules about medication. The epidemiology or pattern of the disease in the project area and in the target herd or flock must be studied in some detail. For example, some types of herbage encourage the transmission of parasites; some types of cattle and sheep are more (or less) susceptible to various diseases; the details of particular types of animal management may have an enormous influence on such matters as calfhood mortality. All these considerations must be taken into account when thinking out a preventive approach.

9. The first essential, then, must be correct diagnosis - correct local diagnosis in the light of local conditions. The presence of a parasite, for example, does not necessarily imply the presence of any disease due to this parasite. (None of us would have survived if such were the case.) For such diagnosis it is essential to have the services of a veterinary investigation officer, backed up by the laboratory skills of at least one technologist. I am not referring to research - the unfolding of new knowledge, the pushing back of the frontiers of science. The investigation team will carry out ad hoc investigation of practical problems which face their clients the pastoralists, and will give advice either directly or through the local veterinary service. Often they will, before giving advice, consult their colleagues of other disciplines, for example rangeland agronomists or soil analysts, in order to offer a completely balanced view. The team,will, however reluctantly leave to the research institutes all difficult and longer term investigations and researches into the root causes of disease.

10. We are not now thinking of large and elaborate laboratories with numerous staff, equipped lavishly, but of a small trouble-shooting place for immediate investigations, with a staff of two or three professionals. Estimates of costs are of the order of US $ 40 - 50,000 for the laboratory equipment; as well as this there will be a need for cross-country transport. For the team must not be laboratory-bound. If such a veterinary investigation officer spends more than half his time in his lab, he is probably not doing his job effectively. I would add to this. I would make it a condition of contract of veterinary staff that they devoted their first month in post not to science or medicine but to a nearly total immersion in the language and customs of the pastoralists. Even to carry on a halting conversation in the client's tongue is of enormous

advantage in the relationship, and a knowledge of social habits will avoid many an embarrassing solecism.

11. Such a comparatively modest investment will, it is certain, repay itself within a very few years in a great saving of expenditure on inappropriate medicines, in closer contact with the pastoralists to the benefit of the whole project, and ultimately in the application of cost-effective methods to control disease conditions actually encountered in the project area.

12. It is one thing to have a good knowledge of the disease entities and management defects which are the cause of loss of production. It is quite another to apply the remedies. The pastoralist has always suffered from a lack of continuity of contact with the 'scientific administration'. Animal health assistants, mostly competent people, have come from settled communities. They have been alienated from life deep in the bush by their schooling and by their further education and training. And they never speak the pastoralists' language to any great extent either literally or figuratively. Formerly they were posted for longer periods to remote bush, often, they felt, as a punishment for being outspoken or unruly; they were not expected to achieve much there and in many cases this lack of achievement was guaranteed by the lack of supervision, transport, encouragement and motivation. In some areas of independent countries the average stay of a junior staff man, for example an animal health assistant, is less than a year (Simpson 1970). Chambers (1979) describes an important meeting of a District Development Committee at which only one of the ten government officers present had been in the pastoral district for more than a year. Even during his short period of posting to a pastoral area, the official may spend many of his days, and a great deal of the petrol allocated, in travelling not to the pastoralists but back into town to enjoy the company to which he is accustomed and to lobby for a posting back to 'civilisation'. This is understandable. Having himself benefited from education, the officer desires for his children even better schooling than his own, and such is not usually available in remote areas. Other factors, such as the lack of amenities, the higher cost of store goods and social isolation enter into the picture. The final result is that the pastoralist does not get the attention and service which he needs and which his development requires.

13. A new approach is needed, and I am suggesting that, just as early medical men and veterinarians used indigenous people as sub-professional assistants and dressers, we should again seek a cadre to serve the pastoralists - a group from within their own pastoral people. I borrow the title of this cadre from the parallel of the 'barefooted doctors' of rural China and I call these men 'barefoot animal health assistants' (BAHAs).1/

14. These men would constitute a two-way channel of communication: in the first place they would bring to the notice of the animal health and production specialists (and thus to the project manager, the

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1/ (Ed.) At this point the author suggested, and subsequently used an additional title "Beaver" (bare foot vet. assistant) conveying the idea of hard constructive work. I got confused by the crosscultural mixture of images and have used my editorial power to use only the title BAHA. My apologies to the author and to those network members who would have preferred "Beaver".

economists, and others) the troubles, constraints, fears and aspirations of the pastoralists. One would expect the early information to be descriptive and probably to be grossly exaggerated for the purpose of attracting services and assistance, but later on it should become more balanced and more plan-orientated. Secondly, the BAHAs would form the channel through which remedial measures will flow; in the early stages these will of course consist mainly of curative and preventive substances, of medicines, vaccines and dips. But gradually as mutual confidence waxes there will be more transfer of advice on how to avoid the worst of the constraints, rather than a method of meeting misfortune head-on. This mutual confidence could better be termed a tripartite confidence, the three parties, project officers, BAHAs and pastoralists, each having confidence in the other's judgement and opinions.

15. The BAHA will not be afraid of the bush; he lives in it. He will need no transport, he requires no 'camping out' allowance. He may be paid a small salary. I do not advise a salary scale because it brings him too much into the Government machine, with worries about status, seniority, cost of living indices and all the other matters which help to distract the present Government servants from their development projects. Let him give a good service to his fellow pastoralists and they will keep him and reward him in kind, in prestige, in grazing rights and in privileges.

16. How should we select a potential BAHA , We should look for a bright man from a major sect of the pastoralist tribe. He must come from the correct age-group. In some tribes deference is given to the younger men of warrior age, in others to their elders. He must be a bright, intelligent and innovative man. These qualities are not universal. They are probably distributed randomly among pastoralists, as they are among planners (except of course for you and I, who are well within the upper decile when it comes to talent!).

17. Many cattle-owning peoples already have their own healers. Among the Dinka for example are <u>bany de wut</u>, skilled diagnosticians and surgeons, and Masai have <u>ol obani</u>, medico-surgical specialists whose skills are handed down from father to son. Schwabe (1978) states that it is unusual for a boy from outside the blood line to be taught the skills of healing. In selecting a BAHA we must bear this in mind. Better to train further an accepted healer than to try and induce the pastoralists to have faith in one who is an "outsider" to medicine.

18. How should the BAHA be trained? First there is not the slightest doubt that it must be through their own language and not through any <u>lingua franca</u> through which they usually communicate with the settled community. Secondly it must be a practical training with demonstrations, and no formal class-room type presentations whatsoever. Whoever is doing the training must remember that to a completely non-literate culture even a blackboard diagram may be unintelligible. Clearly finding the right tutor is of the utmost importance. He will be an educated pastoralist, perhaps a survey assistant or a trader or best of all a teacher. He must be recruited to the project, even 'kidnapped', and there treated well, because he is of cardinal importance. He will work closely with the other project officers, and some of the 'seminars' will involve both him and some of the project specialists. The classes, then, will be short, informal and practical; to Western minds they may also seem to be anecdotal, discursive and even wandering, for that is

the custom of pastoral conversations and these classes must be conversations. The BAHA will be instructed in the cleansing and care of wounds, in elementary suturing, in the use of syringes, in the administration of medicines internal and external and in simple procedures such as clean castration. That will be all. They will learn more but not yet. At a later stage.

19. The school must be arranged for a suitable part of the pastoral year when there is not a lot of herding or travelling to be done nor tribal ceremonies that must be attended. At the end of his few short weeks in the camp the new BAHA will be given a formal and solemn 'graduation', complete with a certificate. And following the ceremony a bull may perhaps be killed and a feast held, with dancing and drummers. We must make a ceremony of this, for we are endeavouring to produce a new cadre of development men, one which has its own rules and esprit de corps. He will be formally presented with an outward and visible sign of his new trade, perhaps a castrator and a box of simple instruments and suitable medicines, replenishable on request. But in teaching him we must not injure his faith in 'native medicine' (indeed it may be that we need our own faith in some local remedies to be kindled). The BAHA will be asked to treat diseases of his fellow men, just as is the veterinarian in the bush. There is no place for the niceties of professional etiquette, so he must learn how to do the least harm to his comrades' wounds and their children's eye infections.

20. Then he goes away among his people and serves them as best he can. When he comes across difficulties and when he meets disease outbreaks one hopes he will report back to his camp. (And we will expect him "when we see him", on Saturdays and Sundays, in the morning or during supper - he is always to be welcomed back.) There must of course be no question, or suggestion even, of a written report; for him to write a report would be like the rest of us composing a symphony. It is only we literates who make our memories short by writing things down. After they have been a year with their clients, their fellow cattle people, the BAHA will be invited back to the camp for an annual gathering at which there will be drumming and dancing and perhaps a film and also a few simple 'scientific papers'. (Thus copying almost exactly the international scientific convention of the developed Western world). The BAHA is to be part of and loyal to two different communities - first his own tribal grouping, in which he has a special standing and to which he renders special services, and secondly to his BAHA service where he learns the recondite mysteries and talks on an equal level with his fellow barefoot practitioners and also the professionals of the project. He must therefore be encouraged as much by the project people as we hope he will by his own nomads.

21. At each of these annual meetings he will learn a little more - one year the emphasis may be on tick control, the next on the care of young calves, the following one on parasites of the gut. But only one topic is taken each year, treated simply and practically and repititously and talked about and around until everyone agrees that he knows it, and until some members of the group themselves interrupt to explain points to the slower wits at the back who still have not grasped the argument. And, each year, a little more emphasis on disease reporting and preventive medicine, and eventually on specimen taking and finally on survey work.

22. The BAHA system will not usurp the regulatory functions of the government service. Indeed it will assist the local veterinary assistant at his work, and make him of greater value, linking him more closely to the pastoral community, yet leaving him more time to help the settled farmers around him.

23. There is much room for criticism of this plan. But there is more room for criticism of the present methods of using civil servants from the settled community who reluctantly and unwillingly exist in a "bush" station for as short a time as they can arrange.

24. There are here, then, two separate but complementary strategies. On the one hand, the scientific discovery of the real animal disease contraints in the area, which should lead to a more rational use of prophylactic and therapeutic measures. And on the other hand, a practical and living link joining the project to its 'customers'.

25. Beech (1911), writing about the Suk, says "the more one observes their cattle customs, the more one realises what an immense amount one does not know and is not likely to be told". Perhaps the BAHA may prove the bridge-builder between cultures, to the enrichment of each.

26. No-one with any experience would pretend that these strategies alone would solve the problems of the vanishing prairie and the increasing hardship and lack of production of the pastoralists. To name but a few other partial solutions, there is the provision of marketing of animals and the associated need for a 'beef finishing' sector, there is the question of human population, there is the implementation of range management techniques. But the animal health plans outlined above may go some way to getting the nomads and semi-nomads on the side of those who are trying to help them.

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

Pastoral Network Paper 11d
January 1981

IMPRESSIONS OF CHINESE PASTORALISM

by

Thadis W. Box[1/]

1. I was asked to write my impressions of Chinese pastoralism by the ODI editor about six months ago. I have hesitated and procrastinated because I simply do not have data.[2/] Pastoralism in China is an old, apparently stable, traditional system of using the rangelands. It varies from one part of China to the other. Considerable differences exist among the various ethnic groups. I had brief contact with a few pastoralists when I was on a National Geographic Society exchange in 1979, but I know little about Chinese pastoralism.
2. I do not read Chinese and cannot efficiently survey the literature that is available. I can only give my impressions of what I saw during a trip of about a month through China's arid regions. My impressions are based upon what I saw, discussions with Chinese scientists, and a few field trips, mostly in the areas of Xinjang Autonomous Region in Western China. Under almost any other conditions, I would consider them unfit for a newsletter. However,

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2/ (Ed) See Pastoral Network Paper 11a para. 2. I am very grateful to Dr Box for overcoming his hesitation.

since most of arid China has been closed to Westerners for over thirty years, even these brief observations, inaccurate though they may be, may be useful.

3. Pastoralism in China apparently takes many forms, depending upon the ethnic minorities involved, the pastoral traditions, the kind of vegetation to be exploited, and the physical barriers of the country. Pastoral use of the rangelands can be loosely lumped into four major areas. The largest, and apparently the most important, is the Inner Mongolian Plateau, where China's major grasslands exist. I was not able to visit these areas except for a train trip through one edge and a flight over the centre of the area. Chinese scientists assured me that the area was still grazed by large numbers of livestock in their traditional nomadic pattern. My observation from the air confirmed the recent written reports from China that this area has suffered rather severe overgrazing, and much erosion from wind and water exists.
4. The second major pastoral area occurs in the Hoxi Corridor through Central China. Again, my only contact was from the window of a train. My observations and the nature of the shrubby vegetation would indicate that sheep are the primary livestock there.
5. The mountains south of the Tarim Basin form the ranges for considerable numbers of pastoral people and their livestock. However I was not able to visit this area and have no information about it.
6. Western China north of the Tarim Basin is the fourth large area of pastoralism in China. My comments in this note will concentrate on that region because it is the only area of which I have first-hand knowledge. As I was able to spend only a little over one week among the pastoralists and observing their operations, my observations could well be in error.
7. First, there was a difficulty in language. Since few pastoralists speak Mandarin, all of my questions and discussions regarding pastoralism and the use of the range involved my speaking in English to an interpreter who spoke Mandarin, the Mandarin speaker relating my thoughts to another Chinese interpreter who spoke both Mandarin and Hasak, and the Hasak speaker then answering in his native language. I suspect that many of the ideas and concepts came not from pastoralists themselves but from the scientists and bureaucrats who interpreted the system for me.
8. The pastoral system in Western China consists of a transhumant movement of people and their livestock between traditional, seasonal ranges. These movements may be rather short - only 20 kilometres

or so - to somewhat more distant - up to 200 kilometres. The livestock are wintered in the deserts where desert shrub vegetation provides the major forage. The animals summer in the high mountains, where meadows and other grasslands are usually available. In the spring and fall they are held on foothill ranges or in protected areas in the bottoms of the canyons near the river. Native hay is cut from the mountain meadows and from the natural meadows along the rivers. The old people and sometimes women with small children may stay in the spring-fall camps year-round. Many of the young men are involved in harvesting and storing hay during the summer range because it is there that the milk flow is greatest and cheese can be made and stored for winter use.

9. Most of the herds of the Hasak pastoralists are mixed herds with cattle being the largest component. Cattle are of mixed colours with no apparent control of time or breeding. They are raised primarily for sale as draft animals, and milk is used for cheese production. Horses are also raised for draft and milk, and a few camels are included in most camps that I observed.

10. Sheep flocks were readily observable. Some of these were of the local Xinjang sheep and others appeared to be rather well-bred Russian Merinos. Some horses and camels were usually kept with the sheep flocks, primarily as beasts of burden or to ride in tending the sheep. Some herds were almost entirely of horses, and apparently being raised for sale as draft replacements in the eastern provinces.

11. All of the pastoralists are theoretically organised into communes, production brigades, and other units of the social system. Many of the pastoralists that I interviewed seemed unaware of exactly where they fit into the production system. Every herd that I observed had at least three different sets of ear marks among the animals, which I was told represented ownership by the state, the commune, and the private individual or herder of the particular group. The percentage of the earmarks varied between different herds observed, and with my limited language ability I could not discover how the marketing system operated or what determined the composition of state, commune, and private animals within an individual herd.

12. The concerns of the pastoralists appeared to be similar to those on almost every other continent on which I have worked. Most people interviewed were worried about the shortage of forages. Most agreed that the ranges were heavily overgrazed and that they had been in better shape prior to the setting of production quotas during the

Cultural Revolution. Some pastoralists frankly stated that herds had built up beyond carrying capacity because of pressure during the time of the Gang of Four.

13. Another concern appeared to be the loss of livestock to predators. The most common predator mentioned was the wolf. Although I saw no wolves or, indeed, scats or other signs, it was almost a universal answer that wolves were a major threat to the existence of the livestock industry.

14. A second major predator mentioned was the snow leopard, an endangered species by world standards. I was not able to tell how much snow leopards actually harmed the flocks, but I did observe snow leopards being held in captivity and was told in Beijing that one could buy a coat made from snow leopard fur.

15. My overall impression is that pastoralism is alive and well in China. While varying from one section of the country to another, apparently all Chinese pastoral organizations still follow their established traditional patterns. Since liberation, new political and economic systems have been superimposed upon the traditional system, and apparently in some cases both systems have had to make modifications. It appears that pastoralism will survive in China and may be the only feasible way to use much of China's arid and mountainous regions.

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

Pastoral Network Paper 11e

January 1981

CATTLE HERD STRUCTURES IN KENYA's PASTORAL RANGELANDS

by

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PART ONE: INTRODUCTION AND BACKGROUND

1.01 In an earlier Pastoral Network Paper[1/] we presented a dynamic herd model for a southern pastoral district in Kenya based on (a) published district cattle population estimates for selective years between 1962 and 1977 which were thought to be reasonably accurate and (b) keeping the parameters for offtake rates and calving rates within a known range of possible values. The most significant, and controversial fact to emerge from the model was that only by allowing a high wastage of male calves was it possible to explain the growth path of the herd between 1962 and 1977 while at the same time ensuring that the proportion of female cattle over one year in the herd remained above 60 percent. It is well documented that the proportion of female cattle over one year of age in pastoral herds is high, typically over 60 percent, in drought conditions approaching 70 percent and exceptionally an even higher proportion.

1.02 Given the interest that the Kajiado model aroused among network readers we would like to circulate the results of some recent field work on cattle herd structures, which was undertaken as part of a wider exercise to determine the marketable surplus of cattle (defined as those surplus to subsistence requirements) from Kenya's northern pastoral rangelands. Some limited herd composition data from the two southern pastoral areas of Narok and Kajiado are also included.

1.03 The purpose of the recent exercise[2/] was to forecast the potential supply of immatures from Kenya's northern rangelands over the 1980's. Immatures are defined here as young male cattle which originate in those semi-arid areas of Kenya where the primary resource conditions are unsuitable for finishing cattle. It was suspected that the assumption on which much of the planning of the current livestock development project rests, namely that there are large numbers of young male cattle in pastoral herds, surplus to subsistence requirements, would prove to be unfounded.

1.04 The methodology used was to forecast the size of the cattle population over the 1980's in the northern rangelands, to undertake a census of cattle herds and classify cattle into selective age and sex cohorts, to relate the proportion of male cattle over one year of age in the herds to the average age of sale of immatures, and to consider the effect of drought on supply.

1.05 Herd composition data were collected by field staff of the Kenya Government's Range Management Division, who categorized several hundred thousand head of cattle into the age and sex cohorts requested. Herd

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1/ S.J. Meadows and J.M. White, Structure of the Herd and Determinants of Offtake Rates in Kajiado District in Kenya 1962-1977. Pastoral Network Paper 7d, March 1979.

2/ S.J. Meadows and J.M. White, The Potential Supply of Immatures Over the 1980's from Kenya's Northern Rangelands, Ministry of Livestock Development, Nairobi, August 1980.

compositions in the different districts covered showed great similarity, after allowing for differences in the age of sale of immatures. This would seem to be a result both of similar pastoral herd management practices between districts and ethnic groups, in particular the selective culling of male calves, and also of conscientious data gathering by field staff.

1.06 The main conclusion of the study was that there are not large numbers of surplus young male cattle in Kenya's northern pastoral range areas under the present livestock production system. The potential annual supply of immatures in a normal year is less than 5 percent of the cattle population. In drought years the proportion rises, as younger animals are offloaded onto the market, while immediately following a drought the proportion falls as pastoralists hold back from selling until immatures have reached the preferred age of sale. The effect of a lower than average male calf weaning rate during the drought also depresses sales in the post drought period.

The Study Area

1.07 There are six districts in Kenya which are suppliers of immatures, northern Garissa, Wajir, Mandera, Isiolo, Marsabit and Samburu, covering an area of almost ¼ million sq. km. and supporting a pastoral population of just under ½ million (1979 Population Census). The people are predominantly Hamitic and Nilo Hamitic, the Somali and Boran groups, the Samburu and the Rendille with a few Nilotics, the Turkana. Average rainfall in the area is low, falling mainly between the 250 to 350 mm isohyet, with the major exception of southern Garissa, where it rises to 500 to 750 mm per annum. Because of its higher rainfall, southern Garissa is not a supplier of immatures, but sells older steers to Coast Province, mainly for immediate slaughter. Throughout the northern pastoral districts the production system is one of nomadic pastoralism. The livestock herds are mobile, moving long distances as necessary in search of forage and water, some crossing not only district and provincial boundaries, but also national frontiers. Dependence on types of livestock (cattle, camels, sheep and goats) varies between and within tribes. Some groups are predominantly cattle owners, others (primarily among the Somali groups) rely more on camels. Most pastoralists own some sheep and goats. Livestock production is the most important source of livelihood in all six districts, other forms of economic activity being limited traditionally to hunting, collecting arabic gum, and to collecting honey, while today a few pastoralists engage in agriculture (restricted to the riverine stretches of Isiolo, Garissa and Mandera, and high altitude areas such as Marsabit mountain) or find wage employment in the modern sector.

PART TWO: THE STUDY

Herd Composition: Theory and Practice

2.01 Field staff of the Range Management Division were asked to undertake a census of the cattle population when the cattle would be concentrated around the main households, so minimizing the distances to be travelled during the exercise. In those districts where field staff coverage was good, notably Mandera, Wajir and

northern Garissa, data were gathered at the main water points. In Isiolo and Marsabit, which have fewer staff, it was proposed that the exercise take place in conjunction with the annual veterinary vaccination campaigns, at specified crushes. In Samburu a similar herd composition exercise was undertaken in 1978 covering an estimated 95 percent of the cattle population and so they were not asked to repeat the exercise.

2.02 Cattle were categorized into the following six groups:-

(i) Working bulls
(ii) Other males over one year
(iii) Cows (females 3 years plus)
(iv) Heifers (females 1 to 3 years)
(v) Male calves (males up to one year)
(vi) Heifer calves (females up to one year).

2.03 The decision to limit the age and sex cohorts to six was based on a desire to simplify the exercise to the greatest extent possible consistent with providing the necessary data on the potential supply of immatures. To this end it was obviously vital to collect statistics on male: female sex ratios among calves in order to test the theory that there is imbalance in favour of female calves in pastoral cattle herds, and in order to quantify the male calf offtake rate. It was decided to divide males over one year into working bulls and others, since the former do not constitute potential immatures. It was not thought necessary to sub-divide further the category "other males one year plus "into age cohorts, since reference would be made back to the theoretical Kajiado herd model set out in Pastoral Network Paper 7d to which Table 1 of the present paper refers.

Table I:

Pastoral Herd Structure, Kajiado District 1970 to 1974

	1970	1971	1972	1973	1974
	%	%	%	%	%
Age and Sex Cohorts					
Females 3 years +	44.1	43.8	44.7	44.5	45.2
Heifers 2-3 years	7.7	7.9	8.2	8.3	8.0
Heifers 1-2 years	9.4	9.5	9.7	8.8	9.0
Female calves	11.3	11.3	10.3	10.5	10.4
Working bulls	1.5	1.5	1.6	1.5	1.5
Other males 3 years +	3.8	3.8	4.0	4.1	4.2
Males 2-3 years	4.6	4.6	4.8	4.9	5.0
Males 1-2 years	6.3	6.3	6.4	5.9	6.3
Male calves	11.3	11.3	10.3	10.5	10.5
Total	100.0	100.0	100.0	100.0	100.0

Source S.J. Meadows and J.M. White, Structure of the Herd and Determinants of Offtake Rates in Kajiado District in Kenya 1972-1977, ODI Pastoral Network Paper 7d, March 1979.

2.04 The herd structure, presented in Table 1, that emerged from the theoretical Kajiado model, is now substantiated by data on herd composition collected in the field by RMD staff in Samburu, Narok and Kajiado (1979) and by ILCA (International Livestock Centre for Africa) in Kajiado (1980). In order to faciliate the comparison of theory and fact, the theoretical data of Table I have been recast, in Table 2, into a similar form to that in which the RMD and ILCA data are now available. Their field data, for Samburu, Narok and Kajiado, are presented in Table 3.

Table 2: Herd Structure in Kajiado District 1970 to 1974

	1970	1971	1972	1973	1974
Cows	44.1	43.8	44.7	44.5	45.2
Heifers	17.1	17.4	17.9	17.1	17.0
Males 1 year	16.2	16.2	16.8	16.4	17.0
Calves	22.6	22.6	20.6	21.0	20.8
Total	100.0	100.0	100.0	100.0	100.0

Source: Table 1.

Table 3: Herd Structure In Narok, Samburu and Group Ranches in Kajiado District

	Narok a/	Samburu a/	Kajiado b/	Kajiado c/
Date	1979	1978	1979	1980
Number of cattle	66,700	221,200	32,871	2,500
Cows	46%	44%	42%	45%
Heifers	15%	15%	18%	16%
Males 1 year +	17%	18%	16%	17%
Calves	22%	23%	24%	22%
Total	100%	100%	100%	100%

Sources

a/ RMD Internal Files
b/ RMD Internal Files. Figures refer to Kuku Group Ranch
c/ "A study of Masai Herds on Elangata Wuas Group Ranch." P. Simenye, ILCA, Nairobi 1980.

2.05 The herd structure that emerged from the Kajiado herd model and from the field censuses are virtually identical, which suggests that, other things being equal, a similar breakdown of males over one year into different age cohorts can be made for the northern pastoral districts. Where male calf offtake averages 40 percent per annum, as in the Kajiado model, and where male

1/ (Ed) N.B. Meadows and White use the expression "calf takeoff" to include both calf mortality from natural causes and from slaughter. See Pastoral Network Paper 7d paras. 16 and 18.

cattle are sold at three years plus then males over one can be expected to comprise the following percentage of herd numbers.

Table 4: Age Structure of Male Cattle over One-Year Old

	(as % of total herd numbers)
Males 1-2 years	6.4%
Males 2-3 years	4.8%
Males 3 years +	4.0%
Working Bulls	1.5%
	16.7%

2.06 As the age of sale falls, and males in the older age cohorts are no longer significantly represented in the herd, so the overall proportion of males over one year old in the herd falls significantly, while that of females over one rises slightly.

Results from North East Province (NEP)

2.07 In Garissa, Wajir and Mandera combined, a total of 108,000 head of cattle were categorized by age and sex, representing circa 28 percent of the estimated end-1979 resident NEP cattle population, excluding southern Garissa. Coverage in Garissa was limited to the northern half of the district since southern Garissa is not a source of immatures.

2.08 While it had been hoped to effect a larger coverage this was not achieved. Some field staff delayed starting the exercise, by which time the cattle were widely dispersed. Some field staff were more conscientious than others in tracking down calves which are not brought to the water or vaccination points, but are left behind at the households' dwelling areas. Field staff were asked specifically to check the sex of calves themselves and not to rely on a question and answer approach with the cattle owners. This obviously involved much extra work, visiting each household which used a particular water point, and perhaps it is encouraging that enough staff were prepared to make the necessary effort to allow an estimate to be made of district calf numbers and sex ratios.

2.09 Table 5 summarizes the results of the herd composition exercise separately for each district. Background data provided by field staff are given in Appendix I.[1/]

2.10 In Garissa a good coverage of calves was achieved and they comprise 22.5 percent of the cattle counted. Both the District Range Officers in Wajir and Mandera drew attention in their covering notes to the fact that the exercise in their districts did not get a representative sample of calves among the total of cattle

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1/ In order to reduce printing and other costs the appendices have not been circulated with this paper. They are available, on request, from Judy White at P.O. Box 68228 Nairobi, Kenya or from Stephen Sandford at ODI.

Table 5: District Herd Compositions, North Eastern Province 1980

	District		
	Garissa	Wajir	Mandera
Numbers of cattle	20,599	55,399	32,051
	%	%	%
Working bulls	1.2	2.3	5.2
Other males 1 year +	11.1	8.8	6.3
Cows	45.9	51.9	60.9
Heifers	19.3	25.6	15.3
Female calves	13.5	6.6	7.2
Male calves	9.0	4.8	5.1
Total	100.0	100.0	100.0

counted, and that therefore the proportion of calves that appears in their herd composition tables is too low. In the Rhamu area of Mandera however, the Assistant Range Officer achieved a far better count of calves than was managed in the rest of the district. Of the 12,400 head of cattle included in his count, some 20.4 percent were calves. In Wajir, block managers on three grazing blocks,1/ Kalalut, Tarbaj and Giriftu also discovered a much higher proportion of calves, which represented 18.9 percent, 22.8 percent and 21.3 percent of cattle counted within each grazing block, some 17,700 in total. Conversely at Wajir Bor out of 21,000 head of cattle, less than 5 percent of the total counted were classified as calves and in Buna grazing block, out of 12000 head of cattle only 1 percent were calves. These results reduce the proportion of calves in the district total for Wajir to below what is probably the actual level.

2.11 In order to get a more accurate picture of actual herd compositions in NEP, the proportion of calves in the Wajir and Mandera district statistics must be increased to a more realistic level. On the basis of evidence from those grazing blocks and areas where a good coverage of calves was achieved, this proportion should be 21 to 22 percent of the herd. In Table 6, adjusted herd compositions are given for Mandera and Wajir. The methodology used was to assume that all other cohorts except calves comprise 79 percent of the actual cattle population included in the exercise and that calves counted plus those left behind in the bomas and not counted together comprised 21 percent of the cattle population.

2.12 In Table 6 the numbers of animals in all cohorts except calves has been left unaltered and the adjusted total computed by multiplying up this number from an assumed 79 percent to 100 percent. The number of calves is then the difference between the

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1/ North Eastern Province is divided into grazing blocks, each run by a block manager who is an officer of the Range Management Division.

Table 6: Adjusted Herd Compositions, Wajir and Mandera Districts

	Wajir		Mandera	
	Nos	%	Nos	%
Working bulls	1,263	2.0	1,674	4.7
Other males 1 year +	4,898	7.9	2,025	5.7
Cows	28,741	46.3	19,520	54.8
Heifers	14,173	22.8	4,910	13.8
Calves	6,324	21.0	7,477	21.0
Adjusted Total	62,120	100.0	35,606	100.0

adjusted total and the sum of cattle in all other cohorts.

2.13 Table 7 summarises the herd composition data into three cohorts, males over one year, females over one year and calves, and compares the results for Garissa, Wajir and Mandera. Data for Garissa refer to actual statistics collected in the field, while those for Wajir and Mandera have been adjusted, and are derived from Table 6.

Table 7: A Comparison of Herd Compositions in Garissa, Wajir and Mandera

	Garissa	Wajir	Mandera
Males 1 year +	12.3%	9.9%	10.4%
Females 1 year +	65.2%	69.1%	68.6%
Calves	22.5%	21.0%	21.0%

2.14 In all three districts in North Eastern Province the exercise clearly revealed the expected imbalance between male and female calves. Table 8 gives the number of female and male calves counted in each district. If it is assumed that the offtake[1/] rate for female calves is 10 percent (the lowest it is likely to be in the harsh environment of N.E.P. in an average year) and that the ratio of male to female calves at birth is 1:1, then the total number of calves born, of which the numbers counted in the exercise represent the survivors, can be calculated as follows: total calves born = (number of female calves counted x 10/9) x 2. Male calf wastage can be calculated by comparing the number counted in the exercise with the number assumed to have been born.

2.15 An overall calf mortality rate of 22 to 25 percent accords with evidence collected by a number of authors in pastoral areas

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1/ (Ed) See footnote to para. 2.05.

including Meyn in the IBRD's Study The Availability of Fattening Beef Breeding and Dairy Breeding Stock in East Africa 1970 to 1975 (1972). It also accords with offtake rates derived from the Kajiado dynamic model where the male calf offtake rate was 40 percent in years when the herd was growing under favourable conditions. In years when drought caused stress, both male and female calf offtake rates rose, although the imbalance between the sexes remained.

Table 8: Calculation of Male Calf Wastage in North Eastern Province

	Garissa	Wajir	Mandera
Numbers Counted			
Male calves	1,861	2,660	1,627
Female calves	2,788	3,664	2,295
Assumed Number Born			
Male calves	3,098	4,071	2,550
Female calves	3,098	4,071	2,550
Calculated Offtake Rate			
Male calves	40%	35%	36%
Female calves	10%	10%	10%
Total calves	25%	22%	23%

2.16 Results of the field exercises in Garissa, Wajir and Mandera suggest that both the proportion of calves in the herd and the male calf offtake rates are very similar to those in the Kajiado model. The overall proportion of males over one year in the herd is less, because the average age of sale of male cattle is substantially lower in the three northern districts than it is in Kajiado. The age of sale in the northern districts, where the Government is the major purchaser, can be calculated from information recorded in Livestock Marketing Division's buying centre records. These list animals purchased by sex and individual weight. An FAO study[1/] accorded approximate ages to cattle in northern Kenya, correlating weight with dentition and hence with age. For the present exercise some 2,500 male cattle were analysed, those few weighing 325 kg or over were classified as slaughter stock, and then the average weight of the remainder was calculated and translated into an age range, based on the FAO study. In Garissa and Wajir the average age of sale of cattle analysed was 22-27 months and in Mandera it was 24-29 months. The picture is slightly complicated in Garissa because it is known that some steers are kept to an older age and sold to private traders for movement to Coast Province for slaughter.

2.17 Somali cattle owners in North Eastern Province generally do not castrate male cattle, so that the number of bulls in the herds will exceed the number of working bulls. One working bull is

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1/ UNDP/FAO Rangeland Surveys Kenya 1971 - Technical Report 3.

needed per thirty cows, which would imply that 1½ - 2 percent of the herd should be working bulls in North Eastern Province. Reference to Appendix 1[1] shows that in ten sets of data the proportion of working bulls in the herd ranged from 0.3 percent on Ajao Block to 6.6 percent in Takaba and El Wak. However all the others fell within the range of 1.2 percent to 3.1 percent and the mean of the ten sets of figures was 2.4 percent. It is possible that the field officer in Takaba and El Wak confused bulls with working bulls. For the purpose of calculating the breakdown of males over one year into age cohorts it is assumed that working bulls comprise 2 percent of total herd numbers in each district. The following age structure then emerges:-

Table 9: Age Structure of Male Cattle over One Year Old in North Eastern Province

	Garissa	Wajir	Mandera
	%	%	%
% Herd males 1 year +	12.3	9.9	10.4
Estimated age cohorts			
Males 1 - 2 years	6.4	6.4	6.4
Males 2 - 3 years	3.9	1.5	2.0
Working bulls	2.0	2.0	2.0

Source: Derived from Tables 4 and 7.

2.18 The preferred age of sale of immatures in North Eastern Province is 22 to 29 months and very few older male cattle except working bulls, and, in Garissa, some males held back for sale at an older age for slaughter, are kept in the herds. Hence the very low percentage of the herd in Wajir and Mandera which comprised males 2-3 years in the field data. In Garissa the effect of selling some males as early as 22-27 months is reflected in the smaller proportion of males in the 2-3 year age cohort than is thought to exist in Kajiado.

Results from Isiolo District

2.19 In Isiolo some 40,000 head of cattle were aged and sexed, representing approximately on third of the resident population. In May/June 1979 24,000 head of cattle were counted and classified into selected age and sex cohorts, independently of the current exercise. In the first quarter of 1980 a further 16,000 head of cattle were similarly counted and classified. The results of each exercise are presented separately below:-

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1/ See footnote to Para. 2.09.

Table 10: District Herd Compositions, Yamicha and Merti Blocks of Isiolo District in 1979

	Number of cattle	Percentage of the herd
Mature females	14,317	58.5%
Immature females	3,841	15.7%
Mature males	1,861	7.6%
Immature males	3,149	12.9%
Calves	1,301	5.3%
Total	24,469	100.0%

Source: Internal files, DRO Isiolo.

2.20 In the Yamicha and Merti exercise calves were defined as those cattle left behind with the household, which are generally those up to 3 months of age. If calves are redefined to mean animals up to 12 months of age then the 1,301 calves counted in the exercise must be increased by a factor of three (3,903 + 1,301 = 5,204) and the two categories of immature males and females reduced proportionately (by 3,903). The ratio of immature females to immature males given in Table 10 was 55:45. The cohort immature females in Table 10 is therefore reduced by 3,903 x 55 percent and immature males is reduced by 3,903 x 45 percent. Table 11 gives the adjusted herd structure.

Table 11: Adjusted Herd Composition, Yamicha and Merti Blocks of Isiolo District

	Number of cattle	Percentage of the herd
Mature females	14,317	58.5%
Immature females	1,694	6.9%
Mature males	1,861	7.6%
Immature males	1,393	5.7%
Calves	5,204	21.3%
Total	24,469	100.0%

Males over one year comprise 13.3 percent of total cattle counted. Unfortunately the exercise did not differentiate between male and female calves.

2.21 In Isiolo Central Division a further 16,000 head of cattle were classified into the six age and sex cohorts specified in the Supply of Immatures exercise. Appendix 2 gives details.[1/] A complicating factor was the known presence of a trader's mob of cattle among the numbers counted. Some 62 percent of his cattle were males over one year of age, which he had collected

1/ See footnote to para. 2.09

up for movement out of the district. After extracting his cattle - some 15 percent of the total counted - the following herd composition emerged.

Table 12: Herd Composition, Isiolo Central Division 1980 1/

	Numbers	Percentage
Working bulls	849	6.2%
Other males 1 year +	2,401	17.6%
Cows	5,229	38.4%
Heifers	2,179	16.0%
Females calves	1,570	11.5%
Male calves	1,406	10.3%
Total	13,634	100.0%

2.22 There is still a much higher proportion of males over one, 23.8 percent, than in the earlier exercise on Yamicha and Merti blocks. The results also do not fit into the general pattern found in North Eastern Province, Narok and Samburu and with the Kajiado model (Tables 2,3 and 7 refer). The most likely explanation for the much higher proportion of males over one in the Isiolo Central Division figures is that there were other traders' cattle present at the crushes during the exercise. Isiolo Central is a collection point for cattle from a wide catchment area (Marsabit, Samburu, Garissa and Wajir as well as the rest of Isiolo) being immediately adjacent to the meat deficit area of Meru District and convenient for supply to similar markets in Central Province.

2.23 Calves were not brought to the crushes when the herd composition exercise was undertaken in Isiolo Central. Information on the number and sex of calves was obtained by asking cattle owners to specify what animals belonging to their herds had been left behind with the household. The bias in favour of female calves was much less than was found in North Eastern Province and hypothesized for Kajiado District. Using the same method as employed in Table 8, a male calf offtake rate of 19 percent is suggested. There is no immediately obvious reason why this should be so and work is in hand in Isiolo to carry out further investigation into the sex ratio of calves.

2.24 The private sector dominates cattle marketing in Isiolo, so private traders and Range Management staff were asked to estimate the average age of sale of males. It was said to be between 2 to 3 years of age, which is higher than in Mandera and Wajir but similar to that in Garissa. Also, as in Garissa, males are sold both as immatures and as slaughter stock. The proportion of males over one found in the Garissa exercise was very close to that found on Yamicha and Merti blocks in Isiolo (12.3 percent compared with 13.3 percent).

1/ Excluding the cattle of a trader.

2.25 In conclusion, the evidence from Isiolo appears to be inconsistent. If the herd composition from Yamicha and Merti blocks is taken as representative for the district as a whole, and if the average age of sale of males is 2-3 years, then it is difficult to reconcile these with an apparent male calf offtake rate of only 19 percent. For the present, until further evidence is forthcoming, it is suggested that herd structures in Isiolo, and the breakdown of males over one into age cohorts is identical in the 1-2 year cohort with that in other pastoral districts in Kenya, that the proportion of working bulls is the same, and that thereafter the proportion of males in the other age cohorts is influenced by the varying proportions sold as immatures vis a vis slaughter stock.

Results from Samburu District

2.26 A total of 221,000 head of cattle were classified into selected age and sex cohorts in Samburu District in 1978, representing an 80 to 90 percent coverage of the district cattle population. The results are given below in Table 14.

Table 14: Herd Composition Data, Samburu District, 1978

	------ Division -----			
Numbers of Cattle	Leroki	Wamba	Baragoi	District total
Bulls	3,024	3,049	2,863	8,936
Other males 1 year +	9,963	11,943	9,458	31,364
Cows	31,397	35,298	30,860	97,550
Heifers	11,724	11,249	9,395	32,368
Calves	12,583	20,010	18,434	51,027
Total	68,691	81,544	70,979	221,214
Percentage:				
	%	%	%	%
Bulls	4.4	3.7	4.0	4.0
Other males 1 year +	14.5	14.7	13.3	14.2
Cows	45.7	43.3	43.5	44.1
Heifers	17.1	13.8	13.2	14.6
Calves	18.3	24.4	26.0	23.1
Total	100.0	100.0	100.0	100.0

Source: Range Planning Office, Maralal. Exercise undertaken during annual rinderpest campaign, in conjunction with the Department of Veterinary Services.

2.27 The herd structure that emerged from this exercise was almost identical to that found in a similar exercise in Narok District and hypothesized for Kajiado. (see Tables 2 and 3). The reasons for the similar herd structures are the common herd management

practices and similar sales patterns prevailing in each district. The average age of sale of male cattle from Samburu is 3 to 3½ years. The breakdown of males over one into age cohorts and the proportion of working bulls should therefore approximate that given in Table 4. It is not certain whether those animals classified as bulls in Table 14, comprising 4 percent of cattle counted in Samburu, are in fact working bulls. If they are, the rate of 1 bull to approximately 11 cows is high.

Results from Marsabit District

2.28 The herd composition exercise in Marsabit was not carried out on time due to a delay in the start of the annual district rinderpest campaign. As the largest district in Kenya, with very few Range Management field staff, the exercise could not be undertaken independently.

PART THREE: SUMMARY AND CONCLUSIONS

3.01 The aim of the herd composition exercise was to estimate the potential supply of immatures from Kenya's northern rangelands, hence the emphasis throughout on male cattle - male calf offtake rates, the breakdown of males only into age cohorts, the identification of the working bull cohort and the calculation of the age of sale of males rather than an analysis of all cattle sold. The same approach could very easily be extended to include other aspects of cattle marketing such as the likely age and sex composition of all sales. This is not to ignore the importance of other factors on the supply side - price, diseases, drought etc., - but to put them into perspective.

3.02 We would argue that a knowledge of herd structures is essential to an understanding of livestock production systems and the marketing potential from such systems. In Kenya's pastoral range areas cattle are kept primarily to provide milk for the household and, under current herd management practices, commercial offtake will not exceed 10 percent in an average year. This assumes male cattle are sold at around 2 years and 10 percent of the cow cohort is culled annually. Development plans aiming to improve in the short or medium term what is seen as low commercial offtake rates by even a modest percentage increase are doomed to failure. Such an increase is dependent on a change in the production system itself which implies a change in life-style.

3.03 The data gathering in the form requested was technically a relatively easy exercise for Range Management Division field staff. If a high degree of accuracy were required in categorizing cows and heifers, our experience in this exercise would suggest that it should be done by dentition rather than by observation. The coverage of calves, because of the logistics involved, may not be as comprehensive as that of the rest of the herd. It is obviously an advantage to make the coverage of a herd composition exercise as large as possible, since small samples may show a wide variability of results.

3.04 Finally, referring back to the Kajiado theoretical herd growth model, we would argue that the herd composition data presented in this paper supports our original hypothesis that in pastoral livestock production systems there will be a bias in favour of female calves. We are still investigating when and how it happens among the Masai in Kajiado District. A major factor appears to be simply that of neglect - male calves are not allowed such free access to their dams as female calves. It is indicative that at the end of the dry season, when milk supplies are low, that some households in Kajiado District are still selling milk. They receive 2 shillings a litre and the value of selling only 1 litre per day for 7 months (420 shillings) greatly exceeds the value of a weaned male calf, currently selling for around 300 shillings.

U.S. $1 = KSHS. 7.55

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

Network Paper 11f
January 1981

THE ESTIMATION AND INTERPRETATION OF PASTORALISTS' PRICE RESPONSIVENESS

A comment by Judy White on Allan Low's Paper
(Pastoral Network Paper 9e)

Judy White[1/] writes:

Purpose of the Analysis

The basic concern behind the author's current and earlier articles on Swazi pastoralists' responsiveness appears to be the low level of sales associated with traditional African pastoral herds in comparison with that of commercial ranchers. A longstanding complaint by the authorities throughout Africa against pastoralists is that their practice of building up herd numbers, combined with a low level of sales, leads to overstocking and hence overgrazing. I infer that this is seen as the problem in Swaziland. The purpose of the analysis is therefore a practical one - to attempt to determine whether pastoralists are behaving in a rational economic manner in response to price changes However, after comparing two case studies of pastoralists' price

1/ Ministry of Livestock Development, P O Box 68228, Nairobi, Kenya.

responsiveness, one in Sudan and the other in Swaziland, which come to the opposite conclusions, Allan Low concludes that this approach is of limited value in trying to determine African cattle owners' motives for holding and disposing of stock. There are problems in obtaining reliable and comprehensive data needed for statistical analysis of this sort. However, more important in my view is that the approach itself is limited, and that a broader analysis of the whole production system is needed in order to understand sales strategy.

Types of Pastoral System

2 The first point that concerns me in this article is the use of the term 'pastoralist' to cover two very different types of production systems in Swaziland and Sudan, without attention being drawn to the fact. I know that the term 'pastoralist' is often used in the literature to cover livestock owning people operating very different production systems. However, when comparing the involvement of Swazi and Sudanese pastoralists in the cash economy (in particular their short-term price responsiveness) the different types of pastoralism practised in the two countries may be a partial explanation of the opposite results obtained in the two case studies. In Sudan the pastoral population rely virtually exclusively on their herds and flocks for their livelihood. In Swaziland cattle holding is combined with agriculture. Different models of behaviour are needed for each production system.

An Alternative Approach

3 I would like briefly to describe the Kenyan pastoral economy as it throws some light on some later comments I make on Allan Low's paper. In Kenya's range areas the pastoral population depend on livestock (cattle, camels, sheep and goats in varying proportions between districts) and speaking generally, do not practise agriculture. The cattle herds' prime function is to produce milk for the household and sales of animals surplus to subsistence requirements (steers and cull cows) are a by-product of the system - albeit an important by-product in 1980. In Kenya the pastoralists sell regularly. However, given the herd structures, with the high proportion of females over one year, sales levels are a low proportion of herd numbers.

4 The proportion of males over one year in the herds is kept low, not only because of sales strategy, but also because of the selective culling of male calves. This is done in order to ensure an increased supply of milk to the household and to reduce stress on the dam during the dry season, and possibly for other reasons I have not yet identified. Under the type of pastoral system practised in Kenya only a few cattle are produced for market (work in Kenya suggests 8-9% per annum

maximum, drought years sxcepted). Change can only be expected to come about gradually since increasing sales levels implies fundamental changes in life-style with a move away from subsistence milk to commercial beef production.

5 Under the typical pastoral production system in Kenya supply appears to be relatively price inelastic, and the most important determinant of sales is the availability of animals surplus to subsistence requirements. In Kajiado District, one of the southern pastoral districts in Kenya, an analysis of factors that could be expected to explain annual fluctuations in sales showed that the supply of saleable cattle (as seen by the Masai) was by far the most important factor. Over a 16-year period, from 1962 to 1977, I found an R^2 of 0.6. between changes in the annual volume of sales and changes in the numbers of 3-4 year old steers (the age of sale of the majority of steers) and cull cows (assumed to be 10% of females over 3 years in the Kajiado herd).

6 The analysis of the Majiado pastoral economy was primarily a theoretical one. However it has now been followed up by field work in the pastoral areas. Range Management Division have recently completed an exercise in the range areas which has categorised cattle into selective age and sex cohorts, so that we can better estimate the potential volume of sales from these areas. Such a categorisation allows cattle kept for subsistence purposes to be identified and similarly cattle kept for cash purposes. Interestingly, the work has shown both a very close uniformity between herd structures in different pastoral areas of Kenya (after making allowances for differences in age of sale of make cattle between districts), and the usefulness of this approach in explaining the annual volume of cattle sales. In all the pastoral areas of Kenya, pastoralists now appear to be selling virtually all the cattle that they consider to be surplus to subsistence requirements. However, the system produces relatively few saleable cattle.

Specific points made by Allan Low on the interpretation of pastoralists' price responsiveness

The Inventory Factor

7 A useful distinction is drawn in the article between short and long term supply response to price changes, derived from cattle's dual function as both capital and consumer goods. In North America (and presumably wherever commercial ranching operations are involved) a rise in beef prices leads initially to a fall in beef supplied to the market as fewer heifers are culled than before, but are added to the breeding herd in order to increase long-term beef supplies. Some steers are also held to heavier weights than previously; both actions are in response to the desire to maximise total income over a period, at the expense of current income.

8 I wonder how valuable this distinction is in explaining economic behaviour under traditional African livestock systems, In Kenya the pastoralists very rarely cull heifers as part of their normal herd management practices (those that cannot get into calf may be sold). A price increase for cattle therefore has very little effect on the size of the Breeding herd. I have not looked into this, but there may possibly ne an effect on the numbers of old cows offered for sale, the choice being whether to sell now for current income or try to get one more calf from a cow with declining fertility. The inventory factor will only come into effect in Kenya's pastoral cattle herds to the extent that herd owners decide to keep steers to a slightly heavier weight before selling.

Are the use of offtake rates superior to sales numbers in helping to understand pastoralists' production and sales strategies?

9 I am not clear why the use of offtake rates rather than sal numbers is said to add depth to an analysis of pastoralists' price responsiveness. I see that offtake rates are meant to be a proxy for the inventory factor, but I would argue that the different factors at play need to be spelled out separately rathe than grouped together under one measure. I am sorry to revert to Kenya again, but an example from recent work here will help to illustrate the point.

10 Sid Meadows and I have just completed a study to estimate the potential supply of immatures (young male cattle for fattenin from Kenya's northern rangelands. The annual supply of immatures is a function of the size of the herd and the proportion of the herd sold each year as immatures. Male cattle are sold at differe ages in different districts, varying from 18 months to 3 years pl A look at cattle sales from the mid-70s to the present from northern rangelands shows (a) the effect of drought on sales as younger animals are offloaded onto the market. Both sales numbers and offtake from the herd rise (defined as sales); (b) the post effect of drought as pastoralists rebuild not just their herds but the supply of saleable animals. Depending on the preferred age of sale between districts sales numbers and offtake rates (defined as in a) remain low for one to two years after the rains return.

11 In conclusion, an analysis of the number of sales combined with type of animals sold provides much more information on pastoralist sales strategy than either numbers alone or the offtake rate (sales) alone.

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

ISSN 0260-8588

Pastoral Network Paper 12a

July 1981

NEWSLETTER

1. Together with this Newsletter I am sending you three other papers. Paper 12b, by Louise Fortmann and Emery Roe gives an account of experience of groups managing the use of dams in Botswana which will be of great interest to anyone concerned with groups in pastoral development. Paper 12c by Dick Sandford (n.b. this is my brother not me!) describes an Ethiopian programme in which pastoralists work as animal health workers and is partially in response to Brendan Halpin's "Vets, Barefoot and Otherwise" (11e). Paper 12d, by Martin Fowler, relates technical efficiency in the Swazi nation herd to the degree of overgrazing.

2. Apologies
Production and distribution errors marred the issue of the last set (Series) of Pastoral Network Papers.

a) In Lucas Ayuko's paper (11b) ORGANISATION, STRUCTURES, AND RANCHES IN KENYA, on Page 2, para. 1.03 line 13 an omission occurred in typing in this office. The sentence should read "In range areas it specifically established grazing schemes under the general principles of stock limitation, rotation of grazing and payment of annual grazing fees per head of cattle to cover recurrent expenditure"
(underlining indicates the words omitted by me in error in the published version of the paper).

b) Some (but not all) copies of Papers 11b had blank papers on page 5 and 12. I will send a complete paper to anyone who has a defective copy and who notifies me.

c) Some network members did not get a copy of Thad Box's (11d) paper on pastoralism in China. Let me know if you didn't get a copy and I will send one.

My profound apologies to the authors and recipients concerned.

3. Activities of the Network

I have been more or less static in London for the last six months struggling with my book on pastoral development. In the series of lunchtime meetings, in March Dr Clare Oxby (of ODI) talked about the experience of group ranches in Africa; in April Dr Richard Tapper talked about the allocation of grazing rights among pastoral communities and in May Dr James Ellis talked about the efficiency of pastoral ecosystems.

4. Recent/forthcoming meetings

Nothing to report.

5. Recent/forthcoming pastoral publications

Over the last 18 months I have been simply swamped with publications relevant to pastoral development, a flood with which I have been unable to cope in terms of reading them all in order to select by merit for mention in these newsletters. I have (I confess) now swept my shelf of past accumulations clear and started again; my apologies to those whose publications have thus unfairly disappeared. Amongst the more recent acquisitions the following recent/forthcoming publications appear to me to be of general importance with reference to pastoral development either because of the width of their coverage or because they raise issues in a specific context which could profitably be raised in other pastoral contexts. The list below is not in any particular order.

a) A. Blair Rains and A.H. Kassam, "Land Resources and Animal Production": in FAO Land Resources for Populations of the Future. Appendix VII. FAO, Rome 1980.

b) Alex Gorham, Education and Social Change in Pastoral Society: government initiatives and local responses to primary school provision in Kenya Maasailand, Institute of International Education, Stockholm, 1980: about 310 pages.

c) Stewart Odend'hal, "Human and cattle population changes in deltaic West Bengal, India, between 1966 and 1977", Human Ecology, Vol. 8 No. 1, 1980.

d) Stewart Odend'hal, "Cattle Ecology of upland and deltaic areas of West Bengal", Tropical Animal Health and Production. (1980) 12.

e) Problems of Desert Development, New English translation of Soviet Research Journal. Obtainable from Allerton Press, New York. Current annual subscription is $180 plus $20 outside North America.

f) ILCA, Dairy Development - ILCA Bulletin No. 11, Report on a Workshop on smallholder dairy development in the East African Highlands held in August 1980. About 20 pages.

g) Harold K. Scheider, Livestock and Equality in East Africa: the economic basis for social change, Indiana University Press, 1979.

h) Ørnulf Gulbrandsen, Agro-pastoral production and communal land use: a socio-economic study of the Bangwaketse, University of Bergen and Ministry of Botswana, 1980. About 250 pages.

i) FAO, Report of FAO Panel of Experts on Development Aspects of the Programme for Control of African Animal Trypanosomiasis and related development, FAO, Rome 1981.

6. Other Publications by Network Members

a) Carl Christiansson, "Imagi Dam - a study of soil erosion, reservoir sedimentation and water supply at Dodoma, Central Tanzania", Geografiska Annaler, Vol. 61, Series A, 1979.

b) Anders Hjort, "A social anthropological contribution: living conditions, societal forms and ideology" in The Committee for Future Orientated Research, Natural Resources in a Cultural Perspective, 1981.

c) N.S. Jodha, Agricultural Tenancy in Semi-Arid Tropical Villages of India, Progress Report Economics Program 17, ICRISAT, 1980. About 30 pages.

7. Thank you - Evaluation of AAU

I am grateful to those who responded to letters and questionnaires sent out by the evaluators of this Unit. On the whole the Evaluators report has been favourable and they have recommended the continuation of our grant for another five years but it remains to be seen whether this recommendation will be accepted.

8. Comments on Recent Network Papers

Robin Slade has written some short comments on a number of recent network papers. They are reproduced below:-

a) Vets Barefoot and Otherwise (Pastoral Network Paper 11c)

A lot has been done on this type of training at Isinya Rural Training Centre, and pastoralists from all over Kenya have been trained in Animal Husbandry and Health etc. together with other skills needed in their home areas, and we are pleased to say they have returned to work in their home areas and not been lost.

b) Cattle Structures - Meadows and White (Pastoral Network Papers 7d and 11e).

I would comment that their original hypothesis, that female calves are given preferential treatment is quite wrong. I have discussed this with some prominent Maasai and they confirm my own findings after living years in Maasai country that female calves are not given preferential treatment; under no circumstances are male calves neglected, because they are males.

It is true however that when cash is needed, or animals needed for ceremonial functions, then males are used in preference to females and this would account for a larger female population than male.

c) Re - Off-take

Maasai have many channels of selling off steers for sale. They have sale points all around their perimeters, even into Tanzania, as well as other Kenyan districts, and to get a true picture is not easy, and Meadows and White's figures are not complete.

9. Effective Date of Newsletter

The Effective Date of this Newsletter is 20th June 1980.

Stephen Sandford

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

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Pastoral Network Paper 12b
July 1981

DAM GROUPS IN BOTSWANA

by

Louise Fortmann and Emery Roe 1/

1. This Paper is part of a larger report on water use in the eastern communal areas of Botswana. Since 1974 the Small Dam Unit (SDU) of the Ministry of Agriculture has been constructing dams 2/ intended to water 400 head of cattle in this area where most of the population is rural and most land is still held on a communal basis. The survey took place at twelve sites shown in Figure 1.

1/ Centre for International Studies, Cornell University, Ithaca, New York. This research was done for the Ministry of Agriculture, Republic of Botswana. It was funded in part under USAID contract AID/DSAN-C-0060. The views expressed here are those of the authors and do not necessarily reflect those of the Ministry of Agriculture, USAID, or the Cornell University Centre for International Studies. We wish to acknowledge the considerable contributions of Charles Bailey, the third member of the research team, and of E.B. Egner who edited an earlier version of this paper.

2/ The Small Dam Unit builds dams, haffirs and haffir-dams. For simplicity's sake, all these structures are referred to below as dams. The Unit is also known by other titles, namely, "Small Dam Building Unit" and "Dam Section in the Division of Land Utilization". We have chosen the shortened version.

2. We were asked to test five hypotheses concerning dam management by groups. One of these:

> "Use of local labour on a labour-intensive basis in the Serowe Unit dams leads to better management"

could not be tested because the Serowe Dam Building Unit did not build dams by the method described.

The remaining hypotheses about dams and group management were:

> "Establishment of dam groups before dams are applied for leads to improved management."
>
> "Water points with well defined user rights lead to improved management."
>
> "The existence of written accounts leads to improved management."
>
> "Facilities controlled by a group are managed worse than those controlled by individuals or public authorities."

The issues raised by these hypotheses are investigated and discussed below. However, we have done no formal testing of these hypotheses because they are premised on an inadequate understanding of dam groups. Implicit in the hypotheses and in most discussions of dam groups is the assumption that they are formal, permanent and regularly meeting associations. In fact, these groups are more like working parties with a seasonal existence. Other writers 1/ have also pointed out the intermittent nature of water management groups but their observations have failed to shake conventional wisdom. We hope the evidence presented here will. Before we discuss how groups actually undertake management, we will describe how government expects them to do it.

The Present Ministry of Agriculture Dam Policy 2/

3. In January, 1974, the Government of Botswana declared its policy on haffirs and dams constructed by the Ministry of Agriculture which is still in effect. Between 1974 and early 1980, an estimated 99 dams, haffirs and haffir-dams were constructed under this policy in the eastern communal areas, either through contract

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1/ Pauline E. Peters. 1980. "Preliminary Findings and Observations on Borehole Syndicates in Kgatleng District." Unpublished paper.

J. Flood. 1974. "Reports on Development Projects Supported by Botswana Christian Council". Christian Aid (London).

2/ The quoted extracts in this section are drawn from the original policy statement Dam and Haffir Building Policy, Ministry of Agriculture, 16th January 1974. Other relevant sources are (1) Ministry of Agriculture's Application for Construction of Haffir and Dam: Terms of Agreement and (2) Division of Land Utilisation, Discussion of the Small Dam Construction Programme, undated. Charles Bailey's Keeping Cattle and the Cost of Water Ministry of Agriculture, Gaborone, also provides useful construction information.

or directly by the SDU teams. According to the policy statement, dams are to be "primarily" for stock watering purposes in the lands and cattleposts; they are not intended to serve as village (domestic) water supplies. They are to be large enough to ensure that, given normal rainfall, they can water up to 400 adult cattle for 12 months. In practice, capacity varies from dam to dam averaging about one-fifth of the capacity of the much larger dams built by the Ministry of Agriculture in the late 1960's.

4. The Central Government undertook to pay the full construction costs of these small stock dams, which are to be "built for agreed groups by building them and handing them over to District Councils[1] free of charge". The policy gives a council two options in dam management:

> "... the first option is for District Councils to take complete administrative control of the dams; to appoint a person to look after the dams, to maintain the fence around the dam and the watering point below it if there is one, to keep stock off the dam wall, to keep the wall grassed, and to collect watering fees ... A second option would be for the Council to hand over complete responsibility for maintenance to an established group of farmers using the dam, and to allow them to collect the watering fees and the money in a fund for maintenance of the dam."

In practice, no council has chosen the first option: dam groups have overwhelmingly assumed direct management responsibilities, even though formal handovers by councils to groups have been rare.

5. Under the policy, a dam group is meant to consist of approximately 15 members, each of them owning an average of fewer than 20 adult cattle. (Users are expected to increase their herds over time.) No single person should be allowed to water more than 50 head. Each group should be formed before the dam is constructed and should consist of farmers who want the dam and are "willing to control their grazing". The Ministry of Agriculture extension staff is expected "to take the initiative in organizing groups who want dams". Prior to dam construction each group should sign a standard form, "Terms of Agreement", as a precondition to the dam's handover. The three major conditions to be accepted by the group in this formal agreement are:

(i) The group members will maintain and repair the dam.

(ii) Each member will pay 72 thebe[2] per adult beast per year, the revenue from which will be used for dam maintenance and repair.

(iii) The group agrees to allow no more than 400 adult cattle (or their equivalent) to water at the dam.

1/ Botswana is divided into nine Districts each with a locally elected District Council which has statutory responsibility for the provision of primary education, primary health care, domestic water supplies, the construction and maintenance of non-gazetted roads, and the social and community development programme.

2/ (Ed.) 100 Thebe = 1 Pula = US $0.80 (approx.).

6. The 1974 dam policy sought to achieve a number of objectives. First and foremost, it meant to institute group management of the dams. Such management was to centre around members' payment of set fees; observance of standard stock limitations; and agreement to common maintenance and repair. Through acceptance of these conditions, stock and grazing control around the dams would be established. Moreover, the dams were to be so designed that they could not water more than 400 adult cattle on a year-round basis. Underlying these objectives were both political pressures and lessons government officials felt they had learned from past Ministry of Agriculture dam building activities - the primary lesson being that group management was a necessary condition for the effective management of the dams and of grazing resources around them.

The Dam Group Policy in Operation

7. Group management of a water supply is meant to ensure exclusive and timely access to that supply for the group members. Management activities can be divided into three types:

   (i) Maintenance: keeping the physical structure in proper repair and working order. This is primarily concerned with preventing destruction of the dam wall and reducing siltation. Grass can be planted on the dam wall to reduce rill erosion. Animals should be kept off the dam wall and spillway because trampling weakens them. Siltation is reduced if livestock are kept out of the reservoir and away from the inlet. Much of this type of control can be accomplished by maintaining strong fences.

   (ii) Regulation: laying down and enforcing the amount of water that may be used, by whom (or by what sort of stock), and when and how it may be used.

   (iii) Revenue Generation: raising money for operating or repairing the structure. Fees can also be used as a regulatory mechanism by pricing the water beyond the reach of would-be users or as a means of earning revenue for activities not related to dam management.

What Dam Groups Do [1/]

7. In Table 1 (at end of paper) information on the dams observed in the course of our study is summarized. There are 24 dams, 21 of which have some sort of group management.

Maintenance Functions

8. One of the appealing features of dams is that there is no technically complicated maintenance associated with them unless the wall actually collapses or the dam silts up. Maintenance is largely preventative and its absence is not immediately apparent. About

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1/ A.B.J. Willett's forthcoming publication for the Ministry of Agriculture provides much useful information concerning the operation of individual dam groups.

half the groups do some sort of maintenance. We found no dam group which adhered fully to the suggested maintenance activities. No groups have planted grass on the dam walls, although in some cases natural growth has occurred. The Mmamonkge dam group in Southern District has been reported to have put cow manure on the rills of the dam wall in preparation for seeding. Some, though not all, of the dams have been provided with drinking troughs and hand pumps outside the wall and reservoir area. Many of these do not work at all. Others are not used only because they lack a handle.

9. The predominant maintenance activity is maintaining the fence. In contrast to their earlier relatives, most SDU dams still have their original fences in reasonably good repair. In some cases groups have even improved the original fences - adding droppers or piling thorn bushes around the wire to keep out smallstock. Two groups have hired caretakers whose duties include keeping cattle away from the fence; another two groups are said to have had caretakers in the past. It appears that fences are maintained less for the Ministry's reason of maintaining the life of the dam than because they are an essential tool for regulation which is the most common management activity.

Regulatory Functions

10. All groups attempted to regulate the use of their dams. In addition, at two dams without groups the chief or the headman occasionally exhorted the people to use the dam properly. As the ephemeral rainy season sources start drying up, the use of dams begins to be restricted in many areas. Again, the regulations may not necessarily take the form laid down by the Ministry of Agriculture (we know of no SDU dam group, for example, which deliberately limits the number of stock as prescribed) but they do assist in a rational strategy of overall water management. Four kinds of regulation are common:

(a) The numbers of users may be limited. This appears to be accomplished by turning away outsiders even when they are willing to pay fees, rather than by turning away non-paying group or community members.

(b) The types of use may be restricted. Six dams are limited to domestic use, either permanently or seasonally as other sources start to go dry. (Sometimes watering of calves and smallstock is allowed at domestic water points.) Cattle drink such large amounts of water, that, rather than try to ration use by cattle, the group simply excludes them completely in order to ensure a convenient domestic water supply. The success of such an ordering of priorities ultimately depends on the availability of fallback water points, both for domestic and livestock purposes.

(c) The manner of use may also be controlled. This strategy tends to be associated with a priority for domestic use, in part for reasons of hygiene. Dams used for domestic purposes are more likely to have a limitation on the access of cattle to the reservoir. The only workable hand pump known to us is at Rapalana dam, where the water is used for domestic as well as livestock purposes. Where the water is used for both cattle and domestic purposes, the

cattle are allowed near the reservoir but are kept out of the water (being watered instead from troughs). Ironically the exclusion of cattle from the reservoir, an important maintenance activity in the eyes of the government, occurs mainly in conjunction with the use of the water by humans, a use for which these dams were never intended.

(d) The time of use may be regulated. Some dams are closed completely at certain seasons. This usually occurs for one of two reasons. In some cases, dams are used as fallback points for other water points which are subject to breakdowns, such as boreholes. Such dams are kept closed (by the simple expedient of locking the gate) and opened only when the primary water point is not functioning. Makaleng haffir-dam is controlled in this way. Other dams are part of the sequential system of fallback points. The water source most likely to go dry is used first, followed by the other, more reliable, sources. In Sechele Village (North-East District), one haffir-dam is used first, while a second, deeper haffir is kept locked. When the first goes dry, the second is unlocked. When that is finished, the herds are taken to "the cattle post of last resort", the village, and watered for a fee at the Council borehole, intended only for human consumption.

11. In general then, it appears that regulatory activities take place in an attempt to preserve water quantity and quality over time as the more plentiful and convenient rainy season water supply diminishes. In particular, the demand on these dams for domestic water partly explains why considerably more livestock do not water at some of them. Of the 129 daily counts taken at 15 SDU associated haffirs and haffir-dams between November, 1979 and July, 1980, only 15 of these counts (12 per cent) recorded over 400 Livestock Units (LSU), eight of which were at just one haffir in the North-East District. The average daily count for all SDU constructed or contracted haffir-dams monitored during this period was approximately 100 livestock units.

Revenue Generating Activities

12. Because there are few, if any, operating costs for dams, users are less likely to perceive a need for fees than they are in the case of water points equipped with pumps and engines. Nine groups said they charged fees. As noted above, the Ministry recommends a water fee for SDU dams of 72 thebe per beast per year. We know of no dam where such a fee is collected. Revenue is generated, however, in response to specific needs often in the form of a contribution, e.g., paying a caretaker. Some users appear to pay, say, an initial membership fee out of a general sense of obligation, thereafter treating this payment as a license fee entitling them to take water indefinitely. Groups may have a membership fee or a requirement for contributing labour and a penalty for non-compliance but such penalties are rarely enforced. Under these circumstances it is not surprising to find that record-keeping is rarely practised by the groups. If records are kept, they are unlikely to be sufficient to determine either total revenue or total costs within a given period. It is understandable if users are reluctant to pay fees in circumstances where they consider there to be a complete lack of financial control and accountability. Contributions for a specific purpose seem to constitute a more acceptable way of raising revenue. In this fashion, people are not made to

feel that they are paying for water or, in the absence of trust, "throwing their money away" but that they are chipping in to keep the effort going - rather in the nature of a self-help contribution.

13. No group seems to be collecting more than a small fraction of what the government recommendations envisaged. For example, the Sekerepa Dam group as of 5 January, 1980, had collected between twelve and thirteen Pula. (The dam group chairman could not say precisely what had been collected.) Had the group collected the fees at the government rate, they would have collected at least P127.50. On the other hand, few groups seem inhibited by want of funds from taking essential action for essential purposes. It may be that government overestimated the real costs of dam management, or that in the longer term these costs will emerge. "Essential action" for the users does not include saving to deal with long-term costs.

Why People follow Management Procedures laid down by Government

14. Dams do serve a useful purpose. Rural water users value reliable and convenient supplies - every hour not spent carrying water can be spent doing something else. Hence, it is worthwhile to protect and preserve a nearby supply. Fences are maintained because people can see them working as a management tool. When a dam comes under stress within a fallback system, its supply is regulated.

Why People do not follow Management Procedures laid down by Government

15. There would seem to be two sets of factors which encourage groups to depart from the Terms of Agreement - one technical and one social/organizational. The technical factors are set out in paragraphs 16 - 20 below and the social/organizational in paragraphs 21 - 27.

The Small Capacity of the Dams

16. It was always the intention of the government that these dams should hold water through the dry season. But to give effect to this intention, rain must arrive in sufficient quantity - preferably in the form of quick heavy showers to fill the dam. Rainfall - any rainfall let alone a specific amount and type of rainfall - is not reliable in Botswana. Even given sufficient rain, many small dams do not hold water throughout the dry season. Sometimes this is due to the pressure of an excessive number of stock. If a dam is going to go dry anyway, it makes perfect sense to "mine" the water while it is there. Other dams go dry because, as admitted by SDU personnel, they have not always been well sited. Siting of most SDU dams is based on a short visual inspection, without the aid of technical tools such as soil tests and aerial photography.

Dams as Low Maintenance Structures

17. Many people favour dams precisely because they do not have to worry about their maintenance. Where there are low maintenance requirements, there is even less incentive to pay fees.

The Role of Seasonality and the Position of Dams in the Fallback System

18. The role of dams is significantly affected by the seasonal water fallback system. Dams have their greatest potential for use when they are least needed - during the rainy season. At that time there is little incentive to pay attention to them. Moreover, many dams extend the rainy season supply through only part of the dry season. This varies from year to year. While choosing survey sites in August/September 1979, we found only three dams in the areas we checked (including, but not limited to, the twelve Survey sites) which were holding water. This year, late heavy rains resulted in 73 per cent of the SDU dams containing water at the time they were monitored, compared to 29 per cent of all man-made surface water sources. On the whole, SDU dams have a reputation for going dry before the end of the dry season.

19. During both the rainy season when water is plentiful and during the late dry season, there is little payoff in labour devoted to dams. The payoff comes only when the dam begins to function as a fallback point or when the structure is in obvious need of repair. Management occurs, but it is management under stress at that time of year when use of the dam is critical. If fees are collected or books kept, it is typically at this time.

Dams as Multiple-Purpose Water Points

20. If fencing and deep reservoirs are successful in restricting direct livestock access to dam water, users will be encouraged to use this water for other purposes - especially in many mixed lands 1/ and cattlepost areas where convenient domestic water supplies are at a premium at the start of the dry season. Twenty of the twenty-four dams were used for domestic water. As noted above, the principles applied in managing a dam for both domestic and livestock watering purposes are different from those applied in managing it as a livestock watering source only. More important, calculation of fee payments on the basis of use can become more complicated when a dam is managed for multiple purposes. In particular, domestic water charges are even less favoured than livestock watering fees by the households. Domestic water is supplied free of charge in most major villages.

Shortage of Labour

21. Use of the SDU dams in the mixed lands and cattlepost areas where many of them are sited is affected by a labour shortage in cattle-herding. Of respondents who said they live permanently at the lands, 39 per cent said they did so in order to manage their livestock better and 28 per cent did so in order to stay

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1/ (Ed.) "Lands" in Botswana are blocks of land where the predominant land-use is cultivation: these blocks may be at a very considerable distance from the village where the cultivators have their main residence.

with their cattle and livestock. Those who have traditionally cared for livestock, young men and boys, are now occupied in the wage sector or at school. This means that adult owners, truant children, or low-paid hired herders take care of the livestock. Livestock watering dams are appealing to such herders because cattle can simply water themselves at these single-purpose dams without deep reservoirs and locked gates. Herders would much rather open a gate and allow cattle to water freely than spend their time and energy using a hand pump. The labour constraint makes itself felt in other ways as well. The Motloletsetshega dam group in Kweneng District could not ration its dam water for domestic purposes until after harvest, when field labour became available to herd the cattle to more distant water points.

22. Low wages in cattle-herding and the consequent labour shortage have two other effects. Labour-intensive dam maintenance tasks may not be done for lack of labour; and the very lack of fences and deep reservoirs may in fact increase the value of the dams to labour-short stock holders who use the dams for livestock watering purposes only. In other words, individual cattle-owners may have a vested interest in minimizing their own costs by ensuring that some small dams are not managed and controlled as intended by the government.

Local-level Perceptions Affecting Dam Use

23. Water points which have been established by private individuals are commonly maintained by them (privately owned, open access, sources are not unknown, however). Government dams are often considered to be government property, the local perception sometimes being that government will take care of them as it does its other property. Although the government policy of prior consultation and agreement is meant to give a sense of local ownership, it does not always work.

In addition, surface water, particularly when it is for domestic purposes, is considered to be a common good, like fresh air. In effect, a SDU dam is commonly perceived as belonging either to government or to the community in which it is located; rarely is it seen by community members as belonging exclusively to only a small group of people in that community.

Dams Groups as a Creature of the Government

24. It is often, but not always, the case that dam groups have no life of their own. The members are 15 to 20 people who have signed up with the agricultural extension agent to get a dam. They were simply in the right place at the right time. It is especially at this point that government and community perceptions can run afoul of each other.

25. The government is concerned that there must be a group which has expressed sufficient interest to allow government to assure itself that it is responding to a community need by building the dam. What the group represents in terms of the overall community is not a government concern, as long as the group manages the dam. From the viewpoint of the government the group has the right to use the dam and the responsibility to manage it properly. If there is a need for additional water points in the community, then those outside the group may not

be prepared to accept the group's exclusive right to the water. The land belongs to the community. The dam itself is built by the government at no cost to the group. The water is rain water.

26. Groups who try to exclude others from using the dam or to collect fees find themselves on rather tenuous ground. They may have no real basis of legitimacy. As noted above, there are rarely community norms on which to draw for support for such actions. Further, in communities in which there is still a certain amount of mutual assistance, a group is unlikely to wish to create antagonisms by turning away from the dam potential benefactors in some larger social context. Thus, groups may have to sacrifice the "interests" of dam management in favour of preserving their standing in other social networks in the community. It is for this reason that one finds would-be fee paying outsiders turned away in favour of "freeloading" community members.

27. Dam groups arise in response to a government offer. The government comes to them. Once they say "yes", they have no involvement in the process of dam building until the dam is turned over to them for management. The period between saying "yes" and getting the dam can be from two to six years. This is no basis for building a cohesive group which might try to enforce unpopular dam regulations. Since groups typically have committed no resources to the dam, and since the group itself is not particularly strong, its members have no reason to exert themselves.

Some Lessons

28. Dam groups do not perform as the government might wish. On the other hand, the state of SDU dams is not as bad as that of their predecessors after some five years of use. Most fences are standing upright and intact. Management occurs when it is needed, especially where dams serve both a critical livestock and domestic function, during the dry season. In many cases, community effort is exercised when a clear need for labour or money arises.

29. To claim that group-controlled dams are mismanaged because the government-designed Terms of Agreement are not followed is too narrow a view, resting on preconceived notions of what groups are, what true costs of dam management are and how fees fit into management. The dam groups monitored by the Water Points Survey were essentially ad hoc working groups, seasonal in nature and community-based. They regulated water use; they occasionally organized the maintenance of dams on a short-term basis by contributing time, labour and, in some cases, cash: their sole purpose was to enable their members to have timely access to a convenient, but not very reliable, water point. To expect such working groups to behave as if they were fully-fledged permanent standing committees, with an on-going basis for operation is unrealistic. Moreover, under these circumstances, the failure to obey stock limitations is balanced by the fact that grazing pressure on a dam is rarely sustained the entire year. There is no real evidence that the SDU dams are any better or any worse in affecting the associated range conditions than other types of water points used presently in the same areas as these dams are now located.

30. The alternatives to group management are not necessarily better. One possibility is that councils could, as they do with village water supplies, take over the running of the dams. Even if councils could afford the ever increasing wage bill for a cadre of over 100 caretakers, there is no guarantee that such control would assure that fees were collected or stock numbers limited. Another alternative would be to sell dams to private individuals, on condition that they followed government maintenance regulations, including stock limitation. Private leasing of grazing land in Botswana has nowhere secured improved management of the range. There are even questions about how effective the link is between private ownership and restricted access to a water point in controlling grazing pressure. Privatising these dams would certainly disrupt many areas' fallback systems to the detriment of the poor smallholder and domestic user. Finally, privatising a water point may raise the cost of water to the consumer. For example, at Mokatako/Ditlharapa where water, particularly domestic water, is sold commercially and where there is no alternative to these few available private sources, the cost of water tends to be relatively high (i.e., P3/household/month or 10t per bucket).

Improving Group Management

31. If groups are to remain the chief instrument of dam management, there is much which could be done to make them more effective in the longer term. Much could also be done to improve the efficiency of dam structures as sources of water supply. And groups could begin to manage water sources other than dams. Some of the better managed dams are part of a system of multiple water points managed by the same group. Exclusion from a single water point is accepted when it has a clear place in an orderly system of fallback points. The government's emphasis on single water points is inconsistent with the adaptive behaviour necessary for survival in the area.

32. Groups seem to be most effective in two situations. If there are enough water points in an area, they can avoid conflicts with each other and carry on with regulating their own dams. When demand exceeds supply, however, groups are bound to find themselves in conflict with other would-be users; as already noted, the groups are not in a position to be forceful in such conflicts. The second situation in which groups seem to be effective is when they draw their legitimacy from the community as a whole and can draw on community norms and sanctions for their actions. Groups with such a broad basis for their authority often arise in communities with strong leaders or in highly homogeneous communities. Dam groups which came into existence as isolated entities are not particularly viable. They must be tied into and accepted by institutions with some wider legitimacy. In some places this link may be with the village development committee (VDC); elsewhere it may be a farmers' committee, a drift fence group or a kgotla.[1] The need for strong community links is

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1. The kgotla is the traditional village authority, functioning somewhat like a New England town meeting, to which matters of communal concern are brought for discussion.

particularly important if there continues to be a lengthy hiatus from time of signing the agreement to time of receiving the dam. Giving dams to community groups rather than to groups of individuals avoids the problem of who inherits the right to use the dam. A dam belonging to a community group is and remains the property of the community.

33. As a prescription for the future, any new development of dams should be linked to such community-based groups. As for existing dams in areas where conflicts persist, if VDCs, farmers' committees or kgotlas are willing to take over the direct control of the dams, they should be encouraged to do so. The first step would be for council and agricultural extension staff to determine that a particular dam group existed in name only and that dam management was minimal or non-existent. Consideration should be given to involving Group Development Officers in this process. In some cases water rights would also have to be transferred. If the aims are to achieve better management of publicly-owned resources and to reduce conflicts within the community, the vested interest of individual members of existing groups should not be allowed to interfere with implementation.

34. Further it is imperative that Government should not in future act alone, leaving the farmers behind. During the course of this Survey, the North-East District Council fenced five dams as the first step in turning them over to the villages. To the dismay of the council employees, the fences at all five sites were either cut or demolished by cattle within a few weeks. The villagers were viewed as irresponsible and destructive but the entire fencing effort had taken place on the council's initiative without informing the people. The fences were seen, not as management tools, but as devices for preventing use of the dam water. An informative and consultative exercise might have prevented distress on both sides.

35. Fee collection is not an easy matter. One problem is that the relationship between a flat scale of fees and real costs of maintaining different dams is an ambiguous one, based on guesswork. The recommended charge of 72t/beast/year should be abandoned (it has never been collected anyway). Extension efforts should concentrate upon showing groups how to properly maintain a dam and assisting them in finding out the costs involved in doing so. Extension staff, either of the council or of the Ministry of Agriculture, might eventually be trained to teach simple record-keeping to those dam groups who in fact collect some funds for the operation of their dams. If record-keeping is a key for better management, officials should be capable of teaching people how to set up such records and inspect the records to see they are kept up to date. If the officials are themselves incapable of performing simple management tasks, they cannot teach management to others.

36. A second problem is the more general one that self-help activities are in disarray in many areas. The absence of community sanctions against those who do not participate in activities supporting the management of a dam may indicate the low priority that all self-help activities receive in the community. The complaints of some dam group members about people who do not contribute to the management of a dam

occur in the context of an increasing lack of trust and cooperation in some communities. Extension efforts should support locally-initiated efforts by those dam groups who want to improve their revenue collection. Sometimes new ideas can be important. It is understood that the Mmamonkge dam group held a gumba-gumba party[1/] as a way of fund raising; it then bought seed with this money and gave it to its members, who later would donate part of their harvest for sale on behalf of the group.

37. Extension efforts devoted to group formation four to six years prior to dam construction are a waste of time. They can lead to unnecessarily high expectations and subsequent disappointments. If extension workers have not already done so, they should suspend any new efforts to form dam groups. Instead they should direct their attention to determining which outstanding applications might be consolidated under existing VDCs, kgotlas and farmers' committees. There is no point in processing new applications until the SDU has caught up on its four year backlog of existing applications. It is also urgently necessary for the Small Dam Unit to inform the districts and groups concerned about its timetable for undertaking construction in their areas. Political problems are arising in some areas because people have not been told about the ability (or inability, as the case may be) of the SDU to undertake construction in their areas.

38. Finally, the SDU should be restructured into a Water Points Unit which can provide expertise on a variety of water points including open wells, springs, seep wells and subsurface dams. In particular, where hydrogeologically possible, the SDU should consider sinking open wells for those groups in whose areas wells provide a cheaper and more reliable water source than haffir-dams. Evidence in this Survey shows open wells are presently being used more often by more people than are SDU dams. Where labour is not in short supply, open wells may be more cost effective than haffir-dams (see Charles Bailey's Keeping Cattle and the Cost of Water in Eastern Botswana). In addition, SDU dams are probably unhygienic ways of providing domestic water at the lands, where many wells are not. Recent discussions indicate that wells are still a desired form of water development in many areas. Priority should be given to hiring private contractors to sink such wells, not to expanding the construction teams of the Small Dam Unit. Technical staff for siting both dams and open wells will of course be essential.

1/ A gumba-gumba party is one where South African gumba-gumba music is played on a record player and beer is sold.

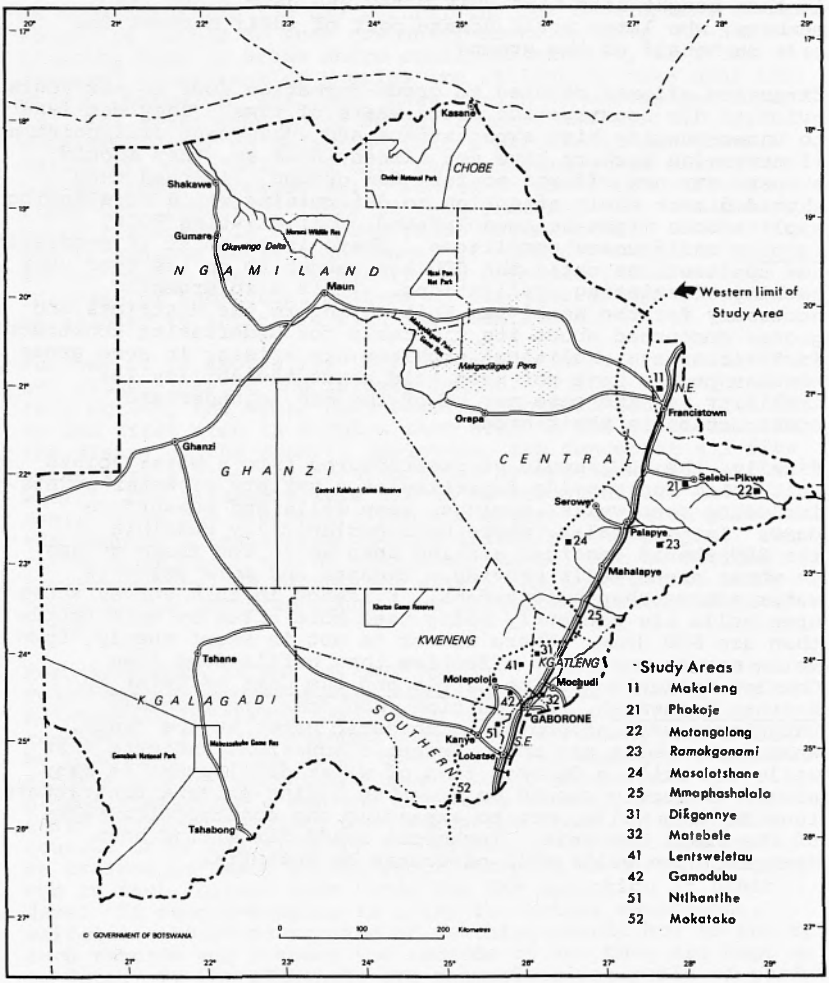

Figure 1 Water Point Survey Study Area

TABLE 11 SUMMARY OF INFORMATION ON DAMS STUDIED

Dam Name and Code Number	Group	Use a/	Maintenance	Regulation	Fees b/	Average Daily Counts* (LSU/Domestic) Users	Condition of Fence	Comments
Makaleng Haffir Dam 11201	VDC d/	L D	None	Gate is locked when village cattle watering borehole is operating.	None	289/0 (Dry Season)	Good	
Mambo Haffir Dam 11204	None	L	None	Occasional exhortation by headman	None	-	Knocked down in places	
Sechele Haffir	VDC	L	Fence reinforced with thorns	Locked until Sechele Haffir Dam goes dry	None	-	Good reinforced	
Sechele Haffir Dam	VDC	L	None	See Sechele Haffir above	None	-	-	
Toteng Haffir 11302	Toteng Ward	D	None	Domestic only	None		Good	
Bosudi Haffir 11303	None	L D	None	Occasional exhortation by Chief	None	148/1 (Jan 1980) 237/4 (April - July 1980)	Gate knocked down	A group has been formed but was told by MOA that they must wait until the dam has been handed over to Council
Lekurwana Haffir Dam 23201	Dam Group	L D	Fence reinforced with thorns	Non members excluded	None	41/2 (Wet season) 60/0 (Dry season	Good reinforced with thorns	Hand pump does not work charge for not working on maintenance
Masdithota 23202	Dam Group	L D		Non members intended to be excluded	None	99/7 (Wet season) 86/14 (Dry season)	Thorns only	Cannot exclude community members from use
Dinokaneng 23203	Dam Group	L D	Fence reinforced with thorns	Non members domestic use only	Members - none Non-members domestic use only 25t/drum (limit one drum per day) 50t month (buckets only) - not collected regularly	94/4 (Wet season) 28/1 (Dry season)	Good	Hand pump not used some have paid fine for not working on maintenance

Cont ... 2

Dam Name and Code Number	Group	Use a/	Maintenance	Regulation	Fees b/	Average Daily Counts* (LSU/Domestic) Users	Condition of Fence	Comments
Sekerepa 23204	Dam Group	L D	Fence reinforced and thorns built fence as a group	If dam going dry, tell non-members not to come	Said to be:- members: Domestic P1.20/ household/year; cattle 72t/beast; Non members: Domestic P2.00/ household/year; Smallstock 1t/4 head/ day; cattle 1t/beast/ day; - not collected regularly.		-	Hand pump not used Have collected fines for not working on maintenance
Belabela Haffir Dam 32201	Dam Group	L D		No non-members said to use haffir-dam	P6.00 Membership fee	0/0 (Wet season) 0/4 (Dry season)	Good	Apparently little used
Segomotlhaba Haffir Dam 41200	Dam Group	Primarily D	None	Livestock excluded often because of lack of sufficient dam water	None	4/13 (Wet season) 0/19 (Dry season)	Good	Hand pump not in order
Galetlhokwane Haffir Dam 41201	Dam Group	L D (Primarily L)	None	Used for domestic only when dam water is low; some non-members use dam	None	218/0 (Wet season) 375/1 (Dry season)	Good	Hand pump not working; major lands cattle watering source
Letswatswe Haffir Dam 41202	None	D			None		Good	Rarely used because of poor water holding capacity
Ngotshwale Haffir Dam 41205	Dam Group	Primarily D & SS	Users have placed metal trough outside fence for calf watering	Galetlhokwane non-community members excluded	None		Good	Proximity of village cattle watering boreholes allows group to restrict dam to domestic only
Mannyelanong Haffir Dam 41206	Dam Group	D		Gate locked to stop livestock water, water rationed primarily for domestic use only	None	14/10 (May 1980)	Good	Said to be seepage and poor holding capacity

Cont ... 3

Dam Name and Code Number	Group	Use [a]	Maintenance	Regulation	Fees [b]	Average Daily Counts* (LSU/Domestic) Users	Condition of Fence	Comments
Kgope 41207	Dam group	D		Gate often locked to prohibit livestock watering; scarcity of water led to rationing for domestic use only	None	7/28 May 1980	Good	Reports of people "forcing" their way into dam for livestock watering have been made recently
Mmanoko Haffir Dam 42200	Dam group (said to be associated with Mmakanke VDC)	D L	Bush fencing within dam area and reservoir pit to exclude livestock walking into water	Caretaker hired. Users have placed a metal trough for watering outside pit; users form "buckets brigade" from pit to trough when watering cattle	Varies: 10t/beast/dry season (1980); P1.00/year 1978/79)	601/1 (June 1980)	Good	Used by and restricted to residents around dam
Motloletse tshega Haffir dam 42201	Sub committee of Mmakanke VDC	D L	Caretaker maintains fence; however, cattle enter dam & trample spillway as outside hand pump not working	Caretakers hired; users have placed a metal trough outside reservoir pit for watering; herders bucket water to trough; rationed for domestic water only in dry season	Varies: 10t/beast/dry season (1980); P100/hh/yr (1978). In past, fees were self-help levies on residents of area. P67 collected since 1977	2/1 (Wet season) 240/16 (Dry season)	Good	Hand pump not working; VDC complaining of people failing to make contributions. Fees collected go into general VDC treasury
Mmamohiko Haffir Dam 42202	"Dam Group"/ Communal	D L	Volunteer caretaker once said to maintain dam, but no longer; new caretaker said to be identified (5/80)	Users have placed water trough outside reservoir pit, with herders bucketing water to trough	Said to be 10t/beast/dry season but apparently no one paid as of 10/80	4/4 (Wet season) 36/9 (Dry season)	Good	When Chairman of original dam group died, group effectively disbanded; hand pump not working
Kapalana Haffir Dam 42203	Dam Group (said to be associated with Mmakanke VDC)	D L	Caretaker herding activities away from dam fencing	Have used outside hand pump and trough in past to ensure no pollution of water for domestic use; caretaker said to be hired	10t/beast/dry season, but varies from time to time	485/21 (June 1980)	Good	Hand pump recently was working; history of disputes with Mmakanke VDC
Mahane Haffir Dam 51200	Dam Group	D L	None	Gate once said to be locked, excluding Chairman of Dam Group from using it. (Vice chairman had key)	None	7/0 (Wet season) 105/1 (Dry season)	Good	Serious disagreements between Dam Group Chairman and Vice Chairman, both of whom are from different communities but farm the same lands area around dam

Cont ... 4

Dam Name and Code Number	Group	Use [a]	Maintenance	Regulation	Fees [b]	Average Daily [c] Counts* (LSU/Domestic) Users	Condition of Fence	Comments
Mmamonkge Haffir Dam 51201	Dam Group	D L	Considerable bush fencing for goat-proofing, cow dung collected for grassing of wall around rill erosion areas	Have bye-laws for members and non-members, meetings held; gate often locked, said to have rationed water in dry season for ss purposes; caretaker said to have volunteered at one time	50t/hh/dry season (covers D & L Uses); said to have collected P150 so far; fees vary yearly for members and non-members	9/0 (Wet season) 108/0 (Dry season)	Good	Group has had fund raising parties and projects for dam
Magolthwane Haffir-Dam 51202	Dam Group	Primarily L (Late 1980)	None	Has not been managed or used since just after construction to mid 1980; availability of domestic village borehole and nearby river has lessened need for dam	Inconsistent reports on fee collections; some P6 - P11 collected in the past	12/0 (Wet season) 139/0 (Dry season)	Good	Hand pump does not work; people want Government to fix pump
24 dams	21 Groups	83% dams used for domestic water. 25% dams used for domestic only	48% of the groups do some maintenance	All the groups try to regulate the use of their dams	43 percent of the groups say they charge fees			

[a] D = Domestic, L = Livestock, SS = smallstock

[b] hh = household

[c] 1979/80 Counts from Water Points Diaries

[d] VDC = Village Development Committee

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PASTORALISTS AS ANIMAL HEALTH WORKERS: THE RANGE DEVELOPMENT PROJECT IN ETHIOPIA [1]

by

Dick Sandford [2]

1/ This paper springs from reading Brendan Halpin's VETS, BAREFOOT AND OTHERWISE (Pastoral Network Paper 11c)

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Veterinary Scouts: Pastoralists as their own animal health workers

1. The Rangelands Development Project (RDP) in Ethiopia established, in 1976, a special cadre of animal health workers recruited from among pastoralists called 'Veterinary Scouts'. A proposal for this had been included in the project's plan of operations after considerable investigation, enquiry and discussion. The comments that follow stem from our experience in this project.

Why recruit Veterinary Scouts?

2. There are two main arguments for recruiting pastoralists to do their own veterinary work and I think it is important to be clear about which one is considered to be paramount. Are we trying mainly to maximise pastoralist employment and hence involvement in a project in order to attach the all round benefits of this? In this case recruitment can be into existing institutions under existing procedures and, apart from minor problems, eg. pastoralists' difficulty in meeting minimum language and educational requirements, is fairly straightforward. Or are we saying that their veterinary needs at root level can only be met effectively by pastoralists themselves and that for this a special service is required? This was our contention in the RDP.

The Scouts' role

3. The service was to be special in that:-

   (i) The scouts were to regard themselves as servants of their people; they were thus to be employed outside of the normal government service, free from the preoccupations of the ordinary civil servant.

   (ii) As pastoralists themselves they would provide a means of closer communication and cooperation between pastoralists and project.

   (iii) They would be as mobile as their communities without the need for mechanical transport.

   (iv) They would be accustomed to and undeterred by environmental hardships.

   (v) They would have the confidence of their communities.

   (vi) They would be content to remain working in their own areas.

   Special service needs special people and, I suspect, we first cast a difficult role for our veterinary scouts and then expected extraordinary motivation from them. Is it realistic to introduce 'bright, intelligent and innovative' pastoralists (Brendan Halpin, para 16) to new work opportunities and then expect them to be technically active but professionally static and to remain content in a traditionalist community?

4. Not if they are young anyhow. We chose young, 18 - 28 year olds. NOMADEP, a small project in the Middle Awash region, chose a mature, sub-clan leader who was respected by the community and was judged by that project to be effective. However, in

conversation with him it was evident that people came to him with their veterinary problems more often than he went to them. Older men, with sufficient status and stake in their society would probably prefer to remain as and where they were rather than to pursue the possibilities of a profession but would, I suppose, be less mobile, less biddable, less available, less teachable and more liable to distraction from veterinary matters than young men with fewer ties. The young men are usually, however, more ambitious. In fact they seek employment as a means of increasing their standing.

Remuneration

5. Having opted for a special service, the project then created difficulties for itself by paying the veterinary scouts a salary.* This very soon undermined the concept of the veterinary scout as a servant of his people. His name had to appear on a muster roll, subject to inspection and audit, and, in spite of attempts to juggle with terms of employment (by calling the scout a casual worker) and in spite of what we wrote in it, his contract became subject to the government labour laws. The project vet scouts did not take long to start enquiring about their terms of work and entitlements under the law. This now sounds pretty predictable but para. 15 of Brendan Halpin's paper sums up, more or less, our thinking at the start. In other circumstances it might be possible for the scouts to be paid by the communities which they serve through local councils of one kind or another but I think now that pastoralist vet scouts, as a special service, need not be paid in cash, will often receive sufficient compensation in other forms from their community to get them to work, and must not be paid if the specialness of their service is to be maintained. The NOMADEP project did not pay their vet 'scouts' and the Ethiopian Veterinary Department had already, when I left the project, trained a number of equivalent veterinary workers and were using them, unpaid, with reported success among Farmers Associations.

Selection

6. Selection of candidates satisfactory to both the project, the local administration and the pastoralists needs more meetings, discussions, time and effort than might be thought and than most of those responsible in the RDP were ready to give. We made some mistakes at least in the first selections. We depended too much on pastoral leaders in one area and recruited their proteges. These proteges, at least in one case, turned out to be even less acceptable beyond their immediate circle than outsiders. We went too fast in two cases which resulted in bunching of the resulting coverage. Although, right from the beginning we aimed to recruit on the basis of a scout for each social unit or grazing association, the speed at which we could

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* Two thirds of the lowest technical sale in the Veterinary Department, with no allowances or benefits.

identify or establish the latter did not keep pace with the rate at which we wanted to recruit vet scouts. Yes, we could have gone much slower but project schedules press hard!

7. The point is very important. I would not, now, recommend the recruitment of veterinary scouts until the pastoral groupings within and for which they were to work had been identified or established and their authority recognised, not only by the Project (easy) but also by other bits of the government. At that stage it is possible to define the responsibilities of the veterinary scout fairly precisely in terms of community and geographical boundaries. Failing this the veterinary scout becomes just another rather unspecial bod in the bush.

Supervision

8. Which brings one to supervision. We hammered away constantly at the need to supervise the scouts. But except for one period of about three months in the NERDU 1/ project area where, by agreement, an expatriate technical officer (the original proponent of the veterinary scout idea) spent nearly all of his time with the scouts, they were little supervised. After all by emphasising their attachment to a pastoralist group and the need for mobility we effectively ruled out supervision if supervision means, for instance, a veterinarian or veterinary assistant working with each scout for half a day once a month. Anyone who has worked among pastoralists will know the time, amounting to days, that it can take to search out and locate an individual and the consequent difficulty in organising this kind of programme. But is anything less really supervision? If veterinary scouts have to work without supervision the scope of their work must be more limited in respect of vaccinations, treatments, etc and directed mainly towards reporting and communicating. This leads to another difficulty, insufficiently foreseen by us and discussed by Brian Halpin at the bottom of page 14 of his paper. If they are 'genuine' pastoralists 90% of the scouts speak only their own language and, with the exception of our Omoro area, 90% of our staff did not speak the pastoralists' language. We, in the RDP in our concern for the pastoralist side of the two-way communication problem did not think enough about the project side. The scout could communicate with the stockowners, and they with him, but how were they supposed to communicate with us or we with them?

Brian Halpin rightly says teach the veterinary staff the relevant language and customs (we also planned for this). But this takes time and does not provide a short term answer. And if the staff stay long enough to communicate freely with the pastoralists and to understand their attitudes will there be a necessity for veterinary scouts? Should we also teach the scouts the official language? I say yes but some say this disorientates, or 'spoils' the scout.

1/ (Ed) North East Rangelands Development Unit, i.e. the Afar or Danakil area.

Training

9. The preliminary training of the veterinary scouts is open to argument as to content but, in our case, was, after early experience, reasonably satisfactory, and straightforward to organise. As one would suppose, their enthusiasm made them pleasing to teach, and of course you don't have to teach animal/plant physiology or management basics; you can start straightaway with 'new technology'.

In the veterinary field the instruction consisted of:-

- a standard sequence for examining animals both live and dead.
- a sequence and procedure for describing symptoms.
- a key for the recognition of the common diseases and conditions.
- action to be taken after diagnosis.
- injection and vaccination techniques.
- dosing for internal parasites.
- simple treatments.
- hand dressing and spraying for external parasites.
- selection and handling of specimens and samples.
- care of equipment.
- responsibilities and work methods.

The courses were divided into 2 - 3 weeks of 'class' instruction and demonstration and 6 - 8 weeks of field work with veterinary teams.

10. The arguments as to content revolve around whether you want a veterinary scout or an "Integrated Development" Scout. I recommend heavy concentration on one field - in this case the veterinary field so as to keep objectives clear, make measurement of achievement easier, and prevent dispersion of effort. We worked alongside a small project training and servicing 'barefoot' doctors but I am doubtful whether it would be sensible to combine human and animal doctoring in one person. We did not, from headquarters, lay down rules and the three regional projects drew up their own course curricula. One of the best courses included sessions on domestic hygiene (we recruited a female Boran scout) and game conservation. All courses had sessions on the aims and methods of the Project. I arranged to check personally the contents of the range management sessions and tried to restrict these to a discussion of the actual steps - grazing reserves - stock ponds - that we were taking. Argument took place on such matters as whether the scouts should be provided with beds during training and what they should eat. It was in the event difficult to keep the Afar scouts together for more than a week without milk being provided and we had to arrange for this. In the Southern project we had to teach a simplified system of recording numbers.

11. The real training problems arose toward the end of my time with the project and they were concerned with opportunities for further, more formal training. A number of the scouts after a year or two of work wanted to train for posts in the Veterinary Department as vaccinators or even as Animal Health Assistants. None of them could meet the minimum educational standards required.

This led to some acrimony between pastoralist representatives and the Department which resulted in pressure on the project to restrict its veterinary ambitions.

12. We took special care, in the RDP, to ensure that the Veterinary Department was fully informed of our intentions and policy as regards the veterinary scouts and we had written agreement to train and employ them. However it is very important that all the government authorities concerned are aware to the various implications, otherwise there is a risk of backlash. To a large extent the problems we had were common to those of any project whose work overlaps that of several different development institutions, but what I am trying to say is that there was a limit to what the RDP could do on its own and it became necessary at an early stage in the case of the veterinary scouts to involve other authorities some of whom had not been early enough or adequately briefed, and therefore tended to be unsympathetic or even obstructive.

Conclusions

13. As to my conclusions which are of course a bit premature after such a brief experience:-

a) The selection, training and employment of the veterinary scouts made a good impression on the pastoralists in all three of our development areas and the project gained a great deal of credit and subsequent support from them, as a result. Visiting VIPs who asked about the benefits to them of the project were always fed this by the pastoralists as an example to be followed. The value we got from this impact was much greater than the value we got through more effective disease prevention.

b) It is quite pointless to employ pastoralists as veterinary scouts in a special role unless one can make concurrent or, better still, prior progress towards a more effective veterinary service as a whole. In fact the veterinary scouts, if they are efficient, immediately highlight deficiencies. This was not, in our case at least, just a matter of making things go better along known routes. It was not also mainly the problem of unwilling and unsympathetic civil servants being posted into the bush although this is one factor. We did not have satisfactory answers to a number of uncertainties. For example:

(i) How does one best plan and time blanket immunisation campaigns in pastoral areas when you have

- 6 or more diseases to be included, with vaccines which protect for different periods, and which cannot all be given together.

- different categories and classes of stock kept in different localities (milking/dry cattle, small stock, camels).

- uncertainty as to the location of the different classes at any one period of any one year. (Location of crushes!).

(ii) How does one best plan and time (in conjunction with the above) treatment campaigns against internal parasites?

The need has been recognised for a long time but is anyone doing it on a regular basis in pastoral areas? We never got beyond treatment on an individual basis although we knew this was not satisfactory.

(iii) How does one satisfactorily identify and so become able to separate protected and unprotected stock (6 diseases) in order to avoid unnecessary re-immunisation and at the same time ensure coverage?

(iv) How does one charge and collect veterinary fees in a form simple enough to be understood and trusted by pastoralists and handled by illiterate veterinary scouts at the same time acceptable to accounting and auditing officers?

The employment of veterinary scouts does not contribute to finding answers to these questions, and one cannot realise the potential of a veterinary scout service unless they have been answered.

14. I agree with Brian Halpin's comments on the need for veterinary investigation. We carried out veterinary surveys (except in NERDU) before the project was implemented. We also employed a veterinary investigation officer for a six month's term in NERDU. However I suggest that the right personnel are difficult to find: that investigation results sufficiently firm for an action programme require a long time (three years minimum?); and that it is very difficult to draw the line between 'ad hoc investigation of practical problems' and 'longer term investigations and researches into the root causes of diseases'. (See Halpin para. 9) The root causes tend to be your practical problems. For example, high camel calf mortality and abortion in goats were declared by the Afar in NERDU to be severe problems. In both cases the severity was confirmed by the investigation officer: possible main causes were identified - salmonella organisms in the case of the newly born camels and the ingestion of Callitropis procera in the case of the goats, and his final report ended with 'and further study will be required to confirm ...' or words to that effect. By which time both the ODA investigation unit and the national Veterinary Institute were involved.

15. The fact remains that at the point where you are coping with Rinderpest, CBPP, Trypanosomiasis, and liver fluke in sheep to the best of your ability you do not - we did not - have sufficient knowledge to be sure of where the next priorities lay.

16. Our experience in this project was gained against a background of political revolution, continuous change in the mechanics of government, and especially in the Somali-speaking areas, of conflict. Conclusions may not therefore be relevant to other areas and situations. In any case the experience - about four years - is very short.

17. We used the term veterinary scouts but a local term would probably be better. I don't personally like the term barefoot. The pastoralists I know wore sandals - at least the men and boys - and the term would not command itself to the veterinary scouts who were pretty well shod after the first month or so.

18. It goes without saying that a special veterinary scout service can only be as successful as project staff want it to be. It was quite easy to get agreement, even support, for the idea. Not so easy to get an understanding of the special effort and sympathy required to develop the idea in practice and really difficult to dispel the idea that the encouragement of "Do-it-yourself" pastoralists encourages separatism. I hope I am right in believing that it works in the opposite way.

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OVERGRAZING IN SWAZILAND? A REVIEW OF THE TECHNICAL EFFICIENCY OF THE SWAZILAND HERD

by

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The author gratefully acknowledges useful comments on an earlier draft of this paper from S. Sandford, A. Low, and numerous colleagues in Swaziland, although he alone is responsible for the views expressed, and the interpretation of the data presented.

INTRODUCTION

1. Writers on Swaziland's agricultural economy were - even 50 years ago - remarking on the overgrazing problem (Pim, 1932 and Evans 1932, were early chroniclers) and for many years there has been debate as to whether the number of stock will eventually exceed the land's carrying capacity. In 1960 the Morse Commission noted, "African livestock is excessive in number and deficient in quality". (Morse 1960). It was followed in 1967 by the statement in the official report of the Department of Agriculture "Overstocking is present in all the physiographic regions". (Department of Agriculture, 1967).

2. People have been alarmed at the steady decline in the quality of the grazing - the more productive, palatable and nutritious grasses are diminishing in number and vigour, and are being replaced by hardier and often inferior species. In the Middleveld and Lowveld, bush encroachment provides evidence of over-grazing. Consequently, the carrying capacity of the veld is being reduced.

3. The solution which has been advocated repeatedly cannot be realised without a drastic culling programme, or supplementation of the unimproved grazing with fodder resources - or both. The optimum stocking densities in the different ecological regions of the country which have been put forward by livestock "experts" are markedly different (Table 1). This has contributed to the understandable scepticism that Swazis already have of expatriate proposals for improvements to the Swazi Nation livestock herd.

4. The belief that Swaziland is overgrazed is not held by everybody. Several authorities point to the continued ability of the national herd to grow - at almost 2 per cent per annum during the last decade - as an indicator that the country's carrying capacity has not yet been reached. Their argument is further strengthened by the fact that in 1950, almost twenty years after visitors first remarked that overstocking was a serious national problem, the average stocking density was 10.25 acres per beast (the 1952 Agricultural Department Report - Agricultural Department 1953 - noted that such a stocking density ..."does not suggest an altogether healthy state of affairs"). By 1979 this figure had shrunk to a mere 6.4 acres per beast; yet the Swazi Nation herd continues to show a healthy growth rate (1.8 per cent between

TABLE 1

RECOMMENDED CARRYING CAPACITIES (ACRES/LIVESTOCK UNIT)

AUTHOR	HIGHVELD	MIDDLEVELD	LOWVELD	LUBOMBO
Morse Commission (1960)	8 - 10	7 - 8	8 - 10	7 - 8
van Biljon J. F. Commission of Enquiry into Livestock Industry (1962)	7.8			
Porter Mission (1965)	10.0 (down to 7 after land has been rehabilitated)			
I'ons and Kidner (1967)	4 (6 months/annum)	5 (8months/annum)	11	-
Spargaaren (1977)	7	6 - 8	6.7 - 7.7	9

1978 and 1979, although it did fall by 0.4 per cent between 1979 and 1980).

5. Interestingly, the average herd size has altered little since 1954 (Table 2). Thus the increase in the total Swazi Nation (African-owned)[1] cattle herd can be attributed to the growth in human population, rather than to an expansion in the number of cattle per owner. The herd structure has also remained remarkably constant over the same period.

6. A Ministry of Agriculture seminar on "Overgrazing and Livestock Development", held in April 1978, carried out a more detailed investigation of the whole question of livestock numbers and the carrying capacity of the veld. While the participants did not agree unanimously that Swaziland as a whole was overstocked, there was a general concensus that many parts of the country were seriously overgrazed. Furthermore, the seminar expressed alarm over the continued growth in cattle numbers on Swazi Nation land, and the declining quality of the pasture (as well as the fast-diminishing area of available natural grazing). The seminar also agreed that control of stock numbers is necessary in order to protect the pasture and soil from permanent damage. (Ministry of Agriculture, 1978).

Methodology

7. In order to provide a more rigorous statistical framework within which the question of overstocking may be examined, this study attempts to determine the extent to which the overgrazing claims can be substantiated in terms of changes in the technical efficiency of the Swazi Nation herd over time. Use is made of the excellent, detailed census data collected annually in August by the Department of Veterinary Services. A continuous data series from 1954 to 1980[1] is available and provides the basis for the subsequent analysis of calving, death and extraction rates.

Calving Rate

8. The number of calves under one year surviving at the date of the census as a proportion of the number of cows, is equivalent to a combined measure of calving percentage and 0 - 1 year old deaths, and is here used as a proxy for the calving percentage. No detailed statistics of calf births during each year are available from the census.

TABLE 2

AVERAGE HERD SIZE (AFRICAN - OWNED) 1954 - 1980*

YEAR	HERD SIZE
1954	19.0
1955	19.0
1956	18.3
1957	18.7
1958	19.5
1959	19.4
1960	19.5
1961	19.5
1962	19.3
1963	18.9
1964	19.0
1965	17.8
1966	17.3
1967	17.1
1968	18.4
1969	17.7
1970	18.5
1971	18.5
1972	18.8
1973	18.9
1974	18.9
1975	19.2
1976	18.9
1977	19.5
1978	18.2
1979	18.3
1980	17.7

*(see note 1)

Death Rate

9. The death rate has been calculated as the number of cattle deaths in any one year(t) as a proportion of the total number of animals enumerated during the census in the August of the subsequent year(t+1). This methodology has been adopted because cattle deaths data are collected independently of the annual livestock census and apply to the period January to December of year(t). Examination of the data has revealed that most deaths occur in the last few months of the year. Therefore, it was felt that deaths in any one calendar year(t) should be expressed as a percentage of the cattle census figures in year(t+1), rather than in year(t).

Extraction Rate

10. The extraction rate is a better measure of the overall technical efficiency of a herd than the offtake figure because it includes the effect of changes in the herd size. It is calculated as the number slaughtered plus the change in the herd inventory during the previous year, as a proportion of the total herd. The slaughter figures were adjusted for exports/imports, to and from South Africa, before the extraction rates were calculated.

Rainfall

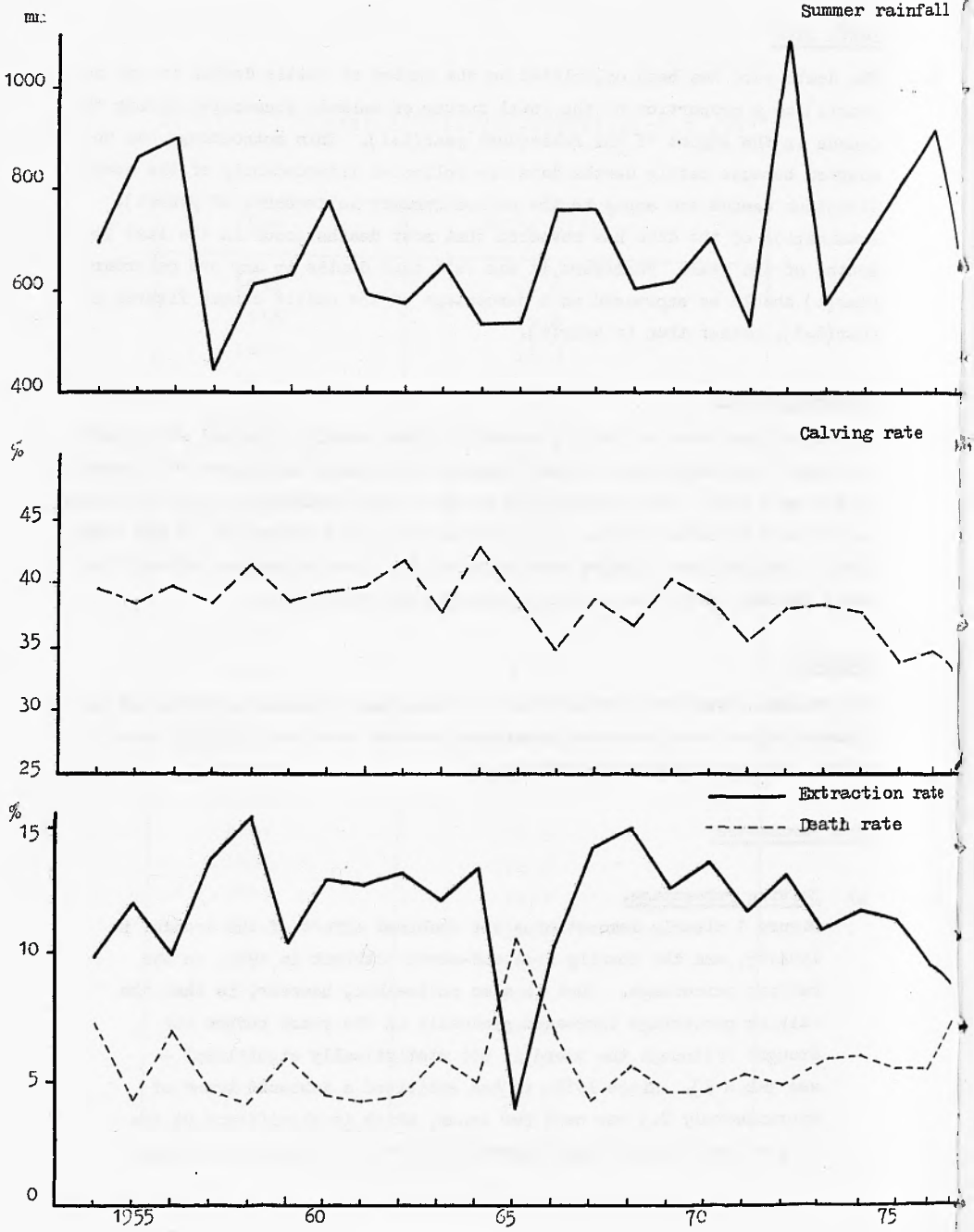
11. The rainfall data that are used are the averages of summer rainfalls of two representative stations where consistent records over the analysis period exist; they are Manzini and Nhlangano.

Herd Parameters

12. a) Calving Percentage.

Figure 1 clearly demonstrates the combined effect of the drought in 1964/65, and the ensuing foot-and-mouth outbreak in 1965, on the calving percentage. What is also noticeable, however, is that the calving percentage increased gradually in the years before the drought (although the trend is not statistically significant - see Table 3). Since 1967, it has exhibited a downward trend of approximately 0.5 per cent per annum, which is significant at the 99 per cent level. Thus, whereas the average calving percentage

FIGURE 1


mm
Summer rainfall
1000
800
600
400
%
Calving rate
45
40
35
30
25
%
Extraction rate
Death rate
15
10
5
0
1955
60
65
70
75
YEAR

for the eleven year period prior to the drought was 39.8 per cent, the average figure between 1967 and 1977 was only 36.8 per cent.

13. One might initially attempt to explain this trend as having been caused by a deterioration in the rainfall pattern, particularly during the last decade. Thus, as the rainfall diminished, this would have had a detrimental effect on the veld plant species, resulting in a lower livestock carrying capacity.

14. In order to test whether it has exhibited any trend, rainfall was correlated with time. The results show no significant downward trend (Table 3). In fact, the rainfall data exhibit a slight annual decline between 1953 and 1963 of 14 mms per annum, and slight increase of 14 mms per annum between 1966 and 1976, but neither result is statistically significant.

15. A better explanation of the downward trend in the calving percentage can be given by the increasing grazing pressure on the land. Until the 1964/65 drought the pasture appeared capable of maintaining the number of animals grazing thereon. However, the drought more than likely resulted in the disappearance of many grass species which were replaced by inferior, less nutritious plants. Because the pastures were not given time to recover to their original level of productivity before being grazed again, the cattle were compelled to adapt to a steadily deteriorating environment, and the effect on production is obvious. The poor pasture results in undernutrition of the animals which "is likely to be the most common reason for poor fertility"[2] because poor nutrition increases the length of the anoestrus which, in turn, is one of the principal reasons for a cow not being able to maintain a twelve-month calving interval.

16. Interestingly, analysis of the census data shows that the calving percentage of the European-owned cattle herd was increasing very gradually and with many fluctuations throughout the 1954-1977 period.[3] (The trend is not significant at the 95 per cent

TABLE 3

SWAZILAND HERD PARAMETERS

		1954 - 1964	1967 - 1977
Death Rate	m	- 0.13	0.18
	y	5.79	4.34
	r	- 0.37	0.73 ***
Extraction Rate	m	0.26	- 0.51
	y	10.80	14.49
	r	0.48	- 0.91 ***
Calving Percentage	m	0.21	- 0.50
	y	38.78	39.33
	r	0.42	- 0.73 ***
Rainfall 1/	m	- 14.06	14.41
	y	752.89	663.70
	r	- 0.40	0.29

1/ 1953 - 63 and 1966 - 76

m = slope of the trend line
y = intercept on "y" ax is
r = correlation coefficient.

*** denotes statistical significance at the 99 per cent level.

level, although it was for the years 1954-1964). Moreover, the European-owned herd does not appear to have been as adversely affected by the mid-sixties drought and foot-and-mouth outbreak, as the Swazi Nation herd; the calving rate in fact increased to 51 per cent in 1965 and then fell in the following year to 47 per cent. Surprisingly, it fell even further, in 1969, to 42 per cent but since then it has continued to increase. The reason(s) for the anomalous 1969 figure has not yet been discovered. The matter clearly deserves further investigation.

b) Death Rate

17. The data in Table 3 and its graphical presentation in Figure 1 show that up to 1964 death rates were falling very gradually - by 0.1 per cent per annum. They increased sharply during the drought and foot-and-mouth years, but by 1967 had fallen back to earlier levels. In the subsequent decade, however, the death rates have risen steadily by about 0.2 per cent per annum, and the trend is statistically highly significant.

c) Extraction Rate

18. Table 3 and Figure 1 portray the historical trend of the extraction rate of the Swazi Nation herd. Since 1967 the productivity of the herd, as indicated by the extraction rate, has fallen at approximately 0.5 per cent per annum. This trend is statistically significant at the 99 per cent level. In the pre-drought years (1954-1964) on the other hand, the extraction rate was increasing gradually at 0.3 per cent per annum (but the figure is not statistically significant).

19. Figure 1 shows that the extraction rate fluctuates greatly from year to year - this is because it is partly related to both the calving rate and the death rate. Indeed, multiple linear regression analysis has demonstrated that almost 70 per cent of the annual variation in extraction rates from 1954 to 1977 can be explained in terms of the calving percentage and the overall herd death rate.

20. Thus the declining calving percentage and the increasing death rate since the drought years of the mid-sixties have resulted in the decreasing extraction rate over the same period.

Table 4: AFRICAN-OWNED CATTLE HERD

EXTRACTION NUMBERS

Year	Extraction Number
1954	32,390
1955	33,917
1956	33,079
1957	48,853
1958	58,640
1959	40,501
1960	51,553
1961	51,844
1962	54,963
1963	49,808
1964	56,240
1965	15,196
1966	40,223
1967	56,121
1968	62,435
1969	54,620
1970	61,806
1971	54,345
1972	63,491
1973	54,669
1974	59,153
1975	59,141
1976	51,267
1977	47,654

21. Table 4 presents the absolute cattle herd extraction figures, and they exhibit the same trend as the calving percentage and extraction rate data. There was an annual increase in the extraction numbers between 1954 and 1964 (and the trend was statistically highly significant). The increase was brought to an abrupt halt in 1965 and 1966 by the combined effect of the drought and the foot-and-mouth outbreak. Between 1967 and 1977 the trend in extraction numbers was negative, although not statistically significant.[4]

22. Although total extraction numbers in recent years have been considerably greater than those recorded in the 1940s and 1950s, the investment in cattle is far higher now than it was then. As mentioned earlier in this paper, the extraction rate is now lower than it was.

23. We therefore have a situation where the recent increase in cattle numbers is not sufficient to sustain the levels of production of the late 1960s, in the face of declining calving percentages and extraction rates. Thus the Swazi Nation herd has apparently passed the point of maximum sustained production. It has been shown earlier that this phenomenon cannot be attributed to an adverse rainfall pattern, but rather it appears to have been caused by the increasing grazing pressure on the veld.

CONCLUSIONS

24. Whereas it is probably correct to say that claims made in "colonial times" about the overstocking of the veld were premature, the data and analysis presented above would appear to support the claim that the Swazi Nation area of the country is today overstocked.

25. Undoubtedly, the maldistribution of stock aggravates the problem, but nevertheless the technical efficiency of the herd has declined at an alarming rate since the mid-sixties and the trend shows no sign of slowing down. It cannot be explained by a worsening rainfall pattern, and it would therefore appear to be the direct result of pasture degradation caused by overstocking.

In searching for solutions to the problem one cannot expect that a severe drought (believed to be a highly likely occurrence in Southern Africa in the next few years[5]) will be a panacea. The evidence presented in Figure 1 shows that the last drought must have had a severe effect on the pasture. The more productive, nutritious grasses were hard hit and were not able to recover sufficiently before intensive grazing began again. Consequently, technical production parameters have never recovered to their pre-drought levels. A drought in the next few years would probably result in a similar state of affairs - production parameters will be cut drastically during the drought and will then recover to a level below that being achieved today. Calving and extraction rates will soon resume their gradual downward trends, so noticeable a feature of the 1967-1977 period, and may eventually result in the kind of situation now obtaining in Lesotho and the Transkei where offtake rates are estimated to be only 1-2 per cent per annum.

26. The unpalatable conclusion appears to be that some form of control of livestock numbers is essential. However, a more detailed analysis of area-specific production parameters is required so that such drastic action is implemented only in areas where a solution to the dilemma of overstocking is imperative.

NOTES

1] Up to and including the 1977 census, livestock data were broken down between African-owned, Eurafrican-owned, and European-owned cattle. Since then data have been collected of (a) cattle held on Swazi Nation land, and (b) cattle held on Title Deed land. Comparison of the pre-1978 data with that of the last three years is problematic and figures for these years have not been included in the statistical analysis. The terms Swazi Nation and African-owned are used interchangeably throughout the paper.

2] Campion E J and Butterworth M H (Eds) 1975, p.58. This relationship has also been noted recently for Lesotho, where "Inadequate nutrition especially during the winter which can be severe, causes high losses and poor reproductive performance". IBRD 1980, p.13. Thus "A decline in livestock numbers in recent years has been attributed mainly to a widespread and serious deterioration in Lesotho's grassland. The latter are unusual in their floristic composition and are outstandingly productive; however, for nearly half a century there has been a serious decline in their productivity". op.cit. p.14.

3] This pattern is to be expected since the European farmers have invested large sums of money in improved breeding programmes. At the same time stocking densities on their Title Deed farms have hardly altered during the last 20 years.

4] $m = -712.96$; $r = -0.48$; $n = 11$.

5] Dyer T G J and Tyson P D. 1977.

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"Rainfall Records of the Water Resources Department." Ministry of Works, Power and Communications, Mbabane, Swaziland. 1949 - 1977.

APPENDIX BASIC DATA FOR CATTLE OWNED BY AFRICANS AND OTHERS

Year	Slaughters	Extraction Rate	Death Rate	0-1 Survival Rate: African Owned Cattle Herd	0-1 Survival Rate: European-owned herd.	Summer Rainfall (mms)	African-Owned Cattle	European and Eurafrican owned Cattle
1947	41,331	12.1				N/A	360,026	73,775
1948	43,113	6.4				N/A	338,405	80,146
1949	44,290	13.1				656.8	338,349	77,873
1950	33,091	8.7				608.1	334,252	83,107
1951	41,815	10.8				592.0	327,964	81,269
1952	33,051	11.1				548.7	331,836	89,714
1953	34,235	9.0				671.8	326,985	93,677
1954	30,968	9.9	7.3	39.5	44.7	696.4	328,407	93,303
1955	28,693	10.2	4.3	38.5	43.9	861.7	333,631	97,714
1956	30,886	9.9	6.9	39.7	49.0	898.8	335,824	102.115
1957	29,018	13.7	4.6	38.4	43.8	542.6	355,659	107,360
1958	33,579	15.4	4.1	41.4	49.7	611.0	380,720	110,959
1959	32,533	10.4	5.8	38.4	49.7	628.7	388,688	115,227
1960	38,268	12.8	4.4	39.3	46.6	774.6	401,973	119,481
1961	40,768	12.6	4.2	39.9	48.1	597.0	413,049	122,330
1962	47,138	13.1	4.4	41.9	47.8	575.6	420,874	122,519
1963	53,965	12.0	5.8	37.9	49.6	650.5	416,717	114,823
1964	48,632	13.3	4.9	43.0	50.4	538.0	424,325	112,135
1965	35,661	3.8	10.5	38.8	51.1	535.4	403,860	106,225
1966	50,950	10.2	6.8	34.7	47.1	762.2	393,133	97,895
1967	48,170	14.0	4.1	38.7	49.6	763.4	401,084	94,438
1968	42,100	14.8	5.5	36.7	49.1	604.5	421,419	93,545
1969	38,463	12.5	4.5	40.2	42.1	619.4	437,576	100,663
1970	40,307	13.5	4.5	38.7	50.1	702.1	459,075	109,294
1971	45,270	11.6	5.1	35.5	44.3	536.7	468,150	103,635
1972	45,325	13.0	4.7	37.9	51.7	1,091.1	486,316	102,954
1973	41,645	10.9	5.7	38.2	53.0	581.0	499,340	103,174
1974	48,640	11.6	5.8	37.7	45.6	698.3	509,853	97,513
1975	42,830	11.2	5.3	33.9	49.6	816.4	526,164	95,607
1976	40,486	9.5	5.3	34.5	46.0	918.1	536,945	97,296
1977	38,500	8.7	7.1	33.1	48.4	691.5	546,099	87,991
1978*	N/A	N/A	5.8	34.4	N/A	N/A	506,565	137,591
1979*	N/A	N/A	N/A	34.4	N/A	N/A	513,140	147,365
1980*	N/A	N/A	N/A	33.3	N/A	N/A	515,925	141,683

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

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Pastoral Network Paper 13a

January 1982

NEWSLETTER

1. Together with this Paper I am sending you three other papers. Paper 13b, by Associate Professor Shen Chang-jiang, of Academia Sinica, discusses pastoral systems in arid and semi-arid zones of China. It follows on the brief note by Thadis Box last year (Paper 11d) describing his impressions after a brief visit to China. Paper 13c, by Moses Olang, formerly Head of the Group Ranches section of the Kenya Range Management Division describes procedures and organisations in group ranch development in Kenya and is in response to a specific request from me that he particularly concentrate on those aspects since other aspects have often been written about by others. In Paper 13d, Clare Oxby, of this Institute, summarises the results of work she undertook for FAO in 1980 reviewing the experience of group ranches in Africa.

2. Activities of the Network

I have now actually completed the draft of a book on pastoral development (stressing organisation and management issues). Publication is expected in late 1982 or early 1983. In the series of lunchtime meetings held here at ODI, Henry Fosbrooke talked, in October 1981, about land pressure in north central Tanzania and its impact on pastoralism. The British Overseas Development Administration (ODA, previously ODM) have now agreed to continue to fund this Agricultural Administration Unit (AAU) here at ODI for another three years up till March 1985. The

part that "pastoralism" will play in the AAU's work in this period is not yet decided.

3. Recent/forthcoming meetings

The Third International Symposium on Veterinary Epidemiology and Economics will take place in Arlington, Virginia, USA from 6 - 10 September 1982. Those offering papers must submit abstracts by 15 March 1982. Applications to attend should be sent to (and further information sought from) Dr William T. Hubbert, Professional Development, Veterinary Services, APHIS-USDA, Federal Building, Hyattsville, MD 20782, USA.

4. The Second International Rangelands Congress will take place in Adelaide, South Australia in May 1984. I don't know the official address for the conference secretariat but I guess that the Australian Rangelands Society, 54 Broome Street, Cottesloe, Western Australia 6011, or Vic Squires, Roseworthy College, Roseworthy, South Australia, would pass enquiries to the right place.

5. Recent/forthcoming pastoral publications

The following recent/forthcoming publications appear to me to be of general importance with reference to pastoral development, either because of the width of their coverage or because they raise issues in a specific context which could profitably be raised in other contexts. The list below is not in any particular order:

a) S.N.H. Putt, P.R. Ellis and others, The Social and Economic Implications of Trypanosomiasis Control. A study of its impact on livestock production and rural development in Northern Nigeria, Veterinary Epidemiology and Economics Research Unit, University of Reading, 1980. About 550 pages.

b) George M. Van Dyne and Sallie H. Van Dyne, Observations on Chinese Grazing Lands - Ecology, Management, Research and Peoples, Range Science Department, Colorado State University, Fort Collins, Colorado 80523, USA, June 1981. About 100 pages.

c) John Galaty, Dan Aronson, Philip Carl Salzman and Amy Chovinard, The Future of Pastoral Peoples. Proceedings of a Conference held in Nairobi, Kenya, 4 - 8 August 1980, International Development Research Centre, Ottawa, 1981. About 400 pages. 30 papers organised into five sections: the role of anthropology in pastoral development; the political economy of pastoralism; the economics of pastoralism; the role of government in pastoral development; the research process - strategies, goals and methods.

d) Commonwealth Secretariat, Clinical Veterinary Services for Small Farmers. Report of an Expert Consultation held in Anand, India, October - November 1980, Commonwealth Secretariat, London. About 40 pages.

e) Werner Doppler, The Economics of Pasture Improvement and Beef Production in Semi-Humid West Africa, GTZ, 1980. About 200 pages.

f) Marcia L. Odell, Botswana's First Livestock Development Project; an experiment in agricultural transformation, Report (Synergy International, Amesbury, Massachusetts, USA). A project completion report prepared for the Swedish International Development Authority, 1980. About 160 pages.

g) Daniel Rosenberg, "The Collectivisation of Mongolia's Pastoral Production" in Nomadic Peoples, No. 9, September 1981, pp 23 - 39.

h) Edmond Bernus, Touaregs Nigériens: Unité culturelle et diversité régionale d'un peuple pasteur, ORSTOM, Paris, 1981. About 510 pages.

i) Carl Christiansson, Soil erosion and sedimentation in semi-arid Tanzania, Scandinavian Institute of African Studies, Uppsala, and Department of Physical Geography, University of Stockholm, 1981. About 210 pages. This study investigates the causes (including overstocking) of erosion in a mixed livestock/farming system.

j) East African Agricultural and Forestry Journal 1979 Special Issue (Printed 1981) on Hydrological Research in East Africa. Pages 192 - 225 include a section on the Atumatak Experiment in Uganda entitled "Grazing Control in Semi-Arid Rangeland".

k) ICRISAT, Proceedings of the International Workshop on Socio-Economic Constraints to Development of Semi-Arid Tropical Agriculture 19 - 23 February 1979, Hyderabad, India, Patancheru, Andhra Pradesh, India, (?1980 or 1981). Chapter Five (40 pages) contains three papers on animal-drawn implements, with discussion of these papers.

l) Leif O. Manger, The Sand Swallows our Land, Bergen Occasional Papers in Social Anthropology, Bergen, 1981. (Subtitle: Overexploitation of productive resources and the problem of household viability in the Kheiran - a Sudanese Oasis.)

m) Charles Bailey, Keeping Cattle and the Cost of Water in Eastern Botswana, Ministry of Agriculture, Botswana, 1980. Report. About 110 pages.

n) Louise Fortmann and Emery Roe, The Water Points Survey, Centre for International Studies, Cornell University, and Ministry of Agriculture, Botswana, 1981. About 500 pages.

o) Louise Fortmann and Emery Roe, Water Use in Botswana: Policy Guide and Summary of the Water Points Survey, Centre for International Studies, Cornell University, and Ministry of Agriculture, Botswana, 1981. 96 pages (!!)

p) D.R. Harris (ed), Human Ecology in Savannah Environments, Academic Press, London and New York, 1980. About 520 pages.

q) ILCA Working Document No. 3: The Camel: a review of some aspects of the physiology, productivity and diseases of the dromedary, based on a literature review by A. Ortiz and E. Mukasa, Mugerwa, Addis Ababa, Ethiopia.

6. Other Publications by Network Members

a) Michael M. Cernea, Land Tenure Systems and Social Implications of Forestry Development Programs, World Bank Staff Working Paper No. 452, 1981.

b) Philip Carl Salzman, "Culture as enhabilmentis" in L. Holy and M. Stuchlik (eds), The Structure of Folk Models, ASA Monograph 20, Academic Press, London, 1981.

7. Pastoral Labour Use and Productivity

Anyone who is interested in this subject should not neglect Jeremy Swift's doctoral thesis, The Economics of Traditional Nomadic Pastoralism, which is an important contribution to knowledge on this subject. Obtainable from University Microfilms International.

8. Effective Date of Newsletter

The effective date of this newsletter is 7 January 1982.

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

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PASTORAL SYSTEMS IN ARID AND SEMI-ARID ZONES OF CHINA

by

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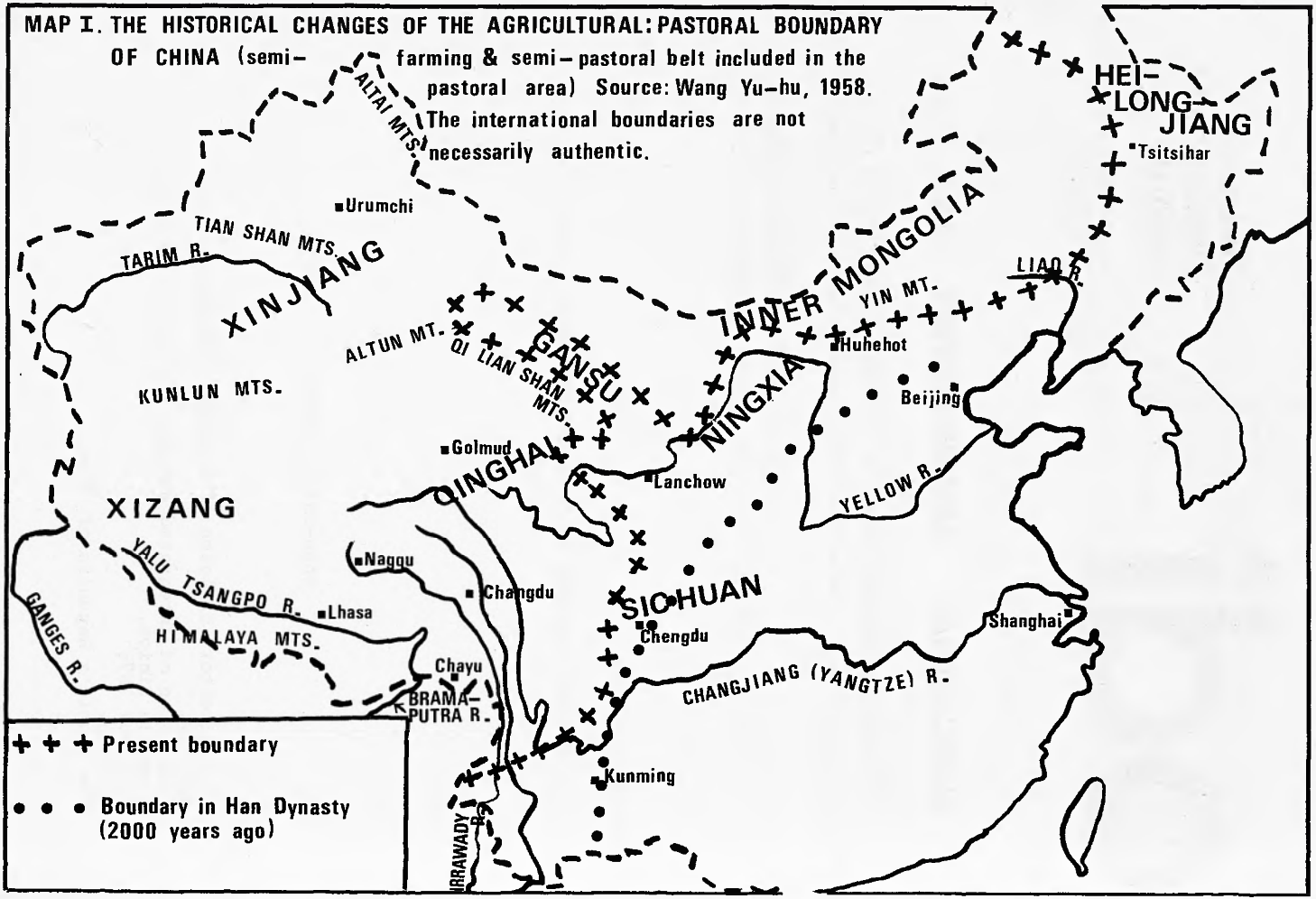
MAP I. THE HISTORICAL CHANGES OF THE AGRICULTURAL: PASTORAL BOUNDARY OF CHINA (semi-farming & semi-pastoral belt included in the pastoral area) Source: Wang Yu-hu, 1958. The international boundaries are not necessarily authentic.



ABSTRACT

The pastoral areas occupy about 52% of the total land in China. An agricultural pastoral boundary has existed for more than 2,000 years since the Han Dynasty. It divided the whole country into two parts: a pastoral area and an agricultural area. The chief characteristics of the two areas are quite different. The pastoral area is a vast land with a sparse human population, many nationalities with a low density of livestock, and with little farmland.

According to the characteristics of pastoral systems and their environmental conditions, the pastoral area can be divided into three zones comprising seven regions and sub-regions, as follows:

(I) Steppe pastoral zone: 1. Forest-steppe region. 2. Dry-steppe region including the desert-steppe region.

(II) Desert pastoral zone: 3. The mountains in the desert region. 4. The plains in the desert region.

(III) High altitude pastoral zone (Qinghai-Xizang Plateau): 5. High-altitude meadow region. 6. High-altitude steppe region: a) The northern plateau steppe sub-region. b) The southern mountains sub-region.

This broad area is not suitable for the development of cereal production, but can be used to develop pastoral systems.

Some main problems inhibiting development that have to be solved are: (1) Rangeland management and feedstuff production. (2) Breeds allocation and improvement. (3) Planning and managing animal production.

1. INTRODUCTION

1.01 In China, the pastoral areas are mainly distributed in the arid and semi-arid zones, occupying about 52% of the total land surface area. They stretch from Northeast to Southwest China. There is an agricultural-pastoral boundary which crosses twelve provinces and atonomous regions and divides the whole country into two parts. The north and west are mainly the pastoral areas; while the south and east, are agricultural areas. Such a boundary has existed since the Han Dynasty more than 2000 years ago. It stretches from the western Song-nen Plain in Northeast China ---> the upper-middle reaches of the Liao River ---> Yin Mountain ---> the east part of Ordos Plateau ---> Qi-lian Shan ---> and finally to the eastern margin of Qinghai-Xizang Plateau (Map I, inside front cover.)

TABLE 1. A Comparison of the Characteristics of Animal Husbandry between Two Areas in China

Items	Pastoral Area	Agricultural Area
1. The ecological environment of livestock and the productive conditions	steppe, desert alpine-steppe and alpine meadow	forests and farmlands
2. The structure of land resources and its utilization	the rangelands for grazing and mowing are the most important	the farmlands are the most important; the grasslands are scarce and separate
3. The sources of feedstuff	are mainly the natural herbages	are mainly the by-products of cereal crops and a few feed crops
4. Livestock species	grazing animals are dominant; the grazing herds of horse, sheep, cattle, goat and camel are the most important	shelter-feeding animals are dominant, such as swine, dairy cattle, dairy goat, poultry and plough beasts
5. The local breeds and populations of livestock	account for half of the total; in the case of sheep and horses, local breeds account for 60%	account for half of the total too; but these are mainly (more than 50%) local breeds and population of swine
6. The pattern of feeding and managing	the grazing pattern is the most important	the shelter-feeding pattern is the most important
7. The structure of grazing herds	the large numbers in grazing herds, e.g. at least 200-300 heads per flock of sheep, at most 500-600 heads or even 1000 heads in each flock	very small grazing herds, e.g. at most the number in a flock are 70-80 heads, with a minimum of only 10-20 heads in each flock
8. The nationalities who engage in animal husbandry	the minority nationalities are the most important; these are Mongol, Tibetan, Kazak, Khalhas, Uigur and Tajik, etc	Han and other farming nationalities, such as Hui, Miao, Yao and Zhuang, etc.

1.02 In the pastoral area, rangelands are the main sources of fodder for grazing animals; while in the agricultural area, the feedstuffs of farm animals are mainly the by-products of cultivated crops, especially the cereal crops. Between these two parts, there is a transitional crisscrossed belt, called "the semi-farming and semi-pastoral belt". It is characterized by a combination of two leading patterns from above mentioned areas, i.e. the grazing pattern and the feeding pattern. The types of animal husbandry management are determined by the customs of different nationalities. The belt is distributed along the Great Wall from east to west. There exist a lot of contradictions between dry farming (rain-fed farming) and pastoral systems; between the quality and quantity of livestock; between the conservation and the utilization of natural resources, especially in the grasslands.

1.03 A comparison of the chief characteristics of these areas is given in Tables 1 and 2.

TABLE 2. The Distribution of Some Items between the Pastoral area and the Agricultural area in China (in % of China total)

Items	Pastoral Area	Agricultural Area
Total area of land	52.0	48.0
Total area of rangeland	88.3	11.7
Total area of farmland	10.4	89.6
Rural population	3.2	96.8
Horses	43.8	56.2
Asses and Donkeys	24.9	75.1
Mules	7.6	92.4
Cattle, yaks and buffaloes	25.1	74.9
Camels	73.1	26.9
Sheep	63.6	36.4
Goats	29.4	70.6
Swine	3.7	96.3
Total number of all animals	22.1	77.9

These two tables show that both natural conditions and animal production activities in the two areas are quite different. The chief characteristics of the pastoral area are: vast land with sparse population; many different nationalities; density of live-stock and a minority of most livestock species and little farmland. Consequently, this broad area is not suitable for the development of cereal production, but it can be used to develop animal husbandry, especially pastoral systems.

II THE CHARACTERISTICS OF PASTORAL REGIONS AND THEIR PROSPECTS

2.01 China's pastoral systems are mainly distributed in the vast area of the northern and western parts of China. According to the characteristics and the environmental conditions, we can distinguish three zones comprising seven regions and sub-regions. They are the forest-steppe region, the dry-steppe region, the mountains in the desert region, the plains in the desert region, the high-altitude meadow region and the high-altitude steppe region which includes two sub-regions, the northern steppe of high-altitude sub-region and the southern mountain of high-altitude sub-region. These are shown in Map II (inside back cover).

2.02 The characteristics of the regions can be obtained from the data of the following Tables 3 - 5 (Institute of Geography 1980). Table 3 gives the herbage yield of the different main types of rangeland in some representative regions. Table 4 gives the proportion of the rural population, livestock and farmland in different pastoral zones and regions (according to date of 1971). Table 5 gives the composition (by percentage of head) of the livestock population in various pastoral regions. The data given in the Tables indicate a very clear differentiation among these regions. This is because they are influenced by a series of such factors as the natural environment, economic conditions, the properties of animal production and the customs of nationalities.

TABLE 3. Herbage Yield (dry weight) in Different Rangeland Types

Main types	Where distributed	Herbage Yield (kg/ha)
Alpine and sub-alpine meadow	Xinjiang, Xizang, the west-part of Sichuan	1050 - 1500
Lowland meadow	Inner-Mongolia, Xinjiang	1050 - 1800
Meadow-steppe	The west-part of North-east, the east-part of Inner-Mongolia	1200 - 2250
Mountain steppe	Xinjiang	750 - 1200
Dry steppe	Inner-Mongolia	1050 (east),450 (west)
Desert-steppe	Ningxia, the west-part of Inner-Mongolia	450 - 750
Steppe-desert	The west-part of Inner-Mongolia	150 - 300
Desert in plain and basin	Xinjiang, the west-part of Inner-Mongolia	300-450-750

Table 4: The Proportion of Population, Farmland and Livestock in Different Pastoral Zones and Regions (% of pastoral total)

Pastoral Zone and Region		Rural Population	Farmland	Cattle	Yaks	Horses	Asses	Mules	Camels	Goats	Sheep	Swine	All Livestock
Steppe Zone	Forest-steppe	53.0	40.7	23.3	-	17.9	30.8	49.2	1.0	5.0	2.4	59.6	10.9
	Dry-steppe	8.2	16.4	11.7	-	16.4	5.5	28.4	24.0	17.5	12.8	18.9	13.3
Desert Zone	Mountain	5.6	8.8	5.1	7.7	14.6	2.9	3.9	14.1	5.2	11.8	1.4	8.6
	Plain	20.4	26.7	36.1	-	40.1	53.6	10.7	60.5	28.6	42.4	13.5	33.7
High Altitude Zone (Qinghai Xizang Plateau)	Meadow	8.7	5.3	15.1	70.0	9.0	3.4	5.9	0.4	11.8	22.0	5.9	20.4
	Steppe: Tableland of Plateau	1.0	0.1	1.6	13.6	1.1	-	-	-	24.5	3.0	-	7.5
	Steppe: Mountain of Plateau	3.1	2.0	7.1	8.7	0.9	3.8	1.9	-	7.4	5.6	0.7	5.6
TOTAL		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 5 : The Composition of the Livestock Population in Various Pastoral Zones and Regions

Pastoral Zone and Region		Cattle	Yaks	Horses	Asses	Mules	Camels	Goats	Sheep	Swine	TOTAL
Steppe Zone	Forest-steppe	17.4	-	6.8	6.4	0.7	-	8.9	10.8	49.0	100.0
	Dry-steppe	7.2	-	5.1	0.9	0.3	0.6	26.0	47.1	12.8	100.0
Desert Zone	Mountain	4.9	6.3	7.1	0.8	0.1	0.5	11.9	67.0	1.4	100.0
	Plain	8.8	-	5.0	3.6	-	0.6	16.7	61.7	3.6	100.0
High Altitude Zone (Qinghai Xizang Plateau)	Meadow	6.1	24.4	1.8	0.4	0.1	-	11.4	53.2	2.6	100.0
	Steppe Tableland of Plateau	1.8	13.0	0.6	-	-	-	64.9	19.6	0.1	100.0
	Steppe Mountain of Plateau	10.4	11.0	0.7	1.6	-	-	26.2	49.0	1.1	100.0
The Pastoral Area		8.2	7.1	4.2	2.3	0.1	0.3	19.7	49.1	9.0	100.0

(1) Steppe pastoral zone

(1.) The forest-steppe region

2.03 This region includes the west part of Hei-long-jiang and Ji-lin provinces, the north part of He-bei Province and the east of Inner-mongolia Autonomous Region (Inner-mongolia and Ningxia Integrated Expedition of Academia Sinica, 1977). Here the precipitation is abundant (about 300-400 mm annually); the soil is deep and thick; the land is fertile; there are a lot of vast and wide rangelands, which are continuous. The Aneurolepidium-forbs steppe and the Aneurolepidium-Stipa steppe are not only good pastures for cattle grazing, but also are good range for the fine wool sheep, lambs and horses. There are many fine native breeds such as; San-he horse, San-he cattle, Bin-zhou cattle, Wuzhumuqin sheep, Inter-Mongolia fine wool sheep, Northeast fine wool sheep and Steppe Red cattle (in breeding). All these breeds have good performances. The region is the best terrain for grazing animals in the steppe pastoral zone of China. It can best be developed as a meat-milk and fine wool production base.[1/]

2.04 At present the main problem is the contradiction of land use between farming and animal husbandry. The grass and feedstuff production does not suit the development of this base. Animal husbandry must be elevated to top priority in planning and then people can decide how to use rationally the land resources for farming and animal husbandry. In an area of concentration of pastoralism a "grain production base" cannot be established. On the contrary in this area it is necessary to plant grasses for livestock.

2. The dry-steppe region (including the desert-steppe)

2.05 This region includes the middle and west parts of Inner-Mongolia except for the furthest west part, the Alxan region or the western side of He-lan mountain, the southern part of Ningxia and a small part of Gan-su and Shan-xi provinces (Inner-Mongolia and Ningxia Integrated Expedition of Academia Sinica, 1977). The dry-steppe of China has the typical landscape of the Eurasia steppe belt. The topography mainly is "high-plain", where the altitude is between 1000-1500 m above sea-level. The mountains (1500-3000m) stand around these high-plains. The dominant species of zonal vegetation is Stipa.

2.06 The precipitation decreases toward the west, while temperatures on the contrary increase from the northeast toward southwest. The types of vegetation and rangeland vary in accordance with the variation of climate. The herbage yields decrease from east to west, but the yields of shrubs and semi-frutex increase. The livestock also varies according to natural factors. From northeast to southwest the numbers

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1/ An animal "production base" means an area or a region which produces a lot of special products for other areas or regions. In this case the forest-steppe region produces a lot of meat, milk and fine wool, so it is called a "meat-milk and fine wool production base".

of sheep and goats, especially the goats, gradually increase; but the numbers of cattle and horse decrease, especially cattle. So the eco-geographical variation is reflected in the products of grazing animals.

2.07 In this region, there are many local and fine breeds, such as Tan sheep and Zhong-wei goat (light fur type); cashmere goat and Karakul sheep. In the western part of this region the quality of the white cashmere goat is better than that of eastern parts. Generally, the regions of dry-steppe and desert-steppe are the typical regions of pastoral husbandry in China. It is the important production base for fleece, wool, cashmere, fur, leather and mutton. The developmental prospect should be constructed on two specific production bases as follows:

(a) Meat and wool base

2.08 This should be located in the semi-farming and semi-pastoral belt between the pastoral area and the agricultural area. The east is from north-part of He-bei Province toward the west to the north-part of Shanxi Province and the Loess Plateau in Gan-su province. Here we find some characteristics of both farming and pastoral regions; moisture, temperature and soil conditions are better than in the pure pastoral region. The vegetation exists as a transitional belt from forest-steppe to dry-steppe; the productive conditions for feedstuffs are also better than in the pure pastoral region. In general it is suitable for fine wool sheep and beef cattle and some places with better farming conditions are suitable for pig raising. In addition this base can be used as a fattening place for sheep and cattle that will come from the northern pastoral region (Liu Shao-bai, 1979).

2.09 At present the main problems for development of this base are drought, disaster of wind-borne sand, lack of fodder and the inappropriate utilization of land resources. The menace of the latent desertification of rangelands and farmlands is also very serious. The land will not be suitable for animal production and crop cultivation if people do not carefully manage it.

(b) Light fur of Tan sheep base

2.10 This should be located in Ningxia and its adjacent areas; in the west from He-lan Mountain toward the east to the north of Shan-xi Province; from north to south it begins in the alluvial plain of Yellow River in Inner-Mongolia to the Loess Plateau of southern Ning-xia and Eastern Gan-su. (Shen Chang-jiang and Di Ying-ming, 1979.)

(11) Desert pastoral zone

2.11 The desert zone in China is about 2.0 million km^2 (including semi-desert). It has a very long history of pastoral husbandry. Three management systems exist in this area; first, the mountainous management system; second, the plain

management system; and third is a combined management system of/above two types. This area has a large number of grazing animals. Herdsmen moved from place to place searching for water and grass following the variation of the climate in different seasons and using the seasonal pastures. (Xinjiang Integrated Expedition of Academia Sinica, 1964.)

3. The mountains in desert region

2.12 This region is distributed in the Altai, Tian-shan, Qi-lian, Kun-lun and Altun mountains. This is the most concentrated region of pastoral husbandry in China. The structures of vertical belt are very clear with various natural conditions and provide the ecological environments for developing the various species of grazing animals. The animal products are diverse and include meat, milk, wool, fleece, cashmere, fur and leather.

2.13 Due to the influence of the vertical distribution of moisture and temperature conditions the aridity gradually increases from east to west, and from north to south. For instance, the structures of vertical belt on the Qi-lian Mountain, the northern slope of Tian-shan and the Altai Mountains are very evident and complete. But on the southern slope of the Tian-shan Mountain, the Kun-lun Mountain and the Altun Mountain, the structures of the vertical belt are not complete; the desert belt often reaches up to 2000m above sea level. Although the structure patterns of vertical belts in the western and the eastern sections of the Tian-shan Mountain are similar nevertheless the dryness of the western section is more serious than the eastern; the vertical belts in the former are distributed in higher places in comparison with the latter.

2.14 Thus the characteristics of the livestock production of the region can be pointed out:

(a) In the Kun-lun and Altun Mountains sheep, goats and yaks are the only important species of grazing animal; the other mountains in this desert region have many more species of grazing animal.

(b) The size, weight and performances of these species decrease from the north to south.

(c) The grazing condition and the composition of seasonal pastures in the mountains of the northern and middle sections of this desert are better than in the mountains of the southern section.

The important breeds and populations of livestock are numerous, such as the local cattle, horses and sheep; the fine breeds are Xin-jiang fine wool sheep, Altai fat rump sheep, Karkul sheep, Yi-li horse, Yi-li cattle and Yi-li swine, etc. Yaks and their hybrids (with cattle) also are important livestock in the mountains.

2.15 The wool-meat production and horse breeding base, should preferably be constructed in this region. The base can be located in the west and north part of the northern

Xinjiang, which is the best area of the desert zone for a pastoral system (Xinjiang Integrated Survey Expedition of Academia Sinica, 1964). Recently, one of the main problems of this base is the disequilibrium of the seasonal pastures, i.e. summer pastures are plentiful but cold-season pastures are very few. In recent years, many fertile rangelands were blindly reclaimed for grain planting, and as a consequence the shortage of winter-spring seasonal pastures became acute. Therefore the right measures are to prohibit and to stop excessive reclamation of rangelands to use only for grain production, and to plant grasses and otherwise re-cover with natural vegetation; at the same time it is very necessary to strengthen the management and rational utilization of the rangelands.

4. The plains in desert region

2.16 This region includes all the plains and basins of Xinjiang, Qinghai, Gansh, Ningxia and Inner-Mongolia. The east is from He-lan Mountain and the west part of Ordos Tableland; the south is from Qinghai and Xizang Plateau. It is the most arid region of China, and there are many oases, sand deserts and gobis. Compared with the steppe regions, the landscape is very unique. Therefore the characteristics of pastoral husbandry and the livestock breeds are correspondingly distinct, e.g. the quantity of sheep, goats and camels in the region is the biggest in the whole pastoral area, and the numbers of the swine in the oases are also the highest in comparison with other pastoral regions.

2.17 Because there are many mountains alongside this region, two systems of grazing management exist. One is the mountain-plain grazing system or transhumance; the other is the plain grazing system without using moutainous pastures. The animals should not be moved between the different seasonal pastures over a very long distance. Due to the specific environments of dryness, desert, salty vegetations, shrubs and semi-frutex etc., fur sheep, goats and camels are the main species and types of livestock. These reflect the characteristics of the desert, and their performance is better. Although cattle, horses and swine are also present they do not reflect the regional characteristics. The meat, milk and eggs of cattle, swine and poultry are the main products only for intraregional markets, but wool, fleece, cashmere, furs and pelts, these products of sheep, goats and camels are for the national markets.

2.18 The quantity of livestock here is the biggest in the whole pastoral area. The local breeds are the Kazakian and Mongolian cattle, horse and sheep; the native fine breeds and populations mainly are Altai fat rump sheep, He-tian sheep, cashmere goat, Alxan camel and North-Xinjiang camel. In this region, it would be possible to establish a series of animal production bases, such as the fur base of sheep; the mutton base of lamb; the cashmere base of goat, and the camel base. Of course, the Karakul sheep's fur base should be considered as the first position to be developed. The problems at present are:- the utilization of pastures is irrational; the lack of water resources and the menace of desertification are serious.

(111) High-altitude pastoral zone (Qinghai-Xizang Plateau)

2.19 This area can be divided into meadow pastoral region and the steppe pastoral region (Huang Wen-xiu and Meng Yon-da, 1980).

5. The high-altitude meadow region

2.20 The region includes the east side of the Naggu ---> Golmud line. The history of pastoral husbandry here is a long one. Tibetan is the main nationality for managing livestock. The characteristics of this region are: high altitude with intensive solar radiation; the actual sunshine hours are long but with low heat value; and the precipitation gradually decreases from south to north; the main vegetation is meadow and the highest yield of herbage is 900-1125kg/ha (dry weight). The above characteristics lead to a concentration of yaks. The main breeds of livestock belong to the Tibetan system. The fine breeds are He-qu horse, Da-tong horse and Ou-la sheep, etc.

2.21 The developmental conditions of this region for animal husbandry are worse than those mentioned previously; but this plateau and its adjacent area are suitable regions to construct a plateau base of meat, milk and fleece production. They have good precipitation from 400 to 600 mm (e.g. north of Chang-du); the highest precipitation can reach 1000-2500 mm (e.g. the Cha-yu county on the southern slope of Himalaya); surface runoff is high; the area has various vegetation types and is rich in forests; alpine and sub-alpine meadows are widely distributed; the vertical belt of rangeland is developed very well and is good for seasonal grazing. There are a lot of livestock on these plateaus at the present time, the species kept not only include sheep and goats but also horses, cattle, yaks and their hybrids (Huang Wen-xiu and Meng You-da, 1980). Due to the difference in the thermal distribution between the north and south, the north of Chang-du produces more yaks, sheep and horses while the south gets only cattle and goats.

2.22 In recent years the basic constraints are weakness in technical skills, extensive management, low levels of production and poor processing of animal products, particularly meat and milk. Consequently, the key for establishing the base is to increase the technical and management levels and to improve the processing conditions for animal products.

6. The high altitude steppe region

2.23 This region includes the west side of the Naggu ---> Golmud line. There are many differences between the southern sub-region and the northern sub-region. The former is a very distinguished place of the pastoral systems in China; but the latter sub-region is the place where the particular pastoral systems on the vertical belt of mountains in the Qinghai and Xizang Plateau are distributed.

(1) The northern Plateau steppe sub-region

2.24 It is from the northern foot of the Gangdise Range until the north-part of Xizang and the west-part of Qinghai. Surrounded by the mountains the steppe is located on the Plateau. The mean altitude is about 4500-5000 m above the sea level. The topography is broad and smooth. The annual mean temperature is 0°C. The annual precipitation is 200-300 mm. The dominant species of the zonal vegetation of the dry-steppe is Stipa glaresoa, S. purpurea, S. aliena and Festuca spp. The yield of herbage is about 125-1500 kg/ha (dry weight). In addition, there are both alpine and marsh meadows composed of many species of Cobresia. But from the south-part of Tangla Range until the north-part of An-duo County, there is the cold desert of the Plateau composed by the cushion plants.

2.25 The main kinds of livestocks are sheep, goats and yaks, then cattle and their hybrids (with yaks), asses and swine. The number of sheep is the biggest, accounting for 65% of the total head in this area, while goats account for 20%, and yaks for 15%. More sheep are found in the east-part than in the west-part. The contrary is the case for goats. More cattle are found in the south-part than in the north-part. The important local breeds are the Tibetan sheep and yaks. They have very strong constitutions and are well adapted to the very special environment. At present, the main problems in production are low temperature and the disequilibrium in the distribution of herbage and water. Thus the rangelands are inappropriately utilized. In addition the management system is very extensive because of lack of labour and production facilities.

(2) The southern mountains sub-region

2.26 The dominant characteristic of this sub-region is the huge high mountains. The temperatures on the vertical belts of these mountains vary tremendously. In general, it is warmer than in the Northern Xizang. Mean annual temperature in valleys is above 5°C and in basins about 0-5°C. The annual precipitation is less than 350 mm. Below the elevation of 5200 m there are alpine steppes and sub-alpine scrub-steppes and alpine meadows distributed on the vertical belts of these mountains. The sub-region is the one with more species of livestock in the Plateau, and is also the sub-region in Xizang Autonomous Region with the more developed agriculture. The cattle, horses, goats and swine, and the performances of Tibetan sheep and yaks are important features. In addition there are some dairy cattle and crossbred fine wool sheep. On the northern slope of Himalaya Range and the southern slope of Gangdise Range, conditions are better and more suitable to develop sheep husbandry. The mountainous rangeland of Xigaze District, has better moisture and temperature conditions; the herbage is plentiful. The percentage of cattle is high, and the Ya-dong yak has a good performance.

2.27 In the light of these factors attention should be paid to giving the highest priority to cattle and yak production,

and at the same time to increase sheep production continually. In the valley region of the Yalutzangpo River where the farmlands lie more widely but the rangelands are fewer, the vegetation mainly is scrup-steppe. These conditions are only suitable for developing grazing sheep and goats; swine raising is only suitable under an intensive feeding pattern.

2.28 To sum up, this is a general description about the pastoral area of China located in the arid and semi-arid zones.

III. SOME PROBLEMS IN THE DEVELOPMENT OF THE PASTORAL AREA OF CHINA

1. Rangeland management and feedstuff production

3.01 The problems of the relationship between livestock and feedstuff is the basic contradiction of pastoral production in China. Under the status quo of rangeland management productivity is decreasing, but excessive reclamation and excessive grazing are continuing and the natural environments in the steppe zone are being seriously degraded. In the meantime the quantity of grazing animals rises, but not enough attention is paid to quality. Thus the contradiction between grazing animals and the rangelands gets gradually more acute year by year. Production of feed crops and g grasses is not developed. In the cold season, grazing animals do not have enough fodder to support them: consequently they are under stress from the bad weather, such as snow-storms (the herdsmen call it "white clamity") or animals die. As the herdsmen describe it: "Summer live; autumn fatten; winter weary and spring died." For instance, in a region of Inner-Mongolia in the Spring of 1978, about one fourth of the total number of grazing animals died from the harmful "white calamity".

3.02 To solve the problem, the only way is to strengthen the management of rangelands and feedstuff production. Some good experiences already exist and can be realized (Li Yi-fang, 1979). These are:- the rational utilization of seasonal pastures in the mountainous areas; rotational grazing and closing pastures for reproducing of grasses; planting the Melilotus albus, M. suaveolens, Astragalus adsurgens (cultivated), Elymus davuricus, E. sibiricus; in some places Medicago sativa, Sorghum sudanense, Avena sativa and Aneurolepidium chinenses, can be planted and so on; mowing the hay in time; stopping the blindly excessive grazing and excessive reclamation. All these measures are important and useful for developing pastoral husbandry in arid and semi-aris zones.

2. Following the eco-geographical principles of livestock; paying much attention to protecting and utilizing germ plasm; establishing breeding systems

3.03 In order to realize the appropriate location of animal husbandry and to construct the production bases, the germ

plasms of livestock are a very important factor for animal production. As already mentioned the best forms of production are coming from just the optimum combination of the germ plasms and the ecological environments.

3.04 In China, animal production has lacked scientific guidance to livestock ecology over a long period. It has often met failures and losses but few lessons have been drawn from them. For example, the spread of the fine wool sheep to the whole country in the '50s; the spread of the Karakul sheep in the '60s; and the spread of beef cattle in the '70s. Tan sheep were introduced in many provinces. Some of these measures had certain achievements, but the blindness on ecology had brought many problems and bad results. Such as the following:-

(a) Serious results have been brought into some fine native breeds of China. In the process of spreading fine wool sheep, the quantity of the traditional carpet fleece sheep has been reduced. But the breeding of this latter type in some countries has led to the flourishing of their carpet industry. The famous Han sheep in the North of China are the most dangerous example of this reduction in carpet fleece sheep. Consequently, from the germ plasm point of view, we cannot rashly adopt a negative attitude towards a breed or a population or replace a breed by others, because the results are often worse.

(b) Some fine breeds were introduced from other provinces or abroad at very high cost. Because the question of adaptation and ecological principles were neglected, these breeds did not fully achieve their potential and always degenerated or died. The introduction of long wool sheep is one typical example, and the introduction of horse breeds is another one. Further examples are the introduction of Karakul sheep into the steppe zone and Merino sheep into the desert zone and the humid area. Because of the blind manner of introduction some of the effects were bad, i.e. the traditional and reasonable direction of animal husbandry was changed.

(c) After the initial introduction there is no clear purpose or a breeding system for protecting them; so that they have to be re-introduced year after year and still have no source.

3.05 In the light of the above problems care must be taken about the following measures that can be designated (i) introducing, (ii) protecting, (iii) improving and (iv) breeding.

(i) Introducing: Introducing a new breed requires a clear economic purpose; then it is essential to study the ecological environment and the differences and similarities, particularly in respect of moisture and temperature conditions

between the new and the original habitat of the introduced breed. The ecological elements of the new place must suit the requirements of the introduced breed (Shen Chang-jiang and Di Xing-ming, 1979). In the beginning, a few head can be introduced, and then, after ecological observation and examination, we may decide the number to be introduced and the appropriate regions.

(ii) Protecting and breeding: Germ plasm of farm animals is the most important factor in steering animal husbandry in the direction of greater productivity. Hence it is one of the most important fundamental matters in constructing the various bases of animal production and in the modernization of animal husbandry. People must invest more in both the introduced and even the native population of farm animals (Yang Ji-ke, 1979a, 1979b). Therefore, as a guarantee for these investments, it is necessary for some relevant organization or for the government to have a long term programme in this matter. For establishing the preservation bases or the production bases such breeds can be identified as: Tan sheep, Altai fat rump sheep, Wuzhumuqin fat tail sheep, He-tian sheep, and so on. Other specific populations, in spite of having only one speciality or economic value, should be protected so as to maintain a viable population size in order to prevent their total loss.

(iii) Improving: Selection of the direction which improvement of native breeds should take in a certain area, must involve considering not only the economic requirements in the short- or long-term, but also ecological principles. In other words, we should consider the direction improvement should take and the means according to the natural regionalization and the agricultural regionalization. To maintain new breeds everywhere is not necessary, because that is not efficient pastoral husbandry.

(iv) Breeding systems: Breeding is an important component of the modernization of Chinese pastoral husbandry; this includes pure-breeds, inbreeding-lines and commercial cross-breeding. How to organize a reasonable breeding system is concerned with quality control by standardization of animal products. In China, people do not have experience on this aspect. Therefore, great attention needs to be paid to study this project.

3. The number of grazing animals and the productive plan of the pastoral husbandry must take into account the production of feedstuffs (especially herbages)

3.06 As already mentioned, the disequilibrium between fodder and animals is the most important problem at present for the development of pastoral husbandry in the arid and semi-arid zones. The basic principle for resolving this contradiction is that the kinds and the levels of production must be determined by the quantity of feedstuffs, especially herbages. That is to say, in the light of what types of rangeland or feedstuff we have, we can then determine the suitable species and breeds of grazing animal accordingly; in the light of how much rangeland and fodder we have, then

we can decide the number of animals accordingly. Between some years, fluctuations in the number of animals may be allowed, but this does not mean increasing the quantity of livestock linearly and continuously.

3.07 For these reasons, the criteria for managing and planning animal production have to be improved. Recently the criterion has been too simple; it is only concerned with animal numbers and this brings many maladies. The criteria must include at least three elements:

1) The increase in total numbers.

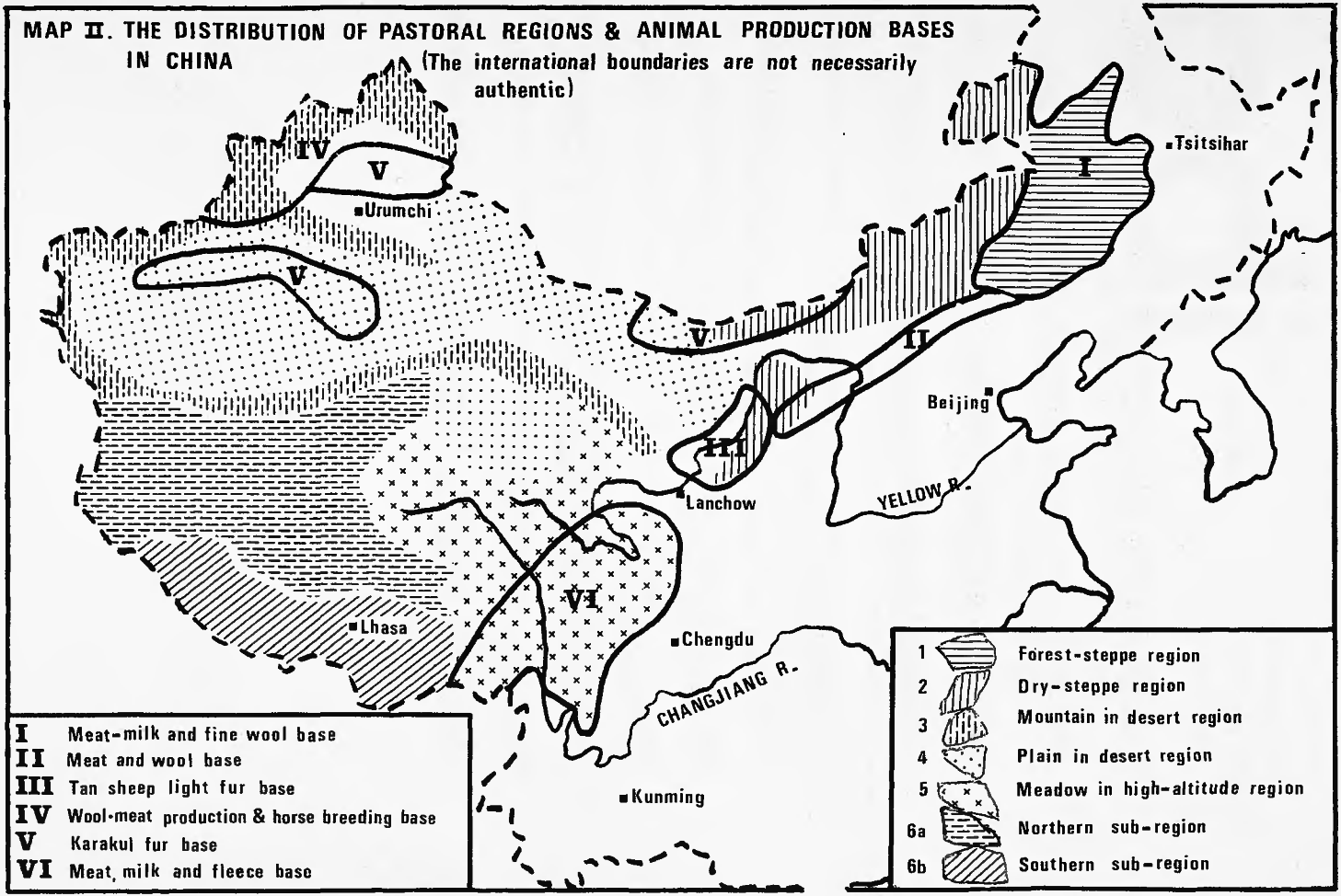
2) The production costs, per animal, or per unit of land.

3) The quantity of products marketed.

Also the management systems for production, purchase and marketing need to be integrated, and the present situation in which they are divorced from one another needs to be changed.

IV CONCLUSION

The arid and semi-arid zones are a broad and vast territory in China. Pastoral husbandry has not only concentrated on these lands, but also has experienced a very long history since ancient times. It is an important part of the national economy, especially in the economy of many pastoral nationalities. Consequently to develop these regions and bases, and to increase the productivity of pastoral husbandry are very important components of Chinese modernization.


MAP II. THE DISTRIBUTION OF PASTORAL REGIONS & ANIMAL PRODUCTION BASES IN CHINA
(The international boundaries are not necessarily authentic)
Tsitsihar
Urumchi
Beijing
Lanchow
YELLOW R.
Lhasa
Chengdu
CHANGJIANG R.
Kunming
I Meat-milk and fine wool base
II Meat and wool base
III Tan sheep light fur base
IV Wool-meat production & horse breeding base
V Karakul fur base
VI Meat, milk and fleece base
1 Forest-steppe region
2 Dry-steppe region
3 Mountain in desert region
4 Plain in desert region
5 Meadow in high-altitude region
6a Northern sub-region
6b Southern sub-region

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ORGANIZATIONS AND PROCEDURES IN GROUP RANCH DEVELOPMENT IN KENYA

by

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I. INTRODUCTION

Historical Background

1.01 In Kenya the drought of the year 1960/61, which was later followed by heavy rains in 1962, killed very many livestock belonging to pastoralists. The government had to provide famine relief food. But at the same time, the government decided to conduct a study into how best to improve and maintain a steady flow of productivity of rangelands. It was in July 1965 that the government of Kenya decided to establish a Range Management Division within the Ministry of Agriculture to be charged with the duties of looking after rangelands.

1.02 Since livestock are owned individually, there was a problem about the sound management of the land, which is owned communally in the pastoral communities. To provide some sort of incentive to pastoralists, land adjudication had to be carried out first. It was originally thought that individual ranches should be established. But later it became clear that this was not possible because pastoral families were already used to staying in one big manyatta for a number of reasons. These included provision of food (that is in the form of milk and meat), and protection against wild animals.

Formation of a group ranch

1.03 Kajiado district was chosen as an example to start range management. At first twelve individual ranches of 1,500-2,000 acres were set aside, but not so many people were ready to start individual ranches. It was then decided that group ranches be started since land was owned on a clan basis. Permanent features like roads, rivers and hills were used to mark the boundaries of these group ranches. An area occupied by one clan could be divided into six or more groups. Then members of that clan were asked to register themselves in any of those groups. The productivity of each group ranch was not considered when members were being registered. So some group ranches which were either small in size or of low productivity got very many members. Such anomalies were not realized until it was too late.

1.04 It is not easy to give an exact figure for the number of group ranches which have been formed so far. By formation I mean those which have been registered. This means that land has been adjudicated and members registered. Formation of group ranches has been easier in districts like Kajiado, Narok and Samburu because in these districts land is owned by the clan. But there are other districts like Baringo and Kitui where members have established group ranches. The main problem is land ownership. Each member in these latter districts has his own piece of land and nobody is ready to lose the identity of his land. This has made it very difficult for such proposed group ranches to start operating.

1.05 In Kajiado district a total of twenty seven group ranches have been formed, fifteen in Livestock Development Phase I (1969 to 1974) and the rest in Phase II (1975 to 1981). In Narok ten group ranches have been formed while in Samburu only five. In Mukogodo, Laikipia district, eight group ranches have been formed. But these eight group ranches are like the five in Samburu district. They have not been given any loan for development because they have more members than the group ranches can support.

Registration of members and organization

1.06 All male members of the clan who are more than 18 years old are registered as members. The register is then made open for the public to raise any objection. Somebody might want to register himself in two different group ranches; or somebody who is not a member of the clan which has been given that group ranch has to be disallowed. After six months without any objection the register is closed. The members then elect a committee of ten people to handle all the group matters on their behalf. The day to day running of the ranch is actually done by the chairman, secretary and treasurer.

1.07 After people have been registered into groups for ranches, then the Assistant Registrar of Groups (see 2.03 below) calls a meeting which elects a committee. This committee is of ten members, and they elect their chairman, treasurer and secretary. The committee acts as the trustee for the members. They negotiate for a loan by surrendering the title deed for that purpose. The land is owned by all the members in undivided form. The only difference between members is in the size of their grazing quota (see 1.11 below).

1.08 There is one general meeting for all the members each year to elect new committee members. Sometimes it is difficult to get a quorum because once members have water and grazing available then they don't bother themselves with meetings. Also members live very far apart in some of the large group ranches so it is not easy to have them all collected for a meeting.

Functions of a group ranch

1.09 The idea behind the formation of group ranches was to control the movement and numbers of livestock in arid and semi-arid areas, which are now called rangelands; this in turn would control overgrazing. But it is still difficult even now to persuade a pastoralist to accept that there are other factors which control livestock numbers. They believe that it is God who has such powers. So they don't accept the idea that by keeping fewer animals the vegetation cover would improve and there would be grazing available during dry seasons.

1.10 Pastoralists traditionally had small animals which produced small amounts of milk. Group ranches make available loans for purchasing improved bulls for improving milk yield and

meat production. Loans are also to be made available for providing drinking water and veterinary facilities like drugs and dips.

Grazing quota

1.11 Grazing quotas have more than one use. The first is to control livestock numbers in the ranch. Secondly it is used for loan distribution among the members. The argument is that when a Masai baby boy is born he is given a cow straight away. Some boys are very lucky in that their animals increase very fast. Some boys are lucky in that, when they go out to raid another tribe or just go to steal, they succeed. So in the end some of them become very rich, others are very poor while some are in between. We consider this to be the work of God. So we have no power to make them equal in wealth. We may reduce the wealth of others by asking them to sell some animals while at the same time allowing poor people to buy more animals. This is done on paper but has been very difficult to implement.

1.12 Calculation of the grazing quota is done by the Range Management Division, the Agricultural Finance Corporation, and the Assistant Registrar of Group Representatives. But implementing it is the work of the Assistant Registrar of Group Representatives. However, I have not witnessed any group ranch where it has been applied because most of the poor people have not yet been in a position to buy more animals.

1.13 A livestock census is carried out for the purpose of grazing quota allocation. The figures which are obtained are then converted into Animal Units (which are later used in calculating grazing quotas).

Example

Family Name	Livestock numbers	A.U.	Grazing quota allocated
Family 'A'	250	150	108
Family 'B'	120	72	72
Family 'C'	40	24	40
Family 'D'	75	45	50
TOTAL	485	291	270

Let this group ranch be for only four families, for the purpose of grazing quota allocation. And also let its maximum permissible animal units be 270. So the grazing quotas should not total more than 270. It has also been found out that a family of six will need 40 animals to provide the minimum home requirement. The allocation starts with the poorest family which is 'C'. This family is given a quota of 40 A.U., then family 'D' is given 50 A.U. Family 'B' is left at 72 while family 'A's quota is brought down to 108. If the ranch is overstocked then this is the figure used for destocking.

This calculation is done in year 1 while loan repayment starts in year 4. But in the fourth year family 'A' may have 170 A.U. In this case what figure should be used for loan repayment? It must also be realized that when the loan was being apportioned to the ranchers it was 150 A.U. which was used for family 'A'. And at the moment it is that figure (150) which is used throughout the loan period, because figures are never adjusted later on.

So it is just in theory that the grazing quota is used for loan repayment. It is used only in destocking.

II ORGANIZATIONS INVOLVED IN GROUP RANCH DEVELOPMENT

2.01 Since development in group ranches means management of livestock, wildlife and rangeland, it involves more than one ministry or department. The Department of Land Adjudication and the Registrar of Group Representatives are deeply involved in the initial establishment of group ranches. The Range Management Division has a key role in drawing up group ranches' development plans. The priority factor which pastoralists would like to see developed is water so the Ministry of Water Development features significantly. The Agricultural Finance Corporation (AFC) is also very important for providing development loans. The Veterinary Department plays a key supporting role. These organizations can be examined one by one.

The Department of Land Adjudication

2.02 This department is divided into two sections. One of these is Surveying which comes to map and fix permanent boundaries when the other, the Land Adjudication Officer, has discussed with the area adjudication committee about the boundaries. So those coming to do surveying make permanent boundaries along the lines which have been agreed upon by the committee. If there is any disagreement between interested parties then the District Land Adjudication Officer has to come back and hold more meetings; at times these officers have been accused of being too slow with adjudication matters. When they have finalized the work and surveyors have fixed permanent boundaries then the Assistant Registrar of Group Representatives comes in.

The Registrar of Group Representatives

2.03 The work of the Assistant Registrar of Group Representatives is to organize the members and to see that the laws and by-laws laid down are followed by all the members. The Assistant Registrar of Group Representatives is supposed to work as an advisor or organizer of the whole group. If members are supposed to collect some money, he will see that the money is collected. When one pasture is being rested, he will work with the committee members to see that nobody goes to graze his animals there. However, in practice this is not possible because there are too many group ranches in one district for one officer. There isn't enough petrol

to make so many safaris for patrolling nor will the condition of the roads to all parts of the ranch allow it.

The Range Management Division

2.04 When the boundaries of a group ranch have been fixed and members registered, officers from the Range Management Division (RMD) start participating in the production of a development plan. Each district has a District Ranch Planning Officer with a Diploma in Range Management, and three or more Range Assistants, with certificates in Range Management. They have one landrover, a driver and a copy typist.

The Ministry of Water Development

2.05 To the pastoralist, this is the most important Ministry because they think that their biggest problem is lack of water. In any case the Ministry of Water has a very important part to play because no grazing system can be planned and succeed without water. Also construction of dips will take place when water has been provided.

2.06 The two main sources of water which are developed for these people is sinking of boreholes and construction of dams. The procedure through which the development of any of them undergoes is so slow that even the money lenders complain. Before a dam is constructed surveyors have to come to see the area; it will take something like one year before it is surveyed. After this then designing, and having the design approved, will take a further one to one-and-a-half years. So when all is ready for construction the quoted price is out of date because of inflation.

2.07 For the boreholes it is a different story. A test borehole may have to be drilled first; the Ministry officials would like a number of proposed boreholes for an area to be handled as one block. But, as you will see later, it really takes a long time to have a development plan approved at the district, then at provincial, and finally at national headquarters. This causes a lot of delay in drilling boreholes for those group ranches which are ready. When boreholes have been drilled they then take one to two years to have them equipped. Delays occur with the ordering of pumps. After drilling the boreholes, there has been a problem in servicing and repairs. This is because the boreholes are constructed in remote areas where even the dip attendant doesn't know much. However, the Ministry of Water is now setting up service units for each district. This will make repairs of boreholes cheap and quick for the ranches. At the moment repairing a borehole is very expensive because private firms have to travel from Nairobi to those remote areas.

Agricultural Finance Corporation (AFC)

2.08 While personnel from Range Management Division are producing a development plan, either the AFC Branch Manager or a Ranch Technician of AFC participate in the production stages. The main part which either of them plays is to make the members of the group ranch aware that they are taking a

loan which will attract annual interest at the prevailing rate. They must make sure that each year the interest plus 1/7 of the total loan is paid (loans used to be for 10 years with 3 years grace period). Members must understand that if the loan is not paid then their land may be sold; however in practice this has never happened in Kenya.

2.09 The biggest exercise which the Branch Manager of AFC, the Ranch Planner from RMD, the Assistant Registrar and the District Range Management Officer tackle is the allocation of Grazing Quotas. Loan repayment is based on the total number of animals each member has at the time the loan is issued and at subsequent livestock censuses. So when it comes to loan repayment each member knows the amount he personally is supposed to pay every year and every member deals direct with the AFC.

2.10 When a development plan has been approved at the District, Provincial and National Headquarters in Nairobi (see 3.07-3.10 below), then it is discussed at the Co-ordination Committee and this is where the AFC comes in again. From there the AFC takes one copy which is presented to their loans' committee. The loan is then approved, after which "Authority to Incur Expenditure" is written and sent to the AFC Branch Manager. The Branch Manager keeps track of all development taking place in that ranch because he is responsible for making payment. The Branch Manager buys steers and then takes them to the ranches for fattening. Sometimes they brand them with their own brand so that they follow them all until they are sold to Kenya Meat Commission. (This is the major source of revenue for members for loan repayment.)

Veterinary Department

2.11 This department does not play a major role, but the part they play is very important. They participate in the discussion stages of the production of the development plan. They recommend the type of drugs to be purchased because they know the local diseases. They produce designs for dips and choose the sites where they are to be constructed.

III PLANNING THE DEVELOPMENT OF A GROUP RANCH

3.01 During Phase I Livestock development (1969 to 1974), plans were produced without the group owners participating in their production. This brought a lot of argument later from the ranchers. In certain cases drilling of boreholes had been rejected by the group members because they thought they knew the best places where to have them constructed. But during Phase II development (1975 to 1981) the approach was changed and it is now done in stages.

The first stage

3.02 The Ranch Planning Officer visits the ranch with the Assistant Registrar of Groups and a general meeting is fixed with the ranch chairman. During the general meeting which

is also attended by the District Range Management Officer (who is the boss of the planner) they discuss whether the group members want any development and what type. The first development they ask for is usually water. They will mention where boreholes should be drilled and where dams can be constructed. In most cases their list is just too long. The next developments asked for are fattening steers because members know that any profit from the steers are used for loan repayment as they are reluctant to sell their own animals for this purpose. The last two are dips and improved bulls. After this meeting the ranch planner is now given the green light by the majority of the ranchers to produce the plan. (Some members do oppose the loan element because they argue that it is the governmen's plan to take their land when they are unable to pay back the loan.)

Second stage

3.03 The planner and his team, which includes the water technician, starts making visits to the ranch assessing the vegetation cover, and plant composition. They also look into the soil types and plant communities because these are useful information when designing the grazing system. (Black cotton soil is not good to graze during the rainy season; Pennisetum mezianum is palatable when it is still green but it becomes coarse and unpalatable as it matures).

3.04 A water technician participates fully in all the planning stages. When the ranch planner is collecting the field data, the water technician also makes the field visits to recommend what type of water to be developed. He will investigate possible dam or borehole sites. This is the time for him to recommend whether a borehole is possible or a pan or a dam. After recommending the type of water to be developed, they then work out the cost. The size of a pan or a dam will depend on livestock requirement, evaporation rate and the size of the catchment area. Any development in a group ranch is really controlled by the development of water because no dips can be constructed without water nor can any meaningful grazing system be designed without proper water distribution. If the development cost is too high (developing water takes about 70% of all development cost) then the planner can recommend that development be taken in stages.

3.05 A livestock and human census is carried out at this time. Depending on the productivity of an area a family of six people will get enough milk and other requirement from twenty-five to forty Animal Units. (A mature Masai cow is about 0.6 A.U.) Such calculation will enable the planner to adjust his plan accordingly. This is because if, for example, a ranch is capable of supporting 4000 A.U. but the members are 150 families, then each family will have only about 27 A.U. (on the assumption of equal livestock holdings, which is not the case). It will be very difficult for such members to sell enough animals to pay back the loan because of too many members.

Third stage

3.06 Another general meeting is called and the plan which is in its draft form is read out to the members. After this meeting a final plan is produced.

Fourth stage

3.07 Another general meeting is called and this time it is mainly for the A.F.C. officials to read out to the members the amount of money they will get as a loan and for what purpose. Using the llivestock census figures, each member is told how much money he will pay back to the A.F.C. In most cases the officer in charge of group ranches in the headquarters of AFC also attends this meeting in order for him to see that the plan is accepted by the ranchers.

3.08 The Provincial Ranch Planning Officer must attend this meeting because he must also be convinced that the plan is accepted. After this meeting the provincial planner takes the plan with him to the provincial headquarters. The Provincial Range Management Officer passes the plan to the national headquarters as being acceptable to him. However, he need not know what is actually in the plan but the provincial planner has to know everything. At times he may return a plan to the district if there are mistakes to do with the calculations.

Fifth stage

3.09 When the plan is forwarded to national headquarters, the officer in charge of group ranches there will look at it and he may reject it. At headquarters, the officers are more concerned with the amount of money which remains after loan repayment for members to spend on themselves,whereas the district planners are more interested in big and quick implementation of the structures.

3.10 The plan is then presented to the Livestock Development Co-ordination Committee. Those from the Ministery of Water, A.F.C. and Registrar of Group Representatives Office come to this meeting with their own copies of the plan after they have gone through it. (They get their copies from the Head of Range Management.) When the plan is passed by the Co-ordination Committee, then the A.F.C. Loans Committee will discuss it and then approve it. "Authority to Incur Expenditure" is then written out and passed on to the A.F.C. Branch Manager in the district headquarters.

IV IMPLEMENTATION OF THE PLAN

4.01 Once the "Authority to Incur Expenditure" has been received, the chairman, secretary and treasurer of the group ranch are informed. The A.F.C. Branch Manager then arranges to have all the members sign the loan agreement form. (This one binds individual members to their portion of the loan which is divided according to their livestock units.)

4.02 Most of the members ask for water first, and it is natural that no other developments can take place before water is developed. The next item they ask for is fattening steers because when they are sold the profit is used to pay back the loan. This is liked a lot because members do not sell their own animals to pay back the loan.

4.03 During this time the planner from RMD has very little to do except to keep pressing the people from the Ministry of Water to start development. The people from the Ministry of Water have been unnecessarily slow in surveying, designing and awarding tenders for either drilling of boreholes or dam construction.

4.04 During Phase I development RMD constructed houses in group ranches for Technical Range Assistants. This idea was not well thought out, because of the following reasons. The technician is supposed to be with the ranchers all the time to advise them as necessary. This has not proved possible because the ranchers move very off for months on end; the houses for the Technical Range Assistants were constructed near boreholes and the Assistants generally had no means of transport either to go with the ranchers, or even to go shopping, since the nearest trading centre was often twenty or more kilometres away. For these reasons most of these houses are not in use now.

4.05 Under Phase II of livestock development, a few Range Assistants are given motorcycles which they use to cover a number of group ranches. These have proved to be more useful than landrovers because they are cheap to run and are not misused.

4.06 Because of the high inflation rate, development is now being taken in phases. In phase one a borehole can be drilled then members start paying it back before a second borehole is equipped.

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GROUP RANCHES IN AFRICA*

by

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Group Ranches in Africa

Clare Oxby[1]

A group ranch resembles other types of ranch in that it consists of a demarcated area of rangeland which provides grazing for certain herds of livestock. The boundaries, although clearly defined on paper, are often not fenced or obvious in any way; fencing is expensive, and anyway it is easy for cattle to break their way through. It is therefore often left to herdsmen to contain the livestock within the area marked out by natural landmarks such as trees.

Group ranches differ from other types of ranch, for example ranches in Australia, in that the livestock is owned by traditional pastoralists such as the Maasai of Kenya. They also differ from other types of ranch where livestock is owned by traditional pastoralists in that the pastoralists have rights to the land under national law. This distinguishes group ranches from what are known as 'grazing blocks', where pastoralists do not have official rights to the land (see Table 1). Also, group ranches differ from other types of ranch where pastoralists have official land rights in that the pastoralists have rights to the land as a group, rather than as individuals, as is the case with what are known as 'individual ranches' in Kenya.[2]

A further characteristic of group ranches concerns the pastoralists' rights to livestock: pastoralists in group ranches retain individual ownership of their herds. This distinguishes them from co-operative ranches where members of the co-operative ideally own their livestock jointly. But experience with co-operative ranches has demonstrated that pastoralists resist giving their individually-owned animals over to joint ownership by the co-operative, with the result that nowhere in Africa are there any examples of pastoralists living solely from a jointly owned herd. The so-called co-operative ranches where livestock is owned by pastoralists are in fact intermediate farms where experimental jointly owned herds — usually bought from the profits of the co-operative or with grants rather than donated from the pastoralists' own herds — co-exist alongside the pastoralists' individually owned herds.[3] Strictly, then, these ranches should be termed 'group/co-operative ranches'.

A group ranch, therefore, is a demarcated area of rangeland to which a group of pastoralists, who graze their individually owned herds on it, have official land rights.

Kenya is the African country with the longest experience of group ranches. In 1964 and 1965 pastoralists were registered on 6 group ranches in Kajiado District, including the pilot scheme, Poka (see Table 2). The

Table 1. Different types of ranch where livestock is owned by pastoralists

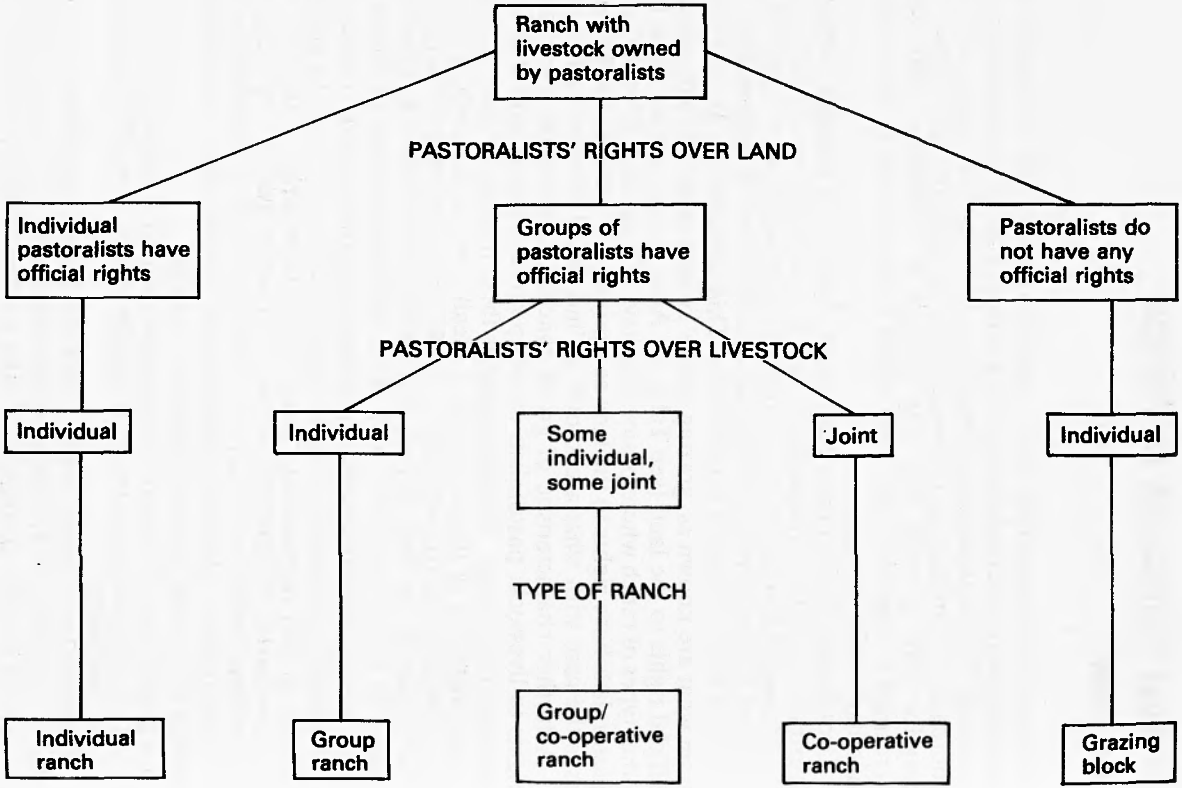

Table 2. Group ranches which received loans under Phase I of the KLDP

Ranch	Size (ha)	Members	Cattle	Sheep and goats	Estimated Carrying Capacity in Livestock Units (LV)
Merueshi	18,296	71	2,373	4,049	1,656
Kiboko	15,687	67	1,912	3,033	1,287
Olkarkar	20,208	64	1,757	2,347	1,295
Poka	8,860	30	1,581	2,378	1,052
Mbilini	14,514	64	2,315	3,194	1,601
Mbuko	18,263	88	2,846	4,383	1,965

Source: ILCA Working Document 13, 1979: p. 10.

pastoralists involved were the Kaputiei Maasai. The ranches averaged about 16,000 ha each and included an average of about 60 members (members being household heads) and 2,000 cattle.
The ranches in Kajiado District[4] were followed by similar ones in Narok District[5] and plans for others in Samburu District.[6]

These group ranches evolved out of efforts by the British Colonial Administration, dating back to the 1930s, to control grazing on the Leroghi Plateau in Samburu District.[7] Grazing controls were strongly resisted by the local pastoralists, the Samburu. The severe drought of 1961 eventually contributed to the downfall of the scheme: since there was not enough grazing within the blocks, pastoralists had to ignore block boundaries in their search for pasture.

In the early days of Kenyan independence, it was felt that if individual pastoralists were given the legal responsibility for a particular piece of land they would exploit it in an ecologically sound way, so that the worst effects of events such as the 1961 drought would be avoided in the future. Many of the more entrepreneurial Maasai were duly given individual titles to land from which they could thereafter legally exclude all other pastoralists. These were called 'individual ranches'.[8] It was gradually realised, however, that the majority of Maasai, who were excluded from these ranches, would suffer the consequences of having to make a living from a diminishing area of grazing.[9] It is against this background that the group ranches evolved: it was hoped that by allocating land rights to a group of pastoralists — ideally the group that had traditional rights to it — the rights of the majority would be protected.

If the primary aim of the group ranches was to divide up the range into ecologically viable units while protecting the land rights of the majority of pastoralists, the planners also had other objectives in mind: in particular,

it was hoped that pastoral production would become more commercial. This meant, it was hoped, that the pastoralists would sell for slaughter the animals that the planners labelled 'surplus', in order to provide meat and other animal products for the urban areas. Although some pastoralists were used to selling animals in order to buy food or other goods, it was never on the scale envisaged by the planners.

The process of allocating land rights to a group of pastoralists is a long and complicated one.[10] First, the land has to be adjudicated, which means that it has to be decided who, on the basis of customary rights, is eligible for the section of land in question. Next, a specially appointed Registrar registers the eligible group of pastoralists and grants them title deeds to the land. Then the ranch is incorporated as a business enterprise so that it can receive loans, incur debts, be sued, and so on. Incorporation requires that a general assembly of group ranch members should meet every 15 months, with a legal quorum of 60 per cent; it also requires the election by the general assembly of 3 to 10 'group representatives' who are the legal trustees of the ranch, and the election of a ranch committee (of which the representatives may or may not be members), which is the executive body responsible for implementing ranch development plans. The incorporated ranch is then eligible for loans from the World Bank under the Kenya Livestock Development Project (Phases I and II).

As at 1978, only 18 group ranches in Kajiado and Narok Districts had received loans; a further 22 ranches in the same districts had loans planned under Phase II of the KLDP. These loans were mainly for the provision of water facilities, but also for the purchase of breeding stock, dips, roads, buildings, vehicles and so on. There are also smaller numbers of group ranches or plans for such in other Districts within Rift Valley Province (West Pokot, Baringo and Laikipia), and a few also in the pastoralist zones of Eastern Province and Coast Province.[11]

Table 3. Progress as at 1978 of group ranches in 3 Kenyan Districts in Rift Valley Province

Districts	Loans disbursed to registered branches	Ranches adjudicated and registered but no loans disbursed yet	Ranches under adjudication or about to be adjudicated	Total
Kajiado	15	28	4	47
Narok	3	34	110	47
Samburu	—	28	15	43

Source: ILCA Working Doc. 13, 1979.

In Tanzania 2 group ranches — known as ranching associations — were registered in 1969, and by 1978 there were 8. They involved the Maasai of Arusha Region. In the mid-1970s these were incorporated into the Ujamaa villagisation programme, and the ranches were registered as multi-purpose co-operatives. Pastoralists were permitted to keep their private herds for what was to be a transitional period, while the communal herd was being established.[12]

Such group/co-operative ranches have had less success among the Maasai of Arusha Region than among the more settled herders-cum-agriculturalists of Shinyanga Region. By 1976 none of the ranches in Arusha had had loans disbursed, and only 3 had loans planned; whereas in Shinyanga 4 ranches had already purchased cattle for the common herds with loans by the same year. But in none of the ranches does it seem that pastoralists have given over any of their privately owned herds to the common herd.

Botswana has made repeated attempts since 1975 at establishing group ranches under the Village Area Development Programme (in the West), the Range and Livestock Management Project (in the East), the Tribal Grazing Land Programme and the Second Livestock Development Programme.[13] Many problems have been experienced, with the result that, in the West, plans have been shelved, and in the East, the one ranch that was established has ceased to function.

In Upper Volta there have also been repeated attempts since 1976 to establish group ranches.[14] Again problems were faced, such that the ambitious proposals have had to be revised, and the number of proposed ranches continually reduced. By 1979, still only one ranch had got off to a rather shaky start.

In Rwanda plans for group ranches — known as *ranches collectifs* — were worked out in the early 1970s for the Mutara Region, situated close to the Ugandan frontier. By 1979 some 950 pastoralist families were occupying 64 ranches covering a total area of 28,000 ha. But it is not clear how many of these families, if any, had been registered as groups with rights in land.

The agro-pastoral development programme in the Eastern region of Senegal includes group ranches — again known as *ranches collectifs*. Although over 50 ranches had been demarcated by 1980, only 5 groups of pastoralists had signed contracts with the regional authorities which gave them rights to the land.

There are many examples, in other African countries, of schemes which might appear at first sight to resemble group ranches, but which in fact are rather different. Several countries have set up herders' co-operatives which are not producers' co-operatives in the sense described

above, but essentially marketing co-operatives (for example, Mali's 6th Region[15]). It is important to distinguish between different uses of the term 'co-operative', since these marketing co-operatives entail no particular form of pastoralists' rights to land or to livestock.

In several countries there are plans for, or actual examples of, herdsmen's associations, pastoral associations, herders' groups (or their equivalent in French, *groupements d'éleveurs*), stock owners' associations, grazing committees, and the like. Again, these do not necessarily imply anything in relation to pastoralists' rights to land or livestock, and are often simply an administrative aid to the local extension services in their target of distributing goods and services.

Several countries have developed 'grazing blocks'.[16] Sometimes the governments concerned attempt to register the pastoralists who use the pasture, though not in any legally binding way; there have been such attempts with the 'Afar in the North East rangelands of Ethiopia[17] and the Fulani in the north of Nigeria. If registration were systematic and legally binding, these blocks would constitute group ranches as defined above. But so far this has not happened.

The nature of pastoralists' land rights in the different group ranches

It is possible to distinguish three systems. The first confers rights of ownership on a semi-permanent basis to a traditional social grouping (eg Kenya); the second gives long leases to a group of selected herdsmen (eg Botswana, Upper Volta); and the third gives short licenses to a number of individuals who are to use the same piece of land (eg Rwanda, Senegal). To illustrate these differences I will contrast the registration process and the consequent pastoralists' rights in Kenya, Botswana and Rwanda.

In Kenya the transfer of land rights to the pastoralists is provided for in a special Act of Parliament: the Land (Group Representatives) Act. This Act sets up a whole new machinery for this purpose, whose most important feature is the incorporation of the group ranch representatives as a corporate group, which then becomes the owner of the land. There is no time limit to these arrangements, and the rights are inheritable. The only way the arrangements may come to an end is if a majority of those attending the meeting choose to dissolve the group.

In Botswana the transfer of land rights is achieved by common law lease. An Act of Parliament lays down the process for registering the groups — called Agricultural Management Associations — which are to hold leases. This Act, the Agricultural Management Associations Act, is not specific to the setting up of groups among livestock owners, but aims to facilitate a variety of group ventures in the agricultural sector, including for example market gardening and forestry. Once registered, the

group, which consists of 10 or more household heads, is in a position to take out a lease on the land. Ownership of the land is retained by the Tribal Land Boards, to whom rent is payable by the group. The leases are normally for 50 years duration, at the discretion of the Land Board. They are inheritable, but only for the duration of the lease, and certain restrictions apply; these are again at the discretion of the Land Board. But these leases are only revocable under clearly defined terms and procedures provided for in law.

In Rwanda, the registration of pastoralists on group ranches takes the form of a contract between each pastoralist in person and the Government which is represented by the regional administrative head. The pastoralist has to submit to many restrictions, such that the contract resembles a license rather than a lease. The contract is revocable instantly and without notice by the Government, if any one of a long list of pastoral management practices are not complied with (for example, dipping herds once a week and keeping to stock quotas established by the Government). It is not inheritable or transferable in any way, since it is a contract with a particular person.

At one extreme, therefore, Kenyan group ranch members acquire full legal rights to the land they use on a semi-permanent basis; at the other extreme, the Rwandan ranchers have no ownership rights at all, only certain very restricted use rights. The initial objective of encouraging the pastoralists' responsibility for the land they use, in the hope that they will exploit it in an ecologically viable way, is therefore much more likely to occur under the Kenyan arrangements than under the Rwandan and Botswanan arrangements, where the pastoralists, as tenants, have only limited responsibility for the land.

In fact it could be argued that the registration process actually decreases the pastoralists' rights to the land and therefore their feelings of responsibility towards it; under the traditional system the pastoralists not only had customary use rights to the land, but usually considered themselves freeholders of land which had been handed down to them over generations. Therefore the signing of legal documents may be interpreted by some pastoralists not as acquiring rights, but as giving them up. In Rwanda they become liable to instant expulsion from land they regard as their own; in Botswana they become obliged to pay rent for land which they regard as their own. Even in Kenya, accepting the legal title to one group ranch may be interpreted, by the pastoralists and by the administrators alike, as relinquishing certain customary rights to areas which are included in other group ranches, or which are outside any ranch boundaries.

This must help to explain the lack of success of group ranches in some

countries, for example Botswana. But perhaps group ranches represent the best of several bleak options for the pastoralists, who are seeing their land gradually encroached on by settled farmers and commercial ranchers. In Kenya at least, the group ranches have guaranteed full legal rights to *some* land, even though the amount of land may have been restricted. This has undoubtedly provided the Maasai with a degree of political security within the nation. But neither the Botswanan leases nor the Rwandan licenses can provide even this degree of security.

Problems experienced with group ranches

i) *Viability of group ranches*. If the main aim of group ranches is to give responsibility for a particular piece of land to a group in order to make the best use of that land, it is rather disturbing that there has been growing evidence that the ranches may not be viable ecological units. This is to say that they may be satisfactory in good years, but in years of low rainfall there may not be enough pasture within the ranch to prevent the pastoralists from ignoring the boundaries and seeking pasture elsewhere.

Halderman[18] suggests that the pilot scheme in Kajiado District, Poka, is unviable in bad years. He also suggests that it is not replicable since conditions are better there than on the other group ranches, with the implication that the other ranches are even less likely than the pilot project scheme to be viable units throughout every year. In support of this, he documents continued nomadism outside the boundaries of the group ranches, even after legal title to the land has been granted. Also, he says that close relatives take up membership of different group ranches in order to guarantee movement from one to the other in times of scarcity.

ii) *Enforcement of stock quotas*. One of the crucial determinants of the viability of a ranch is the number of animals grazing on it. Plans for group

Table 4. Summary of Samburu ranches already planned

Ranch	Size (ha)	Members	Dependents	Present Utilisation[a]	Carrying Capacity Year 0	Carrying Capacity Year 10[b]
Ilkiroriti	5,116	337	776	200	4 ha/SU	2.5 ha/SU
Lodokejek	10,558	437	1,100	300	6 ha/SU	4 ha/SU
Kirimun	10,696	245	609	128	6 ha/SU	4 ha/SU
Mbaringon	4,359	307	694	n.a.	4 ha/SU	2.5 ha/SU
Ilmisigioi	2,876	94	335	280	4 ha/SU	2.5 ha/SU

[a] Given as % of carrying capacity

[b] Carrying capacity in year 10 is the estimated carrying capacity after development.

Source: District Range Planning Team, Maralal, quoted in Helland, 'An outline of group ranching', *op. cit.*, p. 198.

ranches in Kenya assume a stocking rate which is up to twice as low as the current situation: for example, the ranches planned for Samburu District (see Table 4). According to the plans, offtake should be increased, and the 'surplus' should be sold for slaughter.

In individual and other types of ranches, it is a relatively easy proposition to increase offtake and to reduce the overall numbers of animals. But in group ranches, which are supposed to cater to the needs of the whole community rather than to the needs of the few, a 50 per cent reduction in the number of livestock implies either a big reduction in living standards, or forced migration of some group ranch members and their animals outside the group ranch. So far there has been no evidence that stock numbers have been reduced except in this second way, by emigration. The 'surplus' animals, therefore, are not being slaughtered, but are increasing the pressure on the pasture resources outside the ranches. Pastoralists are understandably reluctant to accept a reduction in standards of living, since in the main they would not think they have too many animals; on the contrary. So we are left with a conflict of views, or rather a disagreement about the problem: according to the planners, there are too many animals for the size of the ranches; according to the pastoralists, there are not enough animals for the numbers of people who are group ranch members.

There are further problems about establishing stock quotas on group ranches. There are practical difficulties in counting livestock quickly over such large areas. In Botswana, Paul Devitt[19] has worked out a system which involves ear-tagging each animal and waiting at the water point for three days non-stop (since cattle cannot go without water for longer than three days). But this procedure can only work in the dry season, since in the wet season animals can drink from ponds and do not have to come to the water points. And its accuracy is limited, since animals which are obtaining water elsewhere may come over the borders of the ranch to graze, and it is impractical to think of policing all of the boundaries full-time.

More important, it would be difficult to win the co-operation of the pastoralists in imposing stock quotas, even if they felt that they had enough livestock to support the total population, for the following reason: pastoralists often reject the utility of a stock quota which is a permanent and unchanging upper limit on the animal numbers for a particular area of land. They reject it because, on the whole, they have a different way of thinking about maximising their economic benefits; the pastoralists' view is that, given that the amount, the quality and the location of pasture is so variable from year to year, it is best to keep the largest number of animals at all times, so that full use will be made of the

plentiful pasture in good years, even though the herds will be depleted through starvation in bad years. They cannot see the point of limiting stock numbers to the same number every year, since this means that the surplus pasture in the good years goes to waste. Some planners are gradually coming round to appreciate this argument, and to recognise that if stock quotas are established, they must be flexible, and re-established every year, in accordance with the amount of pasture available in the area. In most parts of Africa where pastoralists live, it is futile to assume that ecological conditions remain stable enough, as they do in more temperate zones, to allow the same conditions of pastoral production every year.

iii) *Managerial problems*. Livestock production and herd management are such that a number of decisions need to be made quickly on a day-to-day basis: for example, where to pasture, when to water, whether to sell, how many to sell, when to sell. Under traditional pastoral production, most of these decisions are made by the household head, who manages the household herds. Household units are characteristically relatively autonomous, and may camp together or separately in order to make the maximum use of the available resources. In a ranch which is aiming to encourage certain innovations in pastoral production — for example, increased offtake of animals for slaughter, or rotational grazing — there must be some mechanism for decision-making at the level of the whole ranch as opposed to the level of individual herds. On an individual ranch this is straightforward; the individual in whose name the ranch is registered takes the managerial decisions, with or without the advice of government officials.

On a group ranch, where several household heads have joint and equal rights to the ranch land, it has proved very difficult to co-ordinate decisions and agree on strategies and innovations. Meetings can delay the taking of decisions which, to maximise productivity, should be taken immediately. In many cases it is difficult even to arrange meetings at all, which means that important decisions never get made. This arises when, as Doherty[20] describes for Rotian Olmakongo Group Ranch in Narok, 24 of the 80 members do not live on the ranch at all. They live elsewhere, and leave their herds in the care of herdsmen who are not in a position to make decisions. In some group ranches, a permanent professionally qualified manager has been appointed; but it has proved difficult for the pastoralists and the manager to agree on strategy, and impossible for the manager to enforce decisions to which the pastoralists have not agreed.

Many of the Kenyan group ranches are in default since they have not arranged for the repayment of loans which were made to them by the Agricultural Finance Corporation. Short of claiming the group ranch land

which acts as collateral for these loans, which would amount to declaring the whole scheme a failure, the AFC has no option but to chase up individual ranch members and try to persuade them to sell stock in order to repay their share of the loans. Here it becomes obvious that the 'group' has only a very limited managerial role. What we are dealing with is a number of individual household heads who are each making herd management decisions fairly autonomously. In other words, the traditional organisation of pastoral production remains largely unchanged, and it would be unrealistic to expect the mere establishment of group ranches to enable radical changes in pastoral production, such as establishing stock quotas and increasing offtake. Supplementary measures would need to be envisaged.

iv) *Pastoralist women*. In many pastoral societies women and children own livestock in their own name, even though these may be managed by the household head. Ownership determines, among other things, whether and how livestock are to be transferred, given or sold. It is therefore possible that the group ranch member would be reluctant to sell certain animals in the herd he manages, if he does not have the consent of the owner. Even where they do not own livestock, women usually have well defined rights to the milk and to other animal products. Group ranches, by registering all the animals in the name of the household head, encourage the erosion of the rights of household dependents, thereby increasing sex and age inequalities. But group ranches should not be singled out in this respect: the author has yet to see any form of intervention in systems of traditional pastoral production which does not have this side effect, since the household head is always made solely responsible on paper for the animals belonging to all household members.

Conclusion

Any conclusion one may come to must depend on what one thinks the ultimate aim of pastoral development is. If it is to commercialise pastoral production and increase the well-being of urban dwellers by providing meat for their tables, then group ranches are clearly inappropriate, and a great failure; commercial ranches are much more effective in this aim. If, on the other hand, the ultimate aim of pastoral development is to protect the rights of pastoralists within the nations in which they live, and to ensure *their* well-being, then it is arguable that group ranches come top of the list, especially those in Kenya which give extensive land rights to ranch members. Group ranches will therefore be evaluated very differently by different people, depending on which of these two objectives they rate more highly.

[1] Research Officer, Agricultural Administration Unit, ODI. This article is based on material collected during a consultancy with FAO; the views expressed are those of the author and do not necessarily reflect those of FAO. Gratitude is expressed to Paul Devitt for extensive comments on an earlier draft.

[2] M.C. Simpson, *Alternative Strategies for Range Land Development in Kenya*, Rural Development Study 2, Department of Agricultural Economics, University of Leeds, 1973.

[3] R.D. Baldus, 'The introduction of co-operative livestock husbandry in Tanzania', *Land Reform* 2, FAO, Rome, 1977; I. Livingstone, 'Group and co-operative ranching (Kenya)' in *Second Overall Evaluation of the Special Rural Development Programme*, Occasional Paper 12, IDS, Nairobi, 1975 and 'The socio-economics of ranching in Kenya' in G. Dalton (ed.), *Research in Economic Anthropology*, vol. 2, JAI Press Inc., Connecticut. 1979, pp. 361-90; M. Wales *et al.*, *District Ranch Development Briefs*, ILCA Working Doc. 13, Nairobi, 1979.

[4] J.M. Halderman, *Analysis of continued Nomadism on the Kaputiei Maasai Group Ranches: Social and Ecological Factors*, Occasional Paper 152, IDS, Nairobi, 1972; C.T. Fumagalli, 'An evaluation of development projects among East African pastoralists', *African Studies Review* 21:3, 1978, pp. 49-64.

[5] D. Doherty, *A Preliminary Report on Group Ranching in Narok District*, Working Paper 350 and *Factors Inhibiting Economic Development on Rotian Olmakongo Group Ranch*, Working Paper 355, IDS, Nairobi, 1979.

[6] M. Wales *et al.*, *op. cit.*

[7] P. Spencer, *Nomads in Alliance: Symbiosis and Growth among the Rendille and Samburu of Kenya*, Oxford University Press, 1973.

[8] L.J. Ayuko, 'Rural organisation structures in the implementation of pastoral range and ranch development projects', paper presented at ILCA Workshop, *Design and Implementation of Pastoral Development Projects*, held in Kaduna, Nigeria in February 1980 and also published in 1981 as 'Organisation, structures and ranches in Kenya', Pastoral Network Paper 11b, ODI, London.

[9] H. Hedlund, *The Impact of Group Ranches on a Pastoral Society*, Staff Paper 100, IDS, Nairobi, 1971 and 'Contradictions in the peripheralization process of a pastoral society', *Review of African Political Economy*, May/December 1979, pp. 15-34; J. Galaty, 'The Maasai group-ranch: politics and development in an African pastoral society' in P. Salzman (ed.), *When Nomads Settle: Sedentarization as Adaptation and Responses*, New York, Bergin, 1978.

[10] R.K. Davis, 'Some issues in the evolution, organization and operation of group ranches in Kenya', *East African Journal of Rural Development*, 4:1, 1971, pp. 22-33; J. Helland, 'An outline of group ranching in pastoral Maasai areas of Kenya' in *Five Essays on the Study of Pastoralists and the Development of Pastoralism*, Occasional Paper 20, African Savannah Series, Institute of Social Anthropology, University of Bergen, Norway, 1980 (also issued as ILCA Working Doc. 17, 1980).

[11] M. Wales *et al.*, *op. cit.*

[12] R.D. Baldus, *op. cit.*

[13] M.L. and M.J. Odell, 'The evolution of a strategy for livestock development in the communal areas of Botswana', Pastoral Network Paper 10b, ODI, London, 1980.

[14] T. Gooch, 'An experiment with group ranches in Upper Volta', Pastoral Network Paper 9b, ODI, London, 1979.

[15] See A. Marty, *Contribution à la relance des coopératives d'éleveurs en 6ème Région (République de Mali). Rapport de Mission*, FAO, Rome, 1975.

[16] See, in relation to Kenya, J. Helland, 'Some aspects and implications of the development of grazing blocks in Northeastern Province, Kenya', in *Five Essays, op. cit.* (also issued as ILCA Working Doc. 18, 1980).

[17] J. Helland, 'An analysis of 'Afar pastoralism in the Northeastern Rangeland of Ethiopia' in *Five Essays, op. cit.*

[18] *op. cit.*

[19] Personal communication.

[20] *Factors Inhibiting Economic Development, op. cit.*

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AGRICULTURAL ADMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

ISSN 0260-8588
Pastoral Network Paper 14a
August 1982

NEWSLETTER

1. Together with this Newsletter I am sending you five other papers. Paper 14b, by Professor Huang Zhaohua, describes a pastoral commune in the Inner Mongolian Autonomous Region of China. Paper 14c, by Michael Hubbard discusses alternative economic instruments for achieving limitation of stock numbers in the context of Botswana. Paper 14d, by Paul Devitt, discusses the management of communal grazing, again in the context of Botswana but drawing on experience in Scotland, Lesotho and Kenya as well. Paper 14e, by Malcolm Odell, covers the same general subject area as Devitt's, although its scope is somewhat wider, it draws on evidence from Asia as well as from Africa, and it is particularly concerned with the efficacy of local institutions. Paper 14f, by Lovell Jarvis, is a comment on a previous network paper (12d) by Martin Fowler which concerned overgrazing in Swaziland.

2. Activities of the Network

There has been an intermission in the usual series of lunchtime meetings at ODI. See also "Farewell and Hello" (para 8) and "Order now while stocks last" (para 9) below.

3. Recent/Forthcoming Meetings

The Second International Rangelands Congress was mentioned in the last newsletter (13a). It will take place in Adelaide, Australia, on 13 - 18 May 1984. It will (provisional programme) consist of eleven full-day symposia in three concurrent sessions. Proposed symposia are: dynamics of range ecosystems; grazing industries; range resources monitoring and administration; ecophysiology of rangeland plants; mining and rangelands; conservation and wildlife; fire in arid and semi-arid regions; technological improvements of arid rangelands; animal production; management of grazing systems; developing world challenges and opportunities. The congress Secretary is P. J. Joss, CSIRO, Deniliquin, New South Wales 2710, Australia (Telex 55457). You were encouraged to respond before 30 June 1982 if you wanted to be considered as an invited speaker (but I expect they take late entries!) and the deadline for receipt of titles of contributed papers is 31 May 1983. If you write to the Secretary (not to me) for a copy of the second circular (due out July 1982 but I have not got my copy yet!) you will find therein the names of symposia convenors and assistant convenors.

4. The 11th International Congress of Anthropological and Ethnological Sciences will take place in Quebec and Vancouver, Canada in 1983. Two ODI network members, Walter Coward and Jere Gilles, are organising a symposium (at Vancouver) at this conference on "traditional resource management strategies for irrigation and pastoral development". The goal of the symposium is to discuss and to identify aspects of local or traditional resource management strategies that should be incorporated in planned development programs. A three-session symposium is planned, one devoted to general issues, one to irrigation and one to range management. The exact dates of the Congress are:

14 - 25 August 1983

15 November 1982:	pre-registration and submission of abstracts of papers to congress organisers (Dr R. Salisbury, Department of Anthropology, University of British Columbia, Canada)
31 December 1982:	final deadline for papers to be presented at the congress
31 March 1983:	the finalised congress programme will go to press.

Some travel funds, to attend the congress, may be available for "scholars from nations where pay scales and institutional resources are too low to permit travel to the Congress".

For all further details on this symposium write to Jere Gilles, Department of Rural Sociology, University of Missouri, Columbia, Missouri 65211, USA.

5. The Commission (of the International Union of Anthropological and Ethnological Sciences) on Nomadic Peoples is also taking advantage of the Congress to sponsor two scholarly meetings:

a) An open session will be held in Vancouver to represent the concerns and activities of the Commission to our scientific colleagues. This session will be organised and chaired by Dr P. K. Misra, and is entitled "Social, Cultural, and Biological Dimensions of Nomadism".

b) An invitational symposium will be held in Montreal on 18 and 19 August between the Quebec City and Vancouver meetings on the topic "L'organisation territoriale et la notion de territoire dans les sociétés de pasteurs nomades". It is being organised by the Equipe écologie et anthropologie des sociétés pastorales. Inquiries should be sent to the:

Equipe écologie et anthropologie des sociétés pastorales
Bureau 117
Maison des Sciences de l'Homme
54 Boulevard Raspail
75270 Paris Cédex 06
France

The Commission on Nomadic Peoples will also have a business meeting during the Congress at a location and time to be announced.

6. Recent/Forthcoming Pastoral Publications

The following recent/forthcoming publications appear to me to be of general importance with reference to pastoral development, either because of the width of their coverage or because they raise issues in a specific context which could profitably be raised in other contexts.

a) Awogbade, Moses A. (1981). "Socio-cultural dimensions in traditional systems of animal management practices and government policy: an overview". Paper presented at first national conference on Tsetse and Trypanosomiasis Research and Control in Nigeria, Kaduna. August 1981.

b) Baduel, Pierre-Robert (1982). "Le Technicien, le Législateur et le Pasteur en Tunisie aride", Bulletin Production Pastorale et Société, 10, pp 70 - 80.

c) Bourbouze, Alain (1982). "Déplacements des troupeaux et utilisation des parcours dans le Haut Atlas central" Bulletin Production Pastorale et Société, 10, pp 34 - 46.

d) Breman, H., Cisse, A. M., Djiteye, M. A., and Elberse, W. Th. (1979/80). "Pasture dynamics and forage availability in the Sahel", Israel Journal of Botany, 28, pp 227 - 251.

e) Campbell, David J. (1981). "Land-use competition at the margins of the rangelands: an issue in development strategies for semi-arid areas", in Norcliffe, Glen and Pinfold, Tom (eds.) (1981). Planning African Development, West View Press and Croom Helm, Boulder and London, pp 39 - 61.

f) Centre for Research on Economic Development (1979 and 1980). Livestock and Meat Marketing in West Africa, Ann Arbor, Michigan, USA, in 5 volumes:

Vol I Synthesis. Upper Volta (authors: Aviza-Nino, Herman, Makinan, Steedman) 1980. About 200 pages.

Vol II Benin. Ghana. Liberia. Togo (authors: Josser and Sullivan) 1979. About 450 pages.

Vol III Ivory Coast and Mali (authors: Delgado and Staatz) 1980. About 440 pages.

Vol IV Suppliers: Argentina, Australia, New Zealand (authors: Aviza-Nino, Griffith) 1980. About 240 pages.

Vol V The World Meat Economy. Other Supplier and Consumer Countries (authors: Aviza-Nino, Manly, Shapiro) 1980. About 185 pages.

g) Eicher Carl K., and Baker, Doyle C. (1982). Research on Agricultural Development in Sub-Saharan Africa: A Critical Survey MSU International Development Paper No. 1, Department of Agricultural Economics, Michigan State University, East Lansing, USA (Chapter 6 - 14 pages - concerns livestock). About 335 pages.

h) Gabre-Mariam, Ayele (1975). The Forgotten Aborigines: a study of farm and livestock systems in Southern Highlands of Ethiopia, a report for the Livestock and Meat Board, Addis Ababa.

i) Gilles, Jere Lee, and Jamtgaard, Keith (1982). "Overgrazing in Pastoral Areas: The Commons Reconsidered", Nomadic Peoples 10, pp 1 - 10.

j) Hjort, Anders (1982). "Critique of ecological models of pastoral land use", Nomadic Peoples 10, pp 11 - 27.

k) Little, Peter D. (1982). The workshop on development and African pastoral production, Institute for Development Anthropology, Binghampton (New York). About 50 pages. Report of a workshop held in late 1981 to help formulate a strategy to guide USAID's investment in the African livestock sub-sector.

l) Ndagala, D. K. (1982). "Operation Imparnati: the sedenterization of the pastoral Maasai in Tanzania" Nomadic Peoples, 10, pp 28 - 39.

m) Niamir, Maryam (1982). Report on Animal Husbandry among the Ngok Dinka of the Sudan, Harvard Institute for International Development Rural Development Studies (mimeo).

n) Oxby, Clare (1982). Social aspects of the settlement of pastoral nomadic communities in tsetse-controlled regions with particular reference to Upper Volta and Nigeria, FAO report.

o) Penning de Vries, F. W. T., and Djiteye, M. A. (eds.) (1982). La productivité des pâturages sahéliens, une étude des sols, des végétations et de l'exploitation de cette resource naturelle, Centre for Agricultural Publishing and Documentation, Waneningen, 1982. About 525 pages overall. In French but with 35 page summary in English. This book, the result of a study, sets out to answer such questions as: What is the actual productivity of rangelands in the Sahel; in terms of quantity and quality? What is its variability from place to place and from year to year? Can productivity be increased? Does the vegetation suffer from exploitation and adverse weather conditions? Is a further increase in the intensity of rangeland exploitation possible? Without overgrazing? What effect will that have on the soil? What kind of solutions to problems of exploitation and overgrazing are feasible, and what kind are not?

p) Proceedings of the Third International Conference on Goat Production and Disease, 1982, Dairy Goat Journal Publishing Co., Scottsdale, Arizona, USA. About 600 pages. Proceedings of conference held in Tucson, Arizona, in January 1982. Contains papers on a wide variety of topics including nutrition, disease, marketing, products and production, reproduction, grazing management, economics, sociology, etc.

q) Raikes, Philip L. (1981). Livestock Development and Policy in East Africa, Scandinavian Institute of African Studies, Uppsala. About 255 pages.

r) Serres, H. (1980). Politique d'hydraulique pastorale, Institut d'Elévage et de Médicine Vétérinaire des Pays Tropicaux (I.E.M.V.T.), Maisons-Alfort, France. Livestock husbandry in tropical Africa is dependent on available water. Water development programmes on behalf of cattle husbandry have been in operation for 30 years but, in some cases, they have had negative side effects. In this publication the results of the establishment of these programmes over this period are discussed. About 120 pages.

s) Starkey, Paul (1981). Farming with Work Oxen in Sierra Leone, Ministry of Agriculture and Forestry, Freetown. About 80 pages.

t) Trail, J. C. M., and Gregory, K. E. (1981). Sahiwal cattle: an evaluation of their potential contribution to milk and beef production in Africa, ILCA Monograph No. 3, International Livestock Centre for Africa, Addis Ababa. About 130 pages.

u) White, J. M., and Meadows, S. J. (1981). Evaluation of the contribution of group and individual ranches in Kajiado District, Kenya, to economic development and pastoral production strategies, Ministry of Livestock Development, Nairobi. About 180 pages.

7. Is this List of Pastoral Publications Any Use?

Since the pastoral network papers started nearly seven years ago there has been a regular item in the newsletter on "recent/forthcoming pastoral publications". I would like to know whether members of the network find this item useful. The resources here at ODI devoted to pastoralism (that's me and half of Gill Hopcraft) are tiny in relation (!) to the growing mass of literature on pastoralism, since this literature occurs under many academic disciplines (range science, economics, geography, animal health and husbandry, anthropology, etc). If the service is useful it will be continued. If, in fact, you all learn about pastoral literature from other far better-endowed sources we will happily bow out of this activity. Silence by you on this issue will be taken as evidence that you do not need the service to continue. Suggestions for improvements in the present service are also welcome. Naturally the most effective way of drawing publications to our attention for listing is to send copies of them here - they then get added to ODI's collection of pastoral papers and publications which is available for anyone to consult. I also do a certain amount of searching of literature abstracts and library accession lists but the chances of an item being selected in this way is much less than if I get a copy in front of me.

8. Farewell and Hello

I have accepted an appointment to join ILCA (The International Livestock Centre for Africa) in January 1983. This set of network papers will, therefore, be the last to issue under my editorship. Thank you all for contributions, your encouragement and your tolerance. Dr Clare Oxby, who has been on the staff of ODI for three years, although she has not been working exclusively on pastoralism, will assume the editorship of the network papers which will continue as before. Clare is a social anthropologist who did field work among the Twareg in Niger in the early 1970s. In the last two years she has done two major pastoral reports for FAO, one on the experience of group ranches in Africa (an experience she also wrote about in Pastoral Network Paper 13d) and one on the settlement of pastoral nomads in tsetse controlled regions (see para 5 (n) above). I hope that you will extend to Clare the same support as you have to me. Although the network papers will continue as before, Clare's research interests are wider than mine have been and overall the amount of time in ODI devoted to pastoralism will probably decrease. From January 1983 my own address will be c/o ILCA, PO Box 5689, Addis Ababa, Ethiopia and I hope that the friends (and enemies!) I have acquired through my work at ODI will continue to keep in touch and visit us in Ethiopia.

9. Order Now While Stocks Last

What follows in this paragraph is in the nature of an advertisement. A book by me on pastoral development is expected to be published in early 1983 by John Wiley and Sons in association with the Overseas Development Institute, under the title Management of Pastoral Development in the Third World. Copies can be ordered from the Publications Officer, ODI, 10-11 Percy Street, London W1P 0JB, (ie here) or from John Wiley. Price is not yet decided; length about 300 pages. As the title implies the book is mainly about management and organisation of pastoral development. There are chapters on particular components of pastoral development, ie water supplies, land allocation, improvement of range productivity, animal health and husbandry and livestock marketing as well as synthesizing chapters on organisations of pastoralists and on government. Objectives of pastoral development, pastoral strategies and range degradation are also discussed. The underlying theme of the book is a comparison of experience in Third World countries of Africa and Asia but experience in developed countries is also cited where relevant. Management and organisation factors have, for long, been recognised as of critical importance in pastoral development and this is the first study to tackle this subject over the whole field.

10. Vacancy

My departure from ODI will create a vacancy on the research staff of the Agricultural Administration Unit (AAU) which it is intended to fill by someone working in non-pastoral fields. At the end of this Newsletter is a notice inviting applications. The post may not attract many members of the Pastoral Network but you are invited to draw it to the attention of any of your acquaintances who may be qualified and interested. Note the early closing date for applications.

11. Administration

Jenny Blake, who was responsible for the administration of network affairs in 1980 and 1981, has now left ODI and we welcome Gill Hopcraft who has succeeded her.

12. Effective Date of Newsletter

The effective date of this Newsletter is 27 August 1982.

Goodbye

Stephen Sandford

OVERSEAS DEVELOPMENT INSTITUTE - AGRICULTURAL ADMINISTRATION UN

ODI wishes to appoint a RESEARCH OFFICER to carry out comparative research and advisory work on the administrative aspects of one or more of the following:

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(b) rural employment;

(c) poverty-focussed development programmes;

(d) agricultural research.

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Overseas Development Institute

10-11 Percy Street London W1P OJB
Tel: 01-580 7683

AGRICULTURAL AOMINISTRATION UNIT

THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

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Pastoral Network Paper 14b
August 1982

A PASTORAL COMMUNE ON THE ORDOS PLATEAU - THE SUMITU COMMUNE

by

Huang Zhaohua*

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A PASTORAL COMMUNE ON THE ORDOS PLATEAU - THE SUMITU COMMUNE

The Commune

1. The Sumitu Commune is situated in the central part of the Ordos Plateau (Fig. 1), covering about 1,800 sq km. It lies between longitudes 108° 10' and 108° 30' E and latitudes 38° 40' and 39° 20' N. The commune is under the jurisdiction of the Otokand Banner in Ikh Chao League[1/], Inner Mongolian Autonomous Region.

Physical Background

2. Elevations in this district range from about 1,350 to 1,500 m asl. According to natural conditions the district is characterized by its transitional nature as from steppe to desert. Shifting sandy lands make 45.1% of the total area, watersheds 21%, lowlands 7.2%, fixed and semi-fixed sandy lands 25.6%, and lakes 1.1%. The zonal soil of this district is light castanozem, while the azonal ones are shifting and fixed aeolian soils and meadow soils. Their parent materials are Cretaceous grayish-green and purplish-red sandstones and Quaternary fluvialacustrine deposits, and consequently the soil texture is inherently rather light and the fertility generally low.

3. The district is relatively rich in groundwater resources, and the depth of water table ranges from 0.5-2.0 m in the lowlands to over 10 m in the watershed areas. In the south-eastern part in this district there is an artesian basin and several artesian wells have been sunk for use. The groundwater is generally good in quality with the total dissolved solids ordinarily not exceeding 0.5 gm/l and suitable both for irrigation and drinking purposes.

4. The climate belongs to extreme continental type, with wide variations in precipitation both between seasons and between years. The average annual precipitation is around 300 m, showing a decreasing tendency from south-east to north-west.

1/ "Banner" and "League" are rendered from Mongolian words, denoting "county" and "prefecture" respectively. The administrative "Ikh Chao League" coincides roughly in land area with the Ordos Plateau.

Figure 1 can be found on page 19.

5. Most precipitation (about two-thirds) falls during the autumn months (July - September), mostly as cloud-bursts or downpours. Annual precipitation may vary by a factor of nearly four between the maximum and minimum. Consequently the livestock industry, which essentially depends upon natural vegetation, is very unstable. Especially when disastrous drought comes, a high death rate of animals may result, eg in 1965, the animal population dropped by 40% during a severe drought.

6. The mean annual temperature is 6.3°C. January is the coldest month, the mean temperature of which is -11°C, while July is the hottest, with a mean temperature of 22°C. The frostless season is around 155 days.

7. The mean annual wind speed is 3.1 m/sec and the maximum may reach as high as 28 m/sec. The main direction of wind is north-west and occurs in the late winter and spring time. During this period, under the effect of strong wind, sand drifting is very active and consequently pastures in areas in front of the drifting sand dunes are often subject to damage resulting from sand dune encroachment.

8. The vegetation distributed in the lowlands are of the meadow and meadow-swamp types, the major components in which are Achnatherum spendens, Carex stenophylloides, common reed, etc. On watersheds there are steppe or shrubby-steppe communities dominated by Krylov needlegrass, Bunge needlegrass, squarrose cleistogenes, fringed sagebrush, and intermediate peashrub. Dominated by Ordos sagebrush, fringed sagebrush, flaccid pennisetum, psammons are widely distributed in this district.

Administrative Background

9. Sumitu Commune belongs to the Otokand Banner which is one of the four pastoral banners occupying the western part - about 70% in area of this league. Before the founding of New China there were five lamaseries in this district, and the Living Buddhas were practically the rulers of the district. During the second half of the thirteenth century when Lamaism spread from Tibet to Mongolia, many pastoralists sent their sons to lamaseries to be lamas. If a family had three sons, at least one would have to serve as a lama. This social custom had been inherited for centuries until the old regime was overturned by the Chinese people.

10. Accounting for over 90% of the whole population, the pastoralists themselves had only a few domestic animals, so they had to work for the herd owners (who possessed most of the grazing lands as well as the livestock) and earned very little from their employers. The pastoralists all led a hard life.

Changes Since Liberation

11. Only after liberation could the pastoral masses have the possibilities to become better off. At first the heavy burden of the pastoralists was lightened and relief articles and funds were sent to the poor and lower-medium pastoralists by the people's government. During the first several years after liberation, the Party's policy dealing with the political life in pastoral areas was very different to that in agricultural areas. It was so-called "three no" policy, ie "no expropriation and redistribution of the herd owners' or other rich people's property, no public struggle against them, and no determination of class status". Thus, the public order was greatly stabilized with this policy and the members of the upper strata were gradually transformed into labouring people. At the same time the representative personages of the upper strata have become the government officials under the party's policy of the united front. So during the period of revolutionary changing, there was neither any social turmoil occurring, nor did the pastoral economy undergo great losses. Shortly after the democratic reforms the pastoralists' herds enlarged gradually and under the guidance of the policies dealing with pastoral production, they started to organize mutual aid teams in 1953.

The elementary pastoral production co-operatives (equivalent to present-day production teams) were formed in 1955 and were subsequently in 1957 to be combined into advanced pastoral producers' co-operatives (equivalent to present-day production brigades). At last, in 1958, the present-day people's commune was organized during the communization campaign. Now, there are six production brigades and a commune-run ranch, as the basic accounting units, including 25 production teams in the commune.

12. Since liberation there has been almost no change in the mobility of livestock and people in their search for grazing. The following points may explain this:

a) There were over a hundred years of history for the pastoralists in this league to lead a sedentary life. Perhaps this is because this district is not very far from the inland agricultural areas. Only in the north-western part of this league, where the animal density was relatively lower, did the pastoralists lead a limited nomadic life some two decades ago.

b) The animal density was relatively high even at the time of liberation, and the area of grazing land occupied by a sheep unit was only 3 ha on average in this league. Consequently, there was not enough territory for carrying out nomadic pastoralism. However, because of the increased animal population and decreased area of grazing lands under the effect of sand dune encroachment, the extent of mobility of livestock has been greatly restricted.

The Pastoralists

13. Here is a traditional pastoral area, having a population of 4,591, among which most people (77%) including cadres are Mongols, and the remainder is of Han and Hui (Moslems) nationalities. Since liberation the population has increased quite rapidly, showing a net increase of 1,418 from 1955 through 1978, which means an average growth rate of 1.57% during this 24-year period.

14. The high growth rate of population is fairly common in this league, especially in Mongolian nationality, and as a result of the eradication of venereal diseases and the improvement in livelihood and medical and sanitary facilities, the population status is very different from that before liberation. Now, a Mongolian family with above five children is not very uncommon.

15. In the pastoralist population the work force amounts to about 45%. The cadres, who are mostly male, oversee production, civil administration, education, health and militia work. Thus the women become a major force either in animal production or in household work and the male work force undertakes the heavy manual labour. The Han people here are mostly settlers from the agricultural zone in northern Shaanxi Province. They came here mainly for a

better livelihood and by their background they mostly undertake the cultivation work in connection with animal husbandry or forestry.

16. The size of a pastoral family is 4.8 members on average, which is a little bit larger than in the 1950s. The residences of pastoralists are rather scattered, which is the way of livelihood needed for their pastoral production.

17. Before 1979, the livelihood of pastoralists almost wholly depended upon the collective economy; they worked for the collective and obtained animal products and monetary payment from the collective. In addition they owned a restricted number of small stock (sheep and/or goats) and donkeys, but camels, horses, and cattle were all collective wealth which was not allowed to be privately owned. However, since 1979 when various systems of responsibility in production had been extended throughout the rural and pastoral areas, the number and kind of private-owned livestock were no longer restricted. Up to the end of 1980 the number of private-owned animals had already increased to 30% of the whole animal population.

18. The principle of distribution is according to work done by each member of the work force. In this commune the average income is about 1 - 1.5 yuans (about 1.8 yuan for one US dollar) for a day's work, ie 10 work-points, which is a medium level in the pastoral areas of the Inner Mongolian Region and a relatively high one in this league. Since 1979, a system of responsibility has been carried out. The system entails the establishment of quotas for the work and a procedure of remuneration for over-fulfilment of production targets. In addition to receiving payment for tending animals the herdsmen are required to maintain the livestock at a death rate not more than three per cent and to ensure that not less than 90 per cent of the newborn animals survive. Should the herdsman surpass the quotas, they will obtain extra income as a reward. But in the event that the herdsmen cannot meet the quotas, deductions will be taken from their work-points. This new system has already had a positive effect in arousing the initiative in labour of the herdsmen.

19. As to the pastoralists' everyday life, they gather the firewood from natural vegetations as energy source without any expense. Their eating-meat is distributed from the collective and also from their own livestocks. Ordinarily they slaughter a part of animals, mainly sheep and goats, during late September to early October when flies have died out, cut the mutton into strips, and hang them under the eaves facing the sun, so as to prepare dried meat in strips for subsequent consumption. Their food-milk is mainly from goats and cows, and seldom from horses, camels or sheep, except the hybrids of wool sheep whose milk is also a kind for ordinary use. During milking season the pastoralists regularly make milk tea with water, brick-tea, milk, and a little salt, which is the traditional everyday

beverage of the Mongolian people. In addition, they like to prepare sour milk for drinking rather than drinking the fresh milk. As there is surplus milk, they process it into various kinds of milk products, such as milk curd, butter, cream, etc.

20. Proso millet and wheat flour are the staple food, supplied by the state because they seldom cultivate grain crops for food. The millet is often processed into "baked crisp rice", a kind of traditional Mongolian food. This kind of ready-made food is very easy to carry about and the method of processing may be passed on from the time when the Mongols' ancestors began to make a nomadic living. Now, in their daily life the custom is to have noodles and meat for lunch, while the other two meals consist of milk tea, milk products and a little baked rice. The Mongolian pastoralists seldom have vegetables in their meals, though they have already begun to grow vegetable crops, such as cabbage, Chinese cabbage, Welsh onion, potato and garlic.

21. The sedentary life of pastoralists has created better conditions for promoting the development of education in the pastoral areas in this league. Now, primary education has been popularized and, generally, in each production brigade there is at least one boarding school which is usually located at the brigade centre. The primary schools in the commune have enrolled about 98% of the children who are at the proper school age. Five junior middle schools have been set up, enrolling the great majority of the pupils after they have accomplished their primary education. However, there are rather fewer pupils graduated at the junior middle schools who can enter the senior middle schools that are situated at the banner centre. In this commune only three students are studying in a college for minority nationalities in Beijing and several young persons in technical schools at the league seat, Dongsheng.

Animal Production

22. Animal husbandry is the major division in this commune and income from animal production constitutes about 85% of the annual total. The commune had an animal population of 145,185 in the crop year 1979, among which there are 2,817 horses, 4,299 cattle, 216 mules (including a few hinnies), 1,298 asses, 94 camels, 49,772 sheep and 86,689 goats. Except the mules and asses and a small number of horses, cattle and camels that are used for draught purposes, the great majority of livestock are all called "grazers" as they are grazing on the grazing lands all the year round.

23. Most of the pastoral households tend sheep or goats. As a rule, for a pastoral household, the house, the well, and the sheep pen are arranged together and in most cases they are built in the border area of lowland, because here the water table is not too deep and also it is not too wet inside the rooms. The flock graze around the dwelling site (we call it flock point) throughout the year with a

radius not more than 1.5 - 2.0 km. About twenty years ago sheep and goats were both kept in the same flock, but with the sheep breed getting improved gradually it is now mostly the case that the two kinds of animal graze separately. The size of flock is dependent on the topography of the rangeland, generally, the more level the topography, the bigger is the flock. However, a flock in this district commonly consists of 150 - 250 animals, which is quite different from the case in the eastern part of Inner Mongolia where a flock often includes 800 - 1,000 animals.

24. The herd usually consists of 50 - 70 head of cattle who like to graze tall grasses, such as Achnatherum splendens, reedgrass, thickspike wild rye, etc, and shrubby willows.

25. The stud commonly includes 20 - 30 horses. They like short grasses and forbs, such as short sedges, short needlegrasses, black medic, some species of milkvetch, dentate sweetclover, etc, and the lowland pastures are more suitable for horse grazing. As the common saying goes here "horses like wetness, while sheep favour dryness".

26. Camels are all grazers, except the gelded ones that are often to be pack animals during the cold season. Camels like browsing, so they often graze on the rangelands with woody species dominant, such as peashrubs, Ordos sagebrush, nitrarias (Nitraria spp.), tamarisks, etc. While grazing, the animals roam about freely throughout the rangelands without the herdsman tending the herd, except when watering them from time to time. The experienced old Mongolian herdsmen have a superb skill in trailing; whenever some camels go far away, the herdsmen can make accurate judgement according to the hoofprints of their own animals and retrieve them back without a chance of an error.

27. The grazers basically get along with grazing yearlong, with only a few management practices, as follows:

a) Dipping. In most cases, there are no specific facilities, but only a pit (sometimes laid with concrete) for sheep and goat dipping. The operation is usually carried out during early summer when the sheep have been sheared or the goat's underfur has been combed out with a special hand-rake made of wire and the hair clipped subsequently.

b) Anthelminitic treatment. The treatment generally takes place once a year during early autumn with copper sulphate, mainly for preventing the infection of liver fluke among both sheep and goats.

c) Medical treatment of camels. As a management practice, a kind of medical stew that is made of water, cane sugar, and medicinal rhubarb is used for camels. When treating, the stew is poured into the camel's mouth and it is commonly believed among the pastoralists that the stew treatment may prevent the camels from contracting some diseases caused by "getting fire" (which is perhaps a phenomenon of disorder in metabolism).

d) Classifying animals. When the cold season is drawing near, the herdsmen will arrange an inspection of all of their animals in order to classify them according to their body condition. The old and the weakest animals that can not pass the severe winter will be eliminated, while the other weaker ones will be better cared for. They will be place on the reserved winter pastures and obtain a certain amount of supplementary feeds, including hay and concentrates. The concentrates, ie sorghum, corn or other grain feeds, are supplied by the state with a quota of 0.5 - 1.0 kg per year for each animal.

e) Buildings. In this district there are no buildings for the large animals, but for sheep and goats there have always been earth-walled sheepyards there, and for lambs and kids, especially for hybrid lambs that are naked at birth, earthen sheepcotes have been built to protect them from frostbite. Now there are about 900 sheepcotes within the whole commune.

28. Though the social economy has been collectivized, yet the pastoral production is still mainly built on the household basis, and there is almost no specialisation in production between production brigades or production teams, except that there is an auxiliary team within each brigade that is composed primarily by the Han people for accomplishing some particular work, such as forage crop and grain crop growing, afforestation, nursery cultivation, etc. Because the production brigade is an accounting unit, the brigade cadres can arrange the workforce, male or female, to accomplish some particular task, eg afforestation, haymaking, harvesting, etc, and the workforce can receive workpoints according to their work done. The organisational units are primarily determined in terms of geographical location within the communes, and this is also consistent with their traditional administrative areas. As already stated the present-day production teams are equivalent to the then elementary pastoral co-operatives. In these communes there is specialisation in particular kinds of animals on a household basis instead of the complex herding (mainly sheep and goats) which was considerably prevailing some two decades ago. As the work of sheep improvement made headway the sheep flocks were generally differentiated according to the degree of improvement, such as the native sheep flocks, the first generation hybrid flocks, second generation hybrid flocks, etc. Only in the Guilistai Hot (a Mongolian word, originally meaning a place with yurts and livestock and here denoting a management unit which is composed of several households with the flocks tended by them), a smaller tryout point, the pastoralists have divided the sheep flocks into lamb-flocks, ewe-flocks, and ram-flocks.

Breeds and Breeding

29. About two decades ago, animals in the district were all of native breeds. Although they were very well adapted to the local natural conditions, yet their productivity, both in quantity and in quality, was rather inferior. An adult native sheep could produce not more than one kg a year of coarse wool, which is suitable only for making felt or fabrics

of low quality. When slaughtered, the animal could give a carcass generally below 15 kg on average. Since the late 1950s the Xinjiang Wool Sheep, an improved breed by Merino sheep, were introduced into this district for improving the native breed.

30. The method widely used in sheep improvement belongs to grade breeding and through many years' efforts a great number of sheep have been improved in various degrees. Statistics show that high grades and hybrids in this commune already constitute over 60% of the sheep population, which is a rather advanced result in the Otokand Banner (the improvement rate within the whole banner is 45% on average).

31. The grades have many desirable characteristics; they are highly productive, averaging 3.5 kg of wool a year per adult animal, and the wool is also much finer than the native sheep's. When slaughtered, the grade's carcasses will weigh over 20 kg on average and its skin is also much more valuable than the native's as sold to the state. The milk of the grade is also used by herdsmen for food and in a lactation period the animal can produce 0.3 - 0.4 kg of milk per day as well as feeding the lamb.

32. The goats are a little smaller than sheep; they play an important role in the pastoral economy, and their reproductivity is fairly strong. Since the early 1970s, the pastoralists have introduced a better native breed called Arbas White from another commune of the Otokand Banner to improve the native goat here. An adult Arbas White can produce 0.3 - 0.4 kg of underfur a year, which is about 50 - 100% higher in yield than the native's here. The goat's underfur is one of the best textile raw materials and priced 3 - 4 times higher than sheep's wool.

33. The Mongolian cattle here are smaller than the same breed raised in eastern Inner Mongolia. In this district the live weight of an adult animal averages about 250 kg, and when slaughtered, the carcass may weigh 120 kg or so. Cows have a lactation period of some 6 months, the mean milk yield, in addition to feeding the calf, is around 3 kg daily on average, but because of their small number cows' milk and beef play a minor role in the pastoralists diet, although the pastoralists are taking more interest in these foods in their daily life. The pastoralists began to improve the native cattle with the Range Red breed, which is a breed improved by Shorthorns, through artificial insemination with frozen semen. But no information on results can be given for the time being.

34. The Mongolian horses here are rather dwarfish, their heights are ranging 120 - 132 cm (according to the Western standard they are only ponies), and they have weights ranging from 200 to 350 kg in adult animals. The horses in this district belong to the Wushen strain, which is a general-purpose type for riding, draught power and even for

packing. Because of their pacing in step and better endurance they are fairly well known as Wushen Horse in North China.

35. The camels are all two-humped (Camelus bactrianus), have heights ranging 150 - 180 cm and can carry (pack) a load of 120 - 200 kg. During late spring to early summer the camels' wool will fall out gradually, hence there is no need to shear. The wool yield is about 3 kg and on account of its heat-retention capacity camels' wool is one of the best materials for quilt- and jacket padding. The old Mongolian pastoralists did not eat camel meat formerly, but as personal relations between the Mongolian and the Han people got more frequent little by little they became more used to eating it, particularly the young Mongols.

36. Mongols had never raised swine before liberation, nor would they eat pork at all. But, now, they become used to it also and the swine population has been increasing during the recent decade.

37. Now, there is at least one breeding station which has been set up to carry out the animal breeding and improvement work.

Animal Products

38. There is a common rule in most pastoral areas in Inner Mongolia that among the animal population there will be a 19% deduction from the whole population in an average year. The common saying is that "7% for slaughtering, 8% for selling, and 4% suffering from death loss". The output as such will make the circulation rate too slow to utilize effectively the productive potential either of animals or of rangelands.

39. The major part of milk production is consumed by the herdsmen's families. However, the herdsmen who have the herds to tend must supply some milk products at a rate of 250 gm butter of dried milk curd per year from each milking animal they raised to the cadres and commune members who are not graziers.

40. The wool, hair and hides produced are basically sold to the state-run co-operatives located at almost each production brigade, and afterwards the animal products are transported to the industrial centres or export seaports. For example, in 1976, there were 24,485 hides and 93,300 kg of wool and hair sold to the state.

Veterinary Aspects

41. In the Inner Mongolian pastoral areas the most common infectious diseases before liberation were horse glanders, foot and mouth disease in ruminants, and anthrax. Since 1949 when Inner Mongolia was liberated, the government put

forward a principle "an ounce of prevention is worth a pound of cure" concerning the veterinary work, and a movement was extensively carried out dealing with the prevention of those highly contagious or stubborn diseases. That was to discard the sick animals (as in the case of glanders), to exterminate the animals (as in the case of anthrax, mainly to bury them deeply and right on the spot), and to isolate the area where the disease had taken place (as in the case of foot and mouth). In addition, many other measures had been adopted for the disease-prevention work, such as vaccine injection, animal quarantine, using disinfectants, etc. Fortunately, these important infectious diseases have been basically eradicated after the consistent and untiring efforts made by the pastoralists and cadres over a long period. As to the common diseases, when they occur, they will be treated in the veterinary stations, which have been set up in almost every production brigade.

Range Improvement

42. During recent years under the guidance of and with the help of the banner authorities, activities dealing with the rational use and improvement of rangelands have been under way to prevent their deterioration, to control desertification, and increase their productivity.

43. a) Rational use of pastures

At first, the Sumitu Production Brigade was assigned to be a point for a trial. The extent of this brigade is 300 odd sq km, including 140 sq km of shifting sandy lands, 100 sq km of fixed and semi-fixed sandy lands. Since 1976, the five production teams which had an animal population of 21,396 sheep units (one large animal equals five sheep units) were reorganized into 11 "hots" and tried to carry out a seasonal grazing system instead of the yearlong continuous grazing.

44. Among these hots, Guilistai Hot is a typical one (Fig. 2) in which there are 12 households and about 1,300 grade sheep (in 1976, six households and over 900 sheep). Originally their dwelling places were rather scattered and during the process of hot organization they had assembled together into a new residence located within the sandy lands where the relief was mildly undulating and the temperature was rather higher in winter. Permanent facilities such as animal houses, veterinary facilities, hay stacks, etc, were also arranged here.

45. On watersheds there are temporary dwelling places for the herdsmen, who will tend the flocks to use the watershed pastures where, because of the open relief and higher elevation, the temperature is relatively cool in summer time.

Figure 2 can be found on page 20.

When the cold season comes they will return to the sandy lands for wintering and use the sandy land pastures. Animals will graze lowland pastures during late spring and early summer when the soil is quite rich in moisture and may support the meadow vegetation to have a luxuriant growth.

46. Since the seasonal grazing system has been carried out the peashrub watershed pastures have been greatly improved in comparison with those under continuous grazing. The productivity, number of flowering plants and number of flowering branches have been increased by 49%, 60 - 70%, and 70 - 90% respectively, and the vegetation coverage has also been increased from 25 - 30% to 35 - 40%.

47. In this district the seasonal grazing system has been extended on a wide scale, and up to 1979 there were more than 40,000 sheep and over 3,000 cattle involved in this system.

b) Pasture improvement

48. Decades ago, the animals were thinly distributed, averaging over 3 ha of rangeland per animal. But, since liberation,

with the drastic increase in both human and animal populations, the mean occupied area of pasture per head of animal has been decreased accordingly, and because of the effects of prolonged misuse of lands, such as over-grazing, irrational grazing systems and excessive gathering of firewood, a considerable part of rangeland ecosystems had already been disturbed. The Sumitu people had to undertake the tasks of improving the pasture lands in order to promote the development of animal production. Their activities involved in these tasks are as follows:

49. i) Protected cultivation of degraded pastures. Measures to exclude grazing and other cultural activities have been adopted for reclaiming the degraded lowland and sandy land pastures. Areas to be protected are fenced with barbed wire and other materials to form "khuries" (a Mongolian word, means enclosures), and after protecting for about three years the pastures are opened for grazing during the cold season. The natural pastures, once placed under protection, will take full advantage of the moisture and heat during the growing season and generate and store their own nutrients. The net result is a significant increase in density, height, and plant cover degree, and increased productivity. For example, in 1972, 650 ha of sagebrush sandy land pastures had been put into protected cultivation and, as investigated in 1977, the degree of cover of protected vegetation had increased from 27% to 41.6%, the sagebrush seedlings from 2 - 4 per m^2 to 15 - 22 per m^2, and the plant density of sweetvetch had increased 10 times as against 1972. The productivity of lowland pastures protected since 1975 had been increased by 1 - 5 times as investigated in 1977.

50. ii) Artificial reseeding. The sites for artificial reseeding are mainly the lightly sand-covered lowlands and the interdune depressions where the vegetation is often rather sparse, and the plants extensively used for this purpose are sweetclover and alfalfa. In early spring (mid March to mid April) when the topsoil has thawed to a depth just permitting the sowing operation, seeds are scattered by hand and later on they are trodden into the soil by a flock of animals. Based on measurements, the yield of green forage from reseeded pastures, depending on the soil condition, is 3,600 - 11,190 kg per ha, which is about 3 - 9 times higher than the unseeded ones.

51. iii) Renewal cutting. Having lived through certain years, shrubs and subshrubs that are widely distributed on rangelands, will gradually lose their growth vigour and decrease their forage production. The pastoralists, in gathering their firewood, have found that if the above-ground parts of the plants have been entirely cut off, the plants will renovate their growth vigour during the coming growing season. The local technicians have called the operation "renewal cutting", and according to the experience of the pastoralists they have conducted some experiments dealing with the effectiveness of the operation. It has been investigated that after the application of this measure

Table 1 The Effectiveness of Renewal Cutting

Plant	Treatment	Canopy (cm)	No. of branches per plant	Height (cm)	Per cent weight		Understory herbs, air-dried matter (kg/ha)	Habitat
					Stems	Leaves		
Sand willow (Salix psammophila)	Experimental*	110 x 109	55	131	58	42	3,495	Inter-dune depression
	Controlled**	210 x 215	21	242	86	14	1,507	
Small catkin willow (Salix microstachya)	Experimental*	90 x 110	56	102	73	27	3,405	Inter-dune depression
	Controlled**	230 x 240	27	210	88	12	1,500	
Intermediate peashrub (Caragana intermedia)	Experimental*	200 x 140	150	120	59	41	795	Watershed
	Controlled **	210 x 193	31	176	80	20	315	
Shrubby sweetvetch (Hedysarum fruticosum var. laeve)	Experimental*	180 x 170	21	115	60	40	810	Semi-shifting sand dune
	Controlled**	220 x 240	14	164	86	14	618	
Ordos sagebrush (Artemisia ordosica)	Experimental*	26 x 39	19	49	38	62	654	Fixed sandy land
	Controlled**	90 x 75	8	86	90	10	322	

* current growth ** old shrubs

the growth vigour and forage yield of the plants of experimental groups have been greatly improved as compared with the controlled ones (Table 1).

52. Table 1 shows that through the treatment of renewal cutting, the number of branches per plant, amount of leaves, and forage yield have all been increased. In addition, according to measurements, the yield of understory herbs has a twofold increase as a result of the improvement in sunshine and ventilation conditions.

53. When the operation is carried out all the branches are cut down with a mattock at a level several centimetres below the surface, except the shrubby sweetvetch which is cut with a sickle at a height about 25 cm above the surface. In order to prevent sand-shifting or wind erosion, cutting should be made in every other row.

c) Forage production

54. Since liberation the government had called for increasing forage production, especially hay-reserving in pastoral areas. Plant cultivation and forage preserving were thus gradually put into practice.

55. i) Haymaking. Since the early post-liberation years the government had already called for hay-reserving for animal husbandry's sake, but the unorganized pastoralists were not concerned for it. As the communization campaign moved on, the organized pastoralists started to make hay. In recent years, 2,500 - 3,000 tons of hay and dried browse were made annually in the whole commune.

56. The haymaking season commonly begins in September and proceeds for three to four weeks. The plants for haymaking are mainly common reed which grow in the meadow bogs. Besides, tickseed (Corispermum spp.), Russian thistle (Salsola pestifer), reedgrass (Calamagrotis pseudophragmites, C. epigeios), thickspike wildrye (Leymus secalinus), and cultivated herbs, ie sweetclover, alfalfa and milkvetch (Astragalus adsurgens) are also used for haymaking. The dried browse are essentially gathered from Hankow willow (Salix matsudana), and Simon poplar (Populus simonii) during late autumn. In addition, a shrub, shrubby sweetvetch, growing on the semi-shifting sand dunes is also an excellent species for dried-browse-making. According to the opinion of pastoralists, the dried browse made of Hankow willow and sweetvetch both are the best feeds for lambs during the spring months when the animals are in urgent need of better nourishment. Sickles and scythes are commonly used for cutting, and, sometimes, animal-drawn mowers are also used. Tree branches are cut with a specific, long-handled trimmer.

57. ii) Silage making. In recent years silage making has made some progress, and up to 1979 some 200 tons of silage had been successfully made. Plants used for silage making are corn, Ordos sagebrush, and some other native herbs.

Ordinarily the plants are cut with silage cutters and preserved in pits.

58. iii) Forage plant cultivation. In pastoral areas forage plant cultivation is all conducted in khuries. On account of developing water conservancy, shelter forest, cultivation of forage herbs, and fodder grain crops, and protection of natural vegetation in the enclosures, the pastoralists often call "water-herb-forest-grain four-in-one khuries", which are fairly popular in the pastoral areas.

59. This commune, up to 1979, had already developed near 4,000 ha of "four-in-one khuries" in which there were 2,800 ha of forage herbs, including white sweetclover, alfalfa, milkvetch, and silage corn, 150 ha of shelter forest and 32 ha of tree nurseries. For irrigation 83 wells of various types that can water some 500 ha of land had been sunk.

d) Rehabilitation of shifting sandy lands

60. Shifting sandy lands occupy a considerable area in this district, and so the Sumitu people have to involve themselves in the work of protecting their rangelands from sand dune encroachment, and at the same time utilizing the sandy lands for forage production.

61. The first step is to plant the Ordos sagebrush or sand willow in rows perpendicular to the main wind direction on the lower one-third of the windward slopes of the barchans or barchan chains where the wind force is comparatively mild and moisture relatively rich. The plant cover thus created will effectively reduce the surface wind velocity. In the meantime the stronger wind force, after passing over the plant belt, will level off the dune slope and form a section of level ground just in front of the belt. As soon as this section of dune slope is levelled off, it will be further planted with the plants in rows during the coming growing season. After operations such as these are carried out for 3 - 4 successive years, the sand dunes will be lowered and basically stabilized.

62. The planting stocks (almost wholly natural) of sand willow are also planted in the inter-dune areas at some distance, generally 5 - 6 metres, in front of the leeward slopes of the dunes. The sand willow has a superior capability in growing adventitious roots as their stems are once buried by sand. Thus, in the process of the advance of dunes, the plants will "climb up" the leeward slopes of the advancing dunes, and meanwhile the dunes will also be stabilized step by step. With stabilizing of dunes, some psammophytes, such as tickseed, sweetvetch, Agriophyllum squarrosum, sand bamboo (Psammochloa villosa), etc, will start to grow on the dunes naturally.

63. Some other plants, such as Hankow willow, Simon poplar, sweetclover, alfalfa, etc, are also widely used for the rehabilitation work, and are all grown in the inter-dune areas.

64. In this commune about 17,240 ha of shifting sandy lands have already been put in the rehabilitation programme and transformed into usable lands in various degrees since the late 1950s.

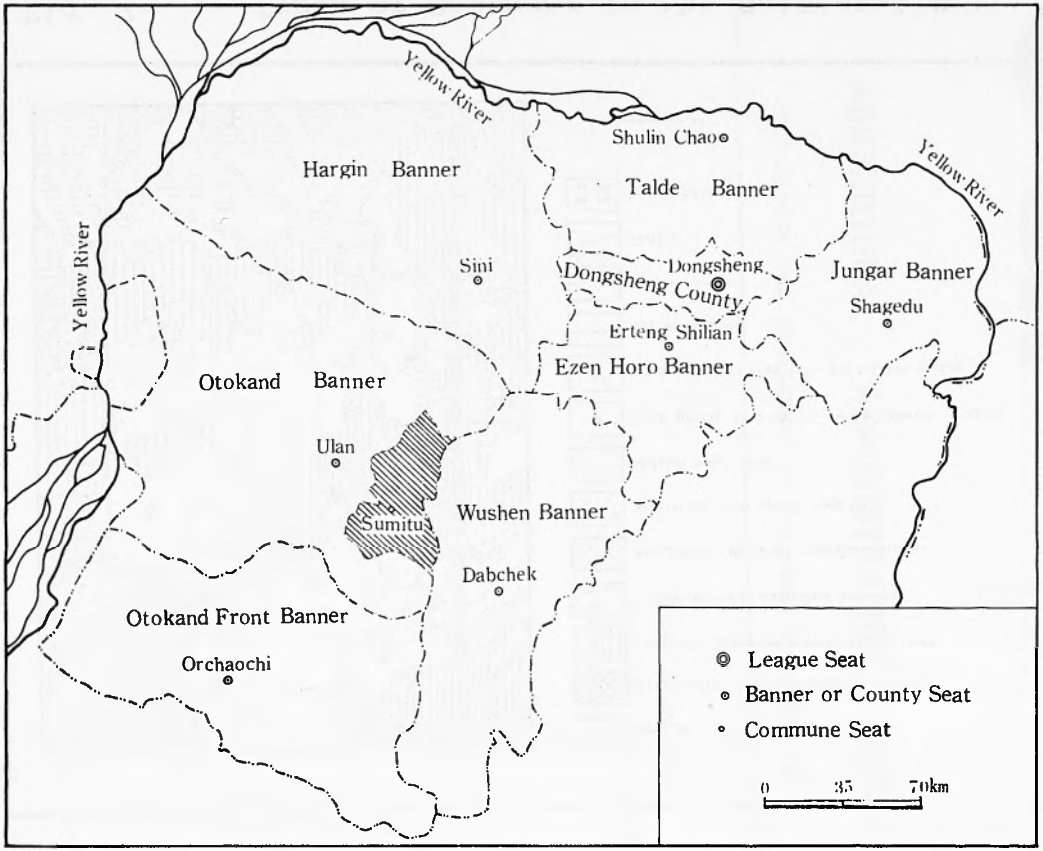

Fig . 1 The Location of Sumitu Commune in Ikh Chao League , Inner Mongolian Autonomous Region

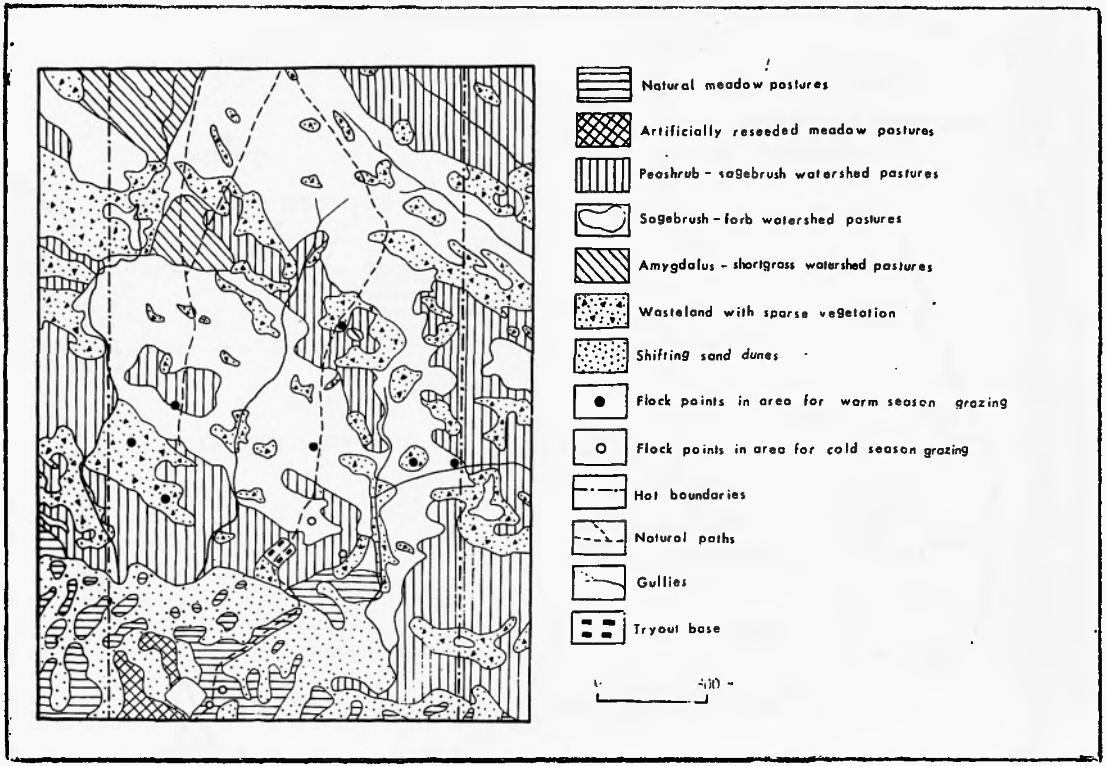

Fig. 2 Types of Pastures in the Guilistai Hot, Sumitu Production Brigade, Sumitu Commune

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STOCK LIMITATION: ANY ECONOMIC ALTERNATIVES FOR BOTSWANA?[1/]

by

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1/ Originally prepared for the "Workshop on Communal Area Livestock Production Systems and their Future Development", Ministry of Agriculture, Gaborone, 3 August 1981.

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Introduction

1. Stock limitation is a matter often hinted at in Botswana but seldom confronted. The 1975 White Paper introducing the Tribal Grazing Land Policy envisaged it for the 'Communal' areas[1]; Litschauer and Kelly stress its importance[2]; Sandford sees it as unavoidable in the 'Commercial' areas[3]. It also lies implicit in the assumptions on which the First and Second Livestock Development Projects have been based, specifically in the proposed offtake rates from the planned ranches.[4]

2. Stock limitation is a subject that provokes strong feelings, both for the younger generations who see in cattle accumulation their future security and for the generations with longer memories who may also remember with anger the compulsory destocking programmes enforced in former times in the reserves of South Africa and Southern Rhodesia, as well as in East Africa, for the benefit of settlers and meat companies.[5] Alternatives to stock limitation in

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1/ "National Policy on Tribal Grazing Land". Government Paper No. 2, 1975. The Tribal Grazing Land Policy (TGLP) has been the government's major initiative to date in the livestock sector, splitting the former tribal grazing areas into 'communal' and 'commercial' zones, under the banner of relieving overgrazing and promoting a fairer distribution of cattle.

2/ Litschauer J. and Kelly W. (1981) Traditional vs. Commercial Agriculture in Botswana. Gaborone: Ministry of Agriculture.

3/ Sandford S. (1980) Keeping an Eye on TGLP. Gaborone: National Institute of Research. Para. 2, 13.

4/ The First and Second Livestock Development Projects are World Bank financed investment packages in livestock production and marketing. Both include a ranching component with herd projections, the offtake rates for which have been planned partly with maximum stocking rates in mind. See Odell M. (1980) Botswana's First Livestock Development Project: an Experiment in Agricultural Transformation. Synergy International. Massachusetts. Table 2.3.

5/ Destocking was enforced in the reserves of Southern Rhodesia in the 1940's and '50's, modelled on the South African system. See Southern Rhodesian Government (1942) "Report of the Commission appointed to inquire into the Marketing of Slaughter Cattle and the Products Thereof", p. 26. Compulsory destocking in Uganda is discussed in R. Baker "Development and the Pastoral Peoples of Karamoja, N.E. Uganda: an example of the treatment of symptoms", in Monod T. (ed.) (1975) Pastoralism in Tropical Africa, Oxford, Oxford University Press. Pages 187 - 205.

Botswana remain unexplored. This note speculates on the economic instruments available to government to try to improve land management by herders. It tries to stake out the relevant territory and suggest to which areas economic instruments might constructively be applied.

Alternatives to Outright Stock Limitation

3. The assumption behind stock limitation is that overstocking degrades grazing land. If the causes of range degradation are:

a) Orientation of cattle owners to continuous accumulation of cattle on communal land; and

b) Too short a time horizon, or ignorance or neglect, by cattle owners or owners of private land;

the alternatives to destocking should alter either or both of these motives. Besides ignorance of correct conservation practices (which is a matter for educative correction through extension) the other motives to overstocking are all economic, ie

continuous accumulation - a store of wealth, insurance during drought;

short time horizon - financial pressure (eg to pay off debts), or land held in such large quantity or so cheaply that the envisaged opportunity cost of abusing it is very small.

The policy initiatives proposed to date in Botswana to combat overstocking have been institutional and directed at altering the access to land; ie the introduction of private tenure to create 'Commercial" areas, and groups or holding companies for the 'Communal' areas. They do not alter stocking rates directly and are therefore not necessarily alternatives to stock limitation. They even rely upon stock limitation for their viability in the case of the ranches of the First and Second Livestock Development Projects.

4. Economic instruments for trying to improve herders' land management are either direct or indirect in their impact upon cattle raising.

Direct Economic Measures

5. These include taxes and subsidies to increase offtake, discourage accumulation and thereby to encourage savings and investments in forms other than cattle.

6. Subsidies These seem to be limited to selective stock sale subsidies, ie paying of a bonus on sales of stock

from a particularly overstocked area. Not only would these face formidable practical difficulties (eg ensuring that only the stock from the affected area received the premium), but they could also backfire if the sellers involved were 'target sellers' and thereby reduce offtake for the year, or if the subsidy was anticipated and stocking rates raised accordingly. Where marketing costs are a real disincentive to offtake from an overstocked area, temporary transport subsidies would also have a clear role to play.

7. Taxes The scope for application of fiscal disincentives is in theory wider. There are three points of possible application:

a) Cattle holdings A progressive tax on cattle holdings above a certain number (or stocking rate above a certain figure), varying according to environmental circumstances, would be the only direct fiscal means of discouraging accumulation rather than cattle holding as such. Given the widespread avoidance of the present Local Government tax on cattle holdings[1] this kind of tax would no doubt be unworkable at the present time.

b) Cattle sales and inputs into cattle production A tax on cattle sales would be equivalent to lowering the domestic price of cattle and this is discussed separately below. A tax levied on essential inputs such as water or veterinary requisites (or simply removal of any existing subsidies thereon) could damage productivity seriously, though stiff taxes on watering in areas from which it is desired to keep cattle away at certain times of the year could, if effectively administered, be a useful control measure.

8. As regards taxes on other factor inputs, the most relevant to the purpose would appear superficially to be a tax on land used for cattle raising, in order to encourage more careful use of the particular resource which the tax is designed to conserve. Crotty (1980) has argued, in the context of the Latin American hacienda, that 'Exaction of Land's market Value will ensure efficient land use'[2]. But the theoretical preconditions for taxation to raise

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1/ On cattle taxes in Botswana see Hudson D., "The Taxation of Income from Cattle Farming", in Harvey C. (ed.) (1981) Papers on the Economy of Botswana, London, Heinemann.

2/ Crotty R. (1980) Cattle, Economics and Development, Commonwealth Agricultural Bureaux.

and preserve the productivity of land are limiting,[1] particularly under Botswana's tenure arrangements and her arid climatic and soil conditions. In general, a tax on grazing land in Botswana would run into the problem of the low taxable capacity of a factor of production whose productivity is very low, even were all other preconditions to be present. Thus the tax would either have to be so low as not to affect land use or be higher and provoke avoidance. A tax on labour use in cattle production would be out of the question, only increasing unemployment. Investment in cattle production could be taxed (eg by a tax on the purchase of breeding stock), but this might not even raise the price of heifers.[2] Overall, taxes on inputs into cattle production would be most unsuitable for improving herders' land use both in principle and in practice.

9. Reducing the price of cattle This could be done through taxation (eg a tax levied on throughput at BMC and local abattoirs) or by redirecting some or all of the EEC levy rebate away from BMC to other purposes. The recommendation of a higher tax on throughput at BMC[3] has been made on the grounds that it would be both economically efficient (low collection costs) and socially equitable (being paid mainly by the wealthy, owing to skewed distribution of cattle, and obliging a wealthy, subsidized industry incurring heavy social costs to pay its way fiscally to a greater extent).

10. Would a substantial price reduction slow down cattle accumulation? Econometric studies elsewhere[4] of long term

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1/ Taxation of land can raise the productivity of land usage, by making land holding too costly for inefficient users. The theoretical preconditions include:

i) effective tax collection;
ii) an effective market in land;
iii) technical potential to raise the productivity of land sustainedly;
iv) innovative farmers with access to capital.

2/ Since heifers are a by-product of beef-oriented cattle production, their supply may be price-inelastic where cattle production for beef is dominant. If so, the sellers of heifers could end up paying a substantial part of the tax.

3/ Hudson (1981) Op. Cit.

4/ See Low A. (1980) "The Estimation and Interpretation of Pastoralists' Price Responsiveness" Pastoral Network Paper 10c. Overseas Development Institute.

response of offtake numbers to price trends suggest it might. Botswana's own historical evidence is unclear - the industry was too set about with marketing restrictions, the cattle population statistics too variable and changes in other determinants of investment too uncertain, for the specific influence of price trends to be discerned. Chronically low prices (together with devastating drought) were associated with the great selling-off of cattle in the mid-1930's. But circumstances have changed markedly since then; prices (money and real) and cattle numbers have drifted upwards and the two major constraints on cattle keeping (water and disease control) have been substantially relieved at public as well as private cost, increasing the ability of individuals to maintain their cattle numbers in the face of economic adversity and drought.

11. Would a cattle price reduction re-channel people's investment of capital and labour time into crops or manufacturing? Or would it simply deal a blow to their standard of living, especially the small herders already struggling to maintain their few head, as Cooper and Gulbrandsen have recently depicted?1/ In countries where the commercial cattle industry is of long standing, cattle inventories (and subsequently the number of cattle marketed) are most responsive to substantial price changes, with the land resource being redirected (the more so the less marginal the land) to crop or sheep production. But where, as in Botswana, alternatives to cattle production are difficult to resort to (technically, socially or economically) the response must be slower and may chiefly take the form of increased poverty unless supported strongly by measures to encourage alternative use of land.

Indirect Economic Measures

12. These comprise measures aimed at two linked economic objectives of a long-term nature: increasing the return on alternative investments and increasing the productivity (ie value) of land. Clearly no one fiscal or monetary instrument can achieve such difficult objectives. Only the function of these long-term objectives relative to better land management by herders is discussed here at all.

1/ Cooper D. (1980) "How urban workers in Botswana manage their cattle and lands: Selebi Phikwe Cast Studies". National Migration Study Working Paper No. 4. Central Statistics Office. Gaborone.
Gulbrandsen Ø. (1980) Agro Pastoral Production and Communal Land Use: a socioleconomic study of the Bangwaketse. Gaborone: Ministry of Agriculture.

13. Increasing the return on alternative investments If one assumes that investment patterns are determined by the rate of return on alternative investments then one would conclude that Botswana's locational disadvantage for manufacturing and her high cattle prices would be the factors underlying the preponderant local investment in cattle rather than manufacturing. But this is to ignore the real constraint on the investing household's activities, which is its employable labour.[1/] Since cattle keeping is not generally an alternative to paid employment for the educated and skilled (since other members of the household mind the cattle on a day-to-day basis, or there are employees) it does not follow that measures to increase the return on investment in secondary and tertiary industry (very important for other reasons) would diminish cattle accumulation, even if they did succeed in competing potential entrepreneurs away from their present paid employment positions.

14. The lesson from this is that the crucial trade-off determining local investment in secondary and tertiary industry is between returns from paid employment and returns from industry, since both compete for the working time of the educated and skilled. By the same argument, a decrease in the returns on cattle keeping would be unlikely to increase industrial investment domestically. But between the returns on cattle keeping and arable farming (provided the land concerned is cultivable) there would seem to be a trade-off in respect of all the factor inputs presently used in cattle-keeping. The implications are looked at below.

15. Increasing the price of land The event which would have most effect on improving land management would be a rise in the value of land, causing land to be regarded as an asset to be used carefully. There is no short-cut to raising land values, such as imposing a land tax, as noted above. The long and difficult road of raising the productivity of land in whatever use has to be followed, a course that can involve severe social costs in displacement of peasants - as the social impact of High Yielding Seed varieties in Latin America and Asia has demonstrated.

16. Development paths of cattle industries have been hypothesised[2/]

1/ Recent studies of household strategy indicates how crucial is maximisation of the returns from its employable labour for the household's decision-making. See Cooper (1980) and Gulbrandsen (1980) Op. Cit. and Field R. (1980) "Patterns of Settlement at the Lands: Family Strategy in a Variegated Economy". Gaborone: Ministry of Agriculture.

2/ Jarman and Butler (1971) in Botswana Notes and Records Special Edition No. 1 Page 132.

to proceed from wasteful to less wasteful land use. This is borne out partly by the historical experience with land use in Western Europe, the U.S., and temperate Argentina and Australia, where rising populations and food needs resulted in arable agriculture with its higher return per unit land competing the most productive land away from livestock. This process is the result of the type of economic development they have experienced, and there is nothing automatic about it.

17. The need in Botswana to increase the productivity of arable agriculture is clear and urgent in order to raise living standards and to provide employment to those with few or no alternative assets. To what extent can programmes to improve arable technology and to channel more labour and capital onto arable land be expected to raise land values in Botswana? Certainly such a process can only be anticipated for the wetter, eastern Hardveld zone. And what of the social consequences?

18. In the western Sandveld it will probably have to be recognized, as has been done in the dry north of America,[1/] that there is no very productive use for these vast land tracts, that land values there will consequently always be low (the relatively fertile Ghanzi limestone ridge excepted), the risk of abuse of the land therefore always great and its ability to recover from abuse most limited. Under these circumstances there is probably no long term substitute for policing of stocking rates, as is carried out in northern Australia with the help of leasehold rather than freehold tenure.

19. To sum up this note on economic alternatives to stock limitation. The scope for direct fiscal measures to achieve better land use by herders is presently limited, and fiscal penalties would have to be used most cautiously and as part of a package to raise returns from alternative land use, if they were not simply to cause hardship. Indirect economic measures to improve land use in cattle production may best be directed to improving the productivity of arable farming, but in any case the impact will be long term and to the east.

1/ See Young M. (1979) "Influencing land use in pastoral Australia". Journal of Arid Environments 2, 279 - 288.

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THE MANAGEMENT OF COMMUNAL GRAZING IN BOTSWANA[1/]

by

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1/ This paper originally appeared in March 1981 as a discussion paper of the Evaluation Unit, Ranch Management Centre, Ramatlabama, Botswana

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Are Communal Grazing Rights Obsolete?

1. Many people with wide experience of rural development in Africa believe that communal grazing is inherently unmanageable, and that communal access to pastures can only bring about their depletion and ultimate ruin. Examples to support this view are all too common. These days it is indeed hard to find a significant area of communal range anywhere between the Sahel and Botswana which could not be used as evidence against the concept of communal grazing rights.

2. Several decades ago the Kenya Government despaired over the prospects for development, and even of conservation under the traditional land tenure systems, which granted communal rights similar to those of Botswana. The Swynnerton Plan of 1954 saw no alternative but to substitute individual freehold tenure for the customary form:

> "Sound agricultural development is dependent on a system of land tenure which will make available to the African Farmer a unit of land, a system of farming whose production will support his family at a level, taking into account prerequisites derived from the farm, comparable with other occupations. He must be provided with such security of tenure through an indefeasible title as will encourage him to invest his labour and profits into the development of his farm and as well enable him to offer it as security against such financial credits as he may wish to secure from such sources as may be open to him." (p. 9)

In Kenya's mixed arable and pastoral areas, broadly comparable to Botswana's more densely populated eastern part, much of what used to be communal pasture has passed into individual ownership following a process of adjudication, consolidation and registration of titles.

3. Many planners and development workers believe that communal pasture rights are incompatible with range management, and that, conversely, individual or corporate group ownership of land is almost bound to promote good husbandry. There is something very compelling about this idea, especially to western minds, but it is simplistic and although many cases can be mentioned in support of it, there are other, perhaps less well known cases, which disprove it.

4. The main aim of this paper is to show that communal grazing can be managed, despite much weighty evidence and argument against it. The question of how it can be managed is both technical and sociological. On the technical side, it is suggested, the basic requirements for managing range do not differ essentially whether grazing rights are communal or private. Botswana has the advantage from this point of view in that it has, within its borders and immediately

beyond, some successful and long established ranches, where much can be learned about the techniques for range management, conservation and rehabilitation. Guidelines on appropriate institutional and social forms for communal grazing management can be found in Botswana itself, as well as elsewhere in Africa and even in Britain. In drawing together these pieces of evidence that local communities are able to exert at least some degree of control over their range and livestock numbers, and that techniques of management for this type of range do exist, this paper is intended as a contribution towards improving the management of communal grazing.

"The Tragedy of the Commons"

5. This arresting phrase was used by Garret Hardin in 1968 as the title of an article which appeared in the journal Science of that year. It inaugurated a decade and more of tragic literature describing and analysing the disasters befalling the world's communal pastures, fishing grounds, parks, atmosphere, etc. The essence of the argument is reproduced here because it underlies much of the current thought about Botswana's communal grazings and the reasons for their apparent decline:

> "The tragedy of the commons develops in this way. Picture a pasture open to all. It is to be expected that each herdsman will try to keep as many cattle as possible on the commons. Such an arrangement may work reasonably satisfactorily for centuries because tribal wars, poaching and disease keep the numbers of both man and beast well below the carrying capacity of the land. Finally, however, comes the day of reckoning, that is, the day when the long-desired goal of social stability becomes a reality. At this point the inherent logic of the commons remorselessly generates tragedy.
>
> As a rational being, each herdsman seeks to maximise his gain. Explicitly or implicitly, more or less consciously, he asks 'What is the utility to me of adding one more animal to my herd?' This utility has one negative and one positive component.
>
> 1) The positive component is a function of the increment of one animal. Since the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.
>
> 2) The negative component is a function of the additional overgrazing created by one more animal. Since, however, the effects of overgrazing are shared by all the herdsmen, the negative utility for any particular decision-making herdsman is a fraction of -1.
>
> Adding together the component partial utilities, the rational herdsman concludes that the only sensible

course for him to pursue is to add another animal to his herd. And another; and another ..... But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system which compels him to increase his herd without limit - in a world that is limited. Ruin is the destination towards which all men rush, each pursuing his own interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all."

The Evolution of Communal Area Grazing Policy

6. This line of thought has been influential in the formulation of Botswana's land reform and rural development policy. It was shared by Chambers and Feldman, authors of the 1973 "Report on Rural Development", upon which Botswana's Tribal Grazing Land Policy (TGLP) was based:

> "We believe there is an inherent contradiction between the present institutional structure of private herd ownership, communal land control and the sustained development of the livestock industry." (p. 57)

The contradiction could only be resolved by a programme of radical land reform:

> "The introduction of pasture management requires that those responsible for the cattle are also responsible for the pasture used by the cattle. This can only be achieved effectively in the tribal areas through changes in the tenure structure to enable pasture rights in a piece of land to be identified with an individual, a defined group, or a responsible organisation." (ibid.)

7. The 1975 Botswana Government White Paper introducing the TGLP opened with the words of the late President:

> "..... And under our communal grazing system it is in no one individual's interest to limit the number of his animals. If one man takes his cattle off, someone else moves his own cattle in. Unless livestock numbers are somehow tied to specific grazing areas no one has an incentive to control grazing ..... We are faced with a situation which demands action."

The White Paper proceeded to announce changes in "the traditional system of land tenure in the tribal grazing areas". These changes were to be based on an improved system of range management developed by the Ministry of Agriculture. They consist of

> "very simple methods of management (rotational grazing, controlled breeding, early weaning, daily watering, bonemeal feeding). Correct stocking rates and paddocking to permit some rotational grazing, will halt deterioration, allow the grass to improve, and provide standing hay for the dry season. All that is needed is some fencing and some piping of water ....."

8. These were the means proposed for the rescue of the communal pastures from otherwise certain destruction. The incentive to apply these means is, as Hardin, Chambers and Feldman, Sir Seretse Khama, and others have pointed out, lacking under the present system. The White Paper therefore proposed that

> "Stockowners should be given complete control over the areas where their animals graze. They will then have an interest in looking after that grazing."

With the technical means and the incentive thus supplied it only remained to see how the means could actually be applied to existing communal pastures in Botswana. Here the White Paper was not specific, and even suggested that the proposed measures would not actually be applied in the communal grazing areas:

> "In these areas the traditional grazing system will not be changed and no rent will be paid."

9. It was proposed, however, that Land Boards should set a ceiling on the size of herd which could be grazed on the commonage, and should compel those whose herds exceeded the maximum to move to the commercial areas. This would help to ensure that large cattleowners were not depleting the communal pasture at the expense of small owners, and that the potentially commercial herds moved to the commercial areas where their productivity would improve. In this way one of the prerequisites for sound range management, correct stocking rates, might be achieved. It was further proposed that

> "Livestock management groups of small owners will be permitted to fence land allocated to them in communal grazing areas."

What is proposed for the communal areas in the White Paper was therefore (a) a removal of the larger herds to make more room for the smaller and (b) the establishment in communal grazing areas of what amounts to group ranches.

10. In practice neither of these proposals has been implemented at the time of writing, some five and a half years after their publication. The Land Boards have declined to impose stock limitations, and despite several attempts there are no group ranches in existence in communal areas.

11. In many Botswana Government circles, in District offices and in villages the whole subject of stock limitation, in communal or commercial areas, is treated as taboo. It is now fairly widely accepted that if ever it becomes feasible to restrict livestock numbers, per owner, or per unit area, the time for its introduction is notnow. To attempt such a universally abhorred control at this time, when TGLP is still in its infancy, would jeopardise the whole policy.

12. Apart from some sporadic and ill-fated efforts (eg in eastern Central District) to promote group ranches in communal areas, and some almost as unsuccessful attempts to establish group ranches in the commercial areas (eg Samane and Ncojane ranches) the only concerted effort to develop an approach to communal ranch management has been through the concept of 'grazing cells'. These are described as follows:

> "1. The proposed cells will be approx. 2340 ha in size and hexagonal in shape. In each of the areas the cells will have 2, 6 or 16 paddocks to allow for continuous or different rotational grazing systems to be practised.
>
> 2. ... the cell will be sited on a communal grazing area around an existing overgrazed water source. (APRU1/, which is responsible for the grazing cells, is specifically selecting sites which are heavily overgrazed in order to test its rehabilitation and management methods).
>
> 3. Weaner calves of 7 - 10 months of age will be admitted to cells ..... 300 cattle to be grazed ..... annual intake of 150. The calves will be heifers and castrated males, which will remain in the cell for two years, after which the males should be ready for slaughter and females ready for service." 2/

13. The grazing cells, according to this concept, are to be restricted to weaners and it is therefore important "to ensure that adequate grazing area is available outside the proposed area for the maintenance of the remainder of the herd ....." The World Bank, however, in its Livestock II Project Appraisal (1977), stresses the fact that, contrary to the claims of the White Paper regarding MOA's "improved system of range management",

> "animal production research in Botswana has failed to date to develop any system of livestock management that promises to assist the many small cattle owners concentrated around villages, or to rehabilitate rangeland that has been overgrazed and degraded. The problems involved are technical and sociological, rehabilitation of pasture has not been demonstrated, and it is not known how producers will work in co-operative management arrangements. In order to provide systematic data concerning these problems, an experimental programme would be undertaken in areas zoned as communal land." (p. 13)

1/ Animal Production Research Unit

2/ The Evaluation of Grazing Systems in Communal Areas. MOA. No date.

14. The stress here is on the experimental approach to grazing cells, both in respect to their technical and sociological aspects. What is not clear is how the results of these experiments would be applied outside the cells. How, in other words, would the knowledge of range management, stocking rates, etc, gained in the cells, under central management, be applied on the remainder of the commonage under community management?

15. It was estimated, in 1977, that it would require at least five years before the grazing cells began to produce material for even a "preliminary assessment" of the grazing systems being tested. At present only one grazing cell is in existence (12 were originally proposed) and is stocked with bought cattle, as local interest in the scheme is slight. This means that even if technically acceptable methods of range rahabilitation and management are developed, their sociological and institutional feasibility will remain untested.

16. It was known from the outset that TGLP could only be implemented gradually and would have to be adapted continuously to changing circumstances and attitudes. The first five years of the policy have brought few of the changes envisaged for the communal areas. Such official efforts as have been made to institute reforms in range and livestock management have been largely unsuccessful to date. Recognition of this fact, sharpened by the Sandford report "Keeping an Eye on TGLP", has produced a widespread concern in Government about the present lack of effectiveness and direction of what has come to be known as "communal area TGLP".

17. Ideas on this subject often diverge sharply. Although there are no clear cut schools of thought there are those who believe, with Hardin, that the "tragedy of the commons" is, in the true Greek sense, a tragedy. Ultimate catastrophe is inherent in the nature of the communal pastures, and no matter which way the victim turns, his fate will sooner or later overtake him. In theory, at least, there are two ways in which the tragedy could be arrested. One is by extending the commonage, an expedient which was, until recently, and is still, in some areas, considered possible. The other is by reducing stock numbers, which, as we have seen, is anathema. There is another course of action, which does not solve the problem but disposes of it by abolishing the commonage. It is argued by some that the natural and evolutionary course of events is for commonages the world over to be converted either suddenly or gradually into a series of private or corporate commercial holdings, that this is the only way that communal pasture coming under increasing pressure can be saved from utter devastation; and that this is what is intended by TGLP when the White Paper speaks of management of communal grazing areas by "groups of small owners" who "will be permitted to fence".

18. There is an alternative view, defended by some Government officials, which, holds that "the tragedy of the commons" exists only as a convenient theory for avoiding a difficult

problem. Kenya's Swynnerton Plan, which resulted in the adjudication and registration of both arable and grazing lands was based on the "tragedy" theory and proceeded to convert most of Kenya's commonages into private holdings. The results, as regards the pastoral areas, have been carefully monitored and in general have yielded neither the economic nor the ecological benefits intended. There is also the significant fact that commonages have served their inhabitants well for millenia; and there are plenty of cases of drastically overgrazed freehold or leasehold farms, in Botswana and neighbouring states. In Botswana the institution of communal grazing rights is a fundamental aspect of the traditional land tenure system, and has so far served to protect the interests of the poor and the weak far better than the imported system of exclusive land rights. The defenders of communal rights therefore seek for means whereby the traditional system can be strengthened and modified to suit contemporary needs, rather than abandoned altogether.

19. The following section tries to present the case for maintaining the system of communal grazing rights suitably adapted to avert the advancing tragedy.

The Vulnerability of the Commonage

20. Until very recently in historical time commonages all over the world provided much, and often all, of the resources exploited by the local populations. Over the last one or two centuries, or even decades in many places, the economic, social and political importance of communal resources has declined as control over them has passed into the hands of large scale commercial and political interests. Those commonages which have so far escaped seizure by outsiders are usually ravaged from within by expanding human and livestock populations, by the use of new technologies which increase the rate of exploitation without serving the needs of conservation, and by the decline of internal discipline which previously set limits to the rapacity of individuals.

21. Communal pastures in Africa (and even in Britain) seem vulnerable both to attack from the outside and to attrition from within. African communal pastures have very often been consumed, sometimes gradually, but in earlier days suddenly, by encroaching arable farmers. Arable land rights seem usually to overwhelm pastoral rights, as they are more specific and demonstrable. In very large areas of East Africa, Zimbabwe and South Africa for example, cultivators have been encroaching on grazing lands for the past one and a half centuries. The reduced size of the grazing areas, the increased livestock and human populations living on them and the limitations on stock movement imposed by political barriers accelerate the decline of the herbage and the rate of erosion. What appears to administrators to be the damage the pastoralists are inflicting on their environment is then taken as justification for transferring even more land to the cultivators. The pastoralists are

condemned for their "wasteful and destructive land use system", and their communal grazing systems carry much of the blame.

The Conditions for Local Control over Local Resources

22. The underlying cause of the present vulnerability of communal pastures is the weakness, almost everywhere in the world, as well as in Botswana, of local control over local resources. The key to the management of a commonage is that the people who use the communal resource should control the manner and the rate of its exploitation. Five conditions are necessary for this to become possible.

23. Firstly, the community itself should be sufficiently cohesive for joint decision making, rule enforcement and mutual surveillance to be feasible. This normally implies that the community should be small enough that its members know one another by sight and repute and live close enough together to meet and co-operate frequently. If the community is too spread out, or contains many recent immigrants identification of intruders and concerted action against them, and identification and restraint of offenders within the community, becomes difficult or impossible.

24. The scale of the community is therefore crucial to the success of commonage management. If it is too large it becomes diffuse and incapable of the close co-operation among members without which all forms of management fail. If it is too small it is liable to be weak in relation to its neighbours and will probably be swamped, as many minorities in Botswana and elsewhere have found to their cost.

25. Secondly, the distribution of the communal resources should not be so wide that the local community is unable to keep them under close watch. The claims of communities to specific areas of commonage have often proved weak because the areas are large and lacking in clearly defined boundaries. In many of Africa's pastoral areas there has been no need until recently to define the exact position of the boundary between territories. With increasing pressure on communal pastures, and the consequent need for better management, however, the delineation of boundaries becomes an essential prerequisite for the development of local responsibility. The limits to the size of an effectively functioning community in charge of its own commonage imposes corresponding limits on the size of the area it can control.

26. In much of Botswana there are no longer any defined areas where members of a specific community may graze. Indeed, most Batswana fear and resist such a development on communal grazing lands, especially when they think areas and boundaries will be established by Government. Some communities believe that TGLP's primary objective is to partition the land and prevent free movement of livestock, and so they reject the policy as a whole. However, there is evidence from several parts of Botswana that grazing

rights in defined areas were traditionally allocated to members of certain descent groups or wards, and that others do not (or did not) graze without permission in those areas. (See Hitchcock, 1980 and Almagor, 1978). We shall return to consider these cases below.

27. This necessary condition for commonage management is, then, that the area of the commonage should not be greater than than which is physically accessible to the members of the community for frequent inspection, and that its boundaries should be known and agreed with neighbouring communities. These requirements make it impossible to conceive of proper management of the vast and undefined areas of communal grazing in Botswana under present conditions.

28. Thirdly, the community must believe that their own communal grazing is a finite resource and that moving onto greener pastures once this one is exhausted is impossible, because, if such pastures exist at all, they are other communities' commonages. And more important than believing this proposition, communities must act on it. This is the basis of all conservation, the realisation that one can no longer exist by means of exploiting one resource to depletion and moving on to the next.

29. Until recently Tswana communities have been highly mobile, travelling over long distances to escape drought, epidemic, and attack, or to find new and more favourable sites for villages and cattle posts. There was also the traditional seasonal migration between villages, lands and cattle posts, which sometimes involved journeys of 50 km or more. The current trend is towards a greater degree of stability and one of the factors contributing to this is the fact that there are no longer any new lands to occupy, other than those which are very remote and expensive to supply with water. Long term settlement is therefore beginning, in some areas, to produce an awareness of the consequences of unrestrained exploitation of communal resources by unlimited numbers of people and livestock.

30. Manifestations of this awareness are appearing, especially in Central District, in the form of drift fences whose ostensible purpose is to separate cattle and standing crops, but which may also serve the conscious, though subsidiary, purpose of separating the cattle and the pastures of one community from those of another.

31. Many people however, still refuse to accept the ultimately unavoidable conclusion that limited resources cannot for long support unlimited demands. The fact that grass grows green each year after rain encourages many herdsmen to continue believing that the herbage is infinitely renewable, varying only with the rain. It is further believed by many Batswana that it rains less now where they are than it used to, but that is still rains well in other places. This is one of the reasons why TGLP, being associated in many peoples' minds with enclosure and restrictions on movement, has aroused widespread apprehension among stockowners, who see freedom of movement as essential to survival - which it probably is.

32. Although there are the beginnings of an acceptance that the communal grazing is finite and that some controls on its exploitation are necessary in theory, there are so far no signs that individual herdsmen or local communities are prepared to take any action themselves to limit stock numbers. Indeed, no public body has yet been prepared to support the idea of stock limitation, except in the broadest theoretical terms.

33. Fourthly, movement of stock between local commonages is essential to cope with the effects of drought, fire and other local disasters. This means that although local communities should control their own specific grazing areas, every effort should be made to facilitate negotiations with other communties for temporary use of their pastures by defined numbers of livestock.

34. This is, in effect, a middle way between the extremes of totally exclusive grazing rights, as on a freehold or leasehold ranch, and unrestricted access of all stock to all grazing lands at any time this is physically possible, which is the system deplored by the antagonists of communal grazing.

35. Fifthly, resources and technical advice for the development of communal grazing areas are necessary to build up local management competence. Most commonages are in need of rehabilitation. Even on a commercial ranch under an experienced manager the improvement of degraded range is a difficult and lengthy task. Under communal management, with the options restricted by the inertia of public opinion, the task will be considerably harder, though not, in principle, impossible.

Experiences with the Reclamation and Management of Botswana's Range

36. When the TGLP was announced in 1975 it was apparently believed by planners that the reclamation of overgrazed and degraded communal range was possible through the use of "very simple methods of management". There is no basis in experience for this belief. Range reclamation or rehabilitation is undoubtedly possible, but it is usually expensive, time consuming, and dependent on tight control of stocking rates, careful regulation of grazing and rest, and sometimes on the judicious use of fire. Always, it seems, decisions on what to do and when have to be taken on the basis of informed judgement, and not according to a prepared schedule.

37. There is very little experience relating to reclamation of commonages. There is some, both in Botswana and on its periphery, relating to fenced farms. The case of freehold farms in Namibia on the western border of Botswana is interesting as the environmental problem inherited by the new generation of farmers there was comparable to that on many of the communal areas in Botswana today, even though the economic and sociological conditions were quite different.

The management of these farms and their methods of range reclamation gave impressive results.

38. Paddocking would seem to be basic to all range management systems in use by commercial ranchers. The 1977 (Botswana) Molopo Farms Survey (Table 1) shows the degree of paddocking on freehold and on leasehold Molopo farms. It is especially interesting that those who have only a 20 year lease found it worthwhile to invest fairly heavily in fencing, suggesting that even over that relatively short period a good number of paddocks is essential for profitable ranching.

Table 1 Paddocks on the Molopo Farms: Freehold and Leasehold

No. of Farms	Average Farm Size (Ha.)	Average Paddocks per Farm	Average Ha. per Paddock
Freehold 28	12,438	22	563
Leasehold 19	15,583	10	1,480
All 47	13,706	16	844

Source: Div. of Land Utilisation, January 1978.

The Range Ecology Section of MOA, who carried out the survey, wrote:

> "An important point which is illustrated by certain farms is the fact that by decreasing the size of paddocks it is possible to carry more cattle without necessarily causing a deterioration in the range condition." (p. 15)

and

> "The advantage of paddocks is most certainly the flexibility they provide." (p. 20)

The Namibian farmers would agree with these propositions.

39. All this may seem far removed from the intractable realities of Botswana's communal grazing areas. We are, however, dealing with a physical environment - soils, rainfall, vegetation, etc - which is, broadly speaking, the same for Molopo farmers, Namibian ranchers and Tswana cattlemen. This environment is fairly unforgiving - a "fragile ecosystem" as many observers have called it. In other words the limits to its tolerance of use and abuse are not very broad. Regardless of the social and political affiliations of its users the pastures of Botswana and its vicinity require increasingly careful management the more intensively they are grazed, and no one is exonerated from this requirement.

40. The commercial ranchers owe much of their success to the fact that management can be centralised and control over

stock numbers and movements can be made by a single man on the spot. This is virtually impossible on a commonage and had led many commentators to assume that leasehold or freehold tenure are the only forms which permit proper range and livestock management. The following section shows that this is not so, and that there are commonages in various parts of the world where stock numbers are controlled, pastures are managed, and that this is done by democratic means.

Communal Grazing Under Local Management

A. The Hebrides of N. W. Scotland

41. It is a long way from Botswana to the Hebrides; their climates are rather different and so are their people; but there are sufficiently interesting parallels to make the case of these islands and their communal grazing system an interesting one in relation to Botswana's "communal area TGLP". The islands depend economically on the export of livestock and labour and until fairly recently it was the former which kept the people in food.

> "At no time that we know of was the cereal production of the Highlands (and islands) as a whole equivalent to the consumption of the inhabitants. Imports of grain were frequent and considerable, and the cost of food brought from more fertile districts was formerly defrayed, as it is now, by the sale of livestock." (Napier, 1884, p. 6)

42. Land in the islands was traditionally held by the chiefs in trust for their people, and allocated to the families of the clan rather as arable land and grazing rights were allocated to wards in Botswana. Families could not be deprived of these rights except by consent of the clan as a whole.

43. In the course of the 18th and 19th centuries the clan system was destroyed and replaced by large land owners whose tenants the clansmen then became. The landowners let out their estates to "tacksmen", who in turn received rent from the small tenants. Tenurial rights to a "croft" normally included a dwelling site on or near a small arable holding, a little private pasture, and access to communal pasture. In some cases there was no limit to the number of stock tenants could graze on the commonage, but in others a quota of livestock grazing rights was allowed each tenant, at the discretion of the tacksman.

44. Although in some areas stocking rates were thus limited, the general picture was one of communal pastures suffering under corporate abuse. A description of this situation was given in the Napier Report of 1884:

> "In former times (the 'township') comprised both arable and pasture lands used in common; the arable land was redistributed at stated periods among the

> tenants, in virtue of regulations indigenous to the country, the mountain pasture being grazed indiscriminately by the livestock of the tenants, with or without limitations on the number allotted to each.
>
> The separate appropriation of the arable lands was, however, only effective between seed time and harvest, for in the winter the fugitive features of individual occupancy were effaced, and the promiscuous herd ranged at large over the naked area of arable and pasture, blended in a common desolation." (p. 17)

Lord Napier may have been the inventor of drift fences[1/], for he recommends that

> "The first condition for the improvement of the township areas is the erection of a substantial and durable fence between the arable grounds of the township and the contiguous hill pasture." (p. 19)

His next proposal is that

> "Rights to grazing lands should be limited to tenants in townships and to others having the right to use the same; and that the amount of stock which each (tenant) should be entitled to pasture should be equitably settled by the proprietor and the constables of the several townships." (p. 19)

45. These methods were to be applied in areas where the traditional methods of stock control had broken down, but in many parts of the Hebrides they were still intact. The traditional means of determining the amount of stock a tenant might graze on the commons was known as "souming". A soum is the pasturage needed for one cow, and depending on locality it may also include a calf, and sometimes a heifer or a steer as well. Each croft in the township has its souming, which determines the number and kind of animals it may graze on the communal pasture. For example, each croft in the township of Elishader in Kilmuir had (in 1948) a souming of one horse, four cows and followers, and fourteen sheep. Soumings are based on the egalitarian principle that each croft in the township has equal rights to the communal grazing, and since that grazing can only support a limited number of livestock, the rights of all should be subject to the same limits.

46. Soumings can be divided, as when one crofter is not using his full quota, while another exceeds his. Then a portion of a souming can be leased by one from the other. In this way the carrying capacity of the commonage is not exceeded

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1/ The term used in Botswana for fences erected by local communities to keep cattle out of the crops during the growing season.

graze them show that the commonage is not inherently unmanageable. They show that even under conditions of heavy grazing pressure systems of indigenous control can continue to operate and, perhaps, to slow the rate of decline in the range. A common factor in all the cases mentioned is that small communities control small grazing areas. The people live close to each other, many are related, and there are strong informal, as well as formal, pressures within the group to urge conformity on its members. The examples therefore strongly endorse the arguments of Hitchcock and Gulbrandsen that communal grazing management is possible only when the scale of operations is small by the contemporary standards of Botswana.

Steps Towards the Management of Communal Grazing

71. This concluding section tries to draw together the arguments and examples so far presented and apply them specifically to the current problems of making TGLP effective in the communal areas. First, it is argued that the approach to communal area development through "privatisation" of communal rights is likely to lead to a situation of uncontrollably escalating inequality, while holding out no reliable prospects for improved range management and conservation. Secondly, some necessary steps towards making communal areas manageable are described.

72. Communal grazing in most of Botswana has become unmanageable. It provides ample evidence for those disposed to believe in the inevitability of the "tragedy of the commons". The consequences of permitting rapidly growing human and livestock populations to graze unrestrainedly over dwindling areas of natural pasture are all too evident. But this does not mean that the only available course of action is to partition the communal grazing areas into a number of group ranches or grazing cells under private and exclusive tenure. There are, in fact, a number of specific objections to this approach.

A. Group Ranches

73. There are no known examples of group ranches in Africa meeting even the basic objectives of a) becoming economically viable, b) limiting stock numbers by means of commercial offtake rather than by transfer back onto the commonage, c) developing an authentic and durable form of group management, d) achieving a method of range management which permits stocking rates the same as or higher than the surrounding commonage, and e) attaining long term stability in group membership and in management methods.[1/]

1/ Clare Oxby (1981) has recently reviewed group ranches in Africa for FAO. The results of this investigation are very discouraging.

The poor record of this type of institution suggests that unless its weaknesses can be diagnosed and remedied, or unless Botswana can be shown to have social or environmental circumstances quite different from other countries which tried group ranches and failed, there is little hope that Botswana will succeed where the others have not.

74. The establishment of group ranches within communal areas is likely to aggravate conditions on the rest of the commonage. If, as predicted, calving rates were to increase and mortality rates fall, a group ranch would soon reach its carrying capacity. As long as cattle themselves remain the favourite form of investment in the communal areas there is no incentive to sell more of them than is necessary for household needs, and it could be expected that the "offtake" from the group ranches would end up, not at the abbatoir, but back on the communal grazing.

75. The group ranch approach to communal area development could proceed in either of two ways: a) each commonage would have one or perhaps several group ranches, whose main purpose would be experimental and for demonstration of new livestock practices, or b) each commonage would gradually be converted almost completely into a set of contiguous group ranches, and all stock owners would belong to one of the groups. There are serious difficulties with either way.

76. If method (a) were adopted it could be expected that the first people to avail themselves of the opportunities and subsidies usually offered by group ranches would be the more enterprising and better established stock owners. If the group ranches were in fact an improvement on traditional stock keeping the effect would be to elevate their members yet further above the economic level of their neighbours on the commonage. Secondly, the group ranches would reduce the amount of grazing left on the commonage for non-members, unless they were distant from the usual grazing grounds - in which case their demonstration effect would be negligible. Thirdly, the "offtake" or overflow from the group ranches could, as mentioned above, increase the pressure on communal grazing. And fourthly, the management methods developed for group ranches are likely to be very difficult to apply on a whole communal grazing area.

77. If method (b) were implemented the first people to join a group ranch would probably obtain the best grazing, and the last people the worst grazing. Since it is likely that the late-joiners would be among the poorer and more socially marginal members of the community this would put them at a further economic disadvantage in relation to early-joiners. The effect would be similar to that of the first alternative of having only a few group ranches, but considerably more serious for the poorer stock owners. It is also probable that the late joiners would be relatively weak in leadership and organisational capacity, and that this would make their group ranches especially prone to management problems. Managerial weakness would be particularly unfortunate in view of the strict controls needed for the regeneration of the overgrazed pastures on these last-established ranches.

A further problem with this approach arises from the fact that group ranch membership would almost certainly have to be voluntary if the process of ranch formation were to be gradual. The later groups would then be residual categories of people thrown together by the necessity of securing the remaining grazing rights, rather than by mutual choice of one another as partners in a cooperative enterprise.

78. If a group of cattle owners are strong enough to run a group ranch successfully why would they be doing it on the commonage rather than in a commercial area? As Sandford says "If it is wrong for one rich individual to appropriate more than his fair share of the communal land it is no less wrong for ten rich men to do so under the guise of being a group" (1980, p. 49).

79. It has been suggested by several researchers and officials that existing associations such as borehole syndicates, drift fencing groups, small stock dipping groups, etc., could be transformed into ranching groups. It is not unknown for single-purpose groups to acquire multi-purpose objectives, for limited-membership groups to become community-inclusive, and for groups with a specific task and a limited lifespan to continue with other tasks once the first is complete. Such transformations occur, but they can seldom be relied upon to endure, unless the objective the group has set itself is essential for survival. Despite enormous financial, logistic, and organisational problems, borehole syndicates, for example, are remarkably resilient, largely because the stakes of the members are very high and the consequences of failure are immediate and drastic. The direct connection between non-cooperation and lack of water is usually sufficient to keep syndicates working. This is not the case where the resource to be managed in common is a tract of land and its vegetation. No direct connection between lack of management of the range, depletion of forage and death of cattle can be observed. Thus, the incentive for individuals to accept painful and onerous restrictions in herd movement and growth is not present.

80. The current enthusiasm for groups tends to overlook the fact that people who associate for one purpose may be reluctant to accept responsibilities which were no part of their original intentions. To expect that groups formed around an interest in boreholes, or keeping cattle out of crops, can be manipulated into range and livestock management groups is wishful thinking. It might work in some instances but it could not form the basis of a policy. Even less could it be expected that everyone living in the communal areas would ultimately become an active member of such a multi-purpose group.

81. In Kenya the transfer of communal land rights to private and exclusive interests has contributed to a massive problem of rural poverty, unemployment and landlessness[1/]. It has

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1/ (Ed.) The author is not, here, referring to the formation of group ranches.

necessitated the establishment of very large scale resettlement schemes in remote parts of the country, and even these, despite their immense cost, touch only the surface of this growing problem.

> "..... the negation of traditional ways of absorbing the landless and the creation of a land market by progressive farmers have made land consolidation and registration a means of increasing the squatter (ie landless) problem" (Mbithi, 1975, p. 8).

The registration of freehold titles to land has not created the problem of landlessness but has considerably aggravated it. Although there may be some improvement in resource management and conservation in certain areas this has taken place at the cost of a widespread and increasing disparity in the income and wealth of those with land and those without.

82. TGLP is committed to avoid this problem. The extreme difficulty of organising economically viable, self-managing groups of very small stock owners in communal areas, combined with the points made above, make anything resembling the Kenyan approach highly contentious in the context of Botswana.

B. Grazing Cells

83. Grazing cells were originally never intended as a means of managing whole communal grazing areas. They were to serve the aims of testing range management methods and of rehabilitation on overgrazed areas, of demonstrating the proven methods to local graziers, and of growing out weaners, the males of which will be marketed and the females returned to the commonage. It was hoped eventually to turn the grazing cells over to local management, but this seems a distant prospect. While the cells may serve useful technical and possibly economic functions they are unlikely to contribute much to the institutional problems posed by the need for communal grazing management.

Creating the Conditions for Mangement

84. In all the examples of range management reviewed in the previous section a common factor was the small scale of both communities and commonages. Hitchcock (1980), Gulbrandsen (1978) and Sandford (1980) all argue strongly that this smallness of scale was the basis of traditional management systems and is a necessary condition for effective management of commonages today.

85. The first step in developing local capacity for commonage management is therefore to bring about the necessary reductions in scale. This is no simple matter because stock owners do not belong to and remain in one locality only. They may live in one place, plough in another and have cattle posts in one or more different places. The owners of stock at one water source may come from a dozen different villages.

It is nevertheless the case that wherever a man takes up his grazing rights he is subject to the authority of the local headman and kgotla. While each local community must bear the primary responsibility for managing its own resources, only the Government can create the conditions necessary for this to come about.

The steps which Government might take are outlined very briefly here. The correct procedure over many of the details are unclear to the author, but if the overall approach to commonage management is considered appropriate and feasible the following proposals could be modified and developed by those responsible for improving the management of communal grazing. The steps set out are specific to the Botswana context but, with adaptations, may also be applicable in other countries.

Step 1: Legislation

86. It would be necessary to provide village communities, as represented by headmen or chiefs' representatives and kgotlas, with exclusive rights to the arable, grazing, timber and water resources in their own areas. Membership of the local community should be determined by the kgotla, but strong guidance may be necessary to prevent exclusion of minority groups or factions. Non-residents with arable or grazing rights in an area should not be deprived. The boundaries of village areas should be determined in discussion and negotiations between the community concerned, its neighbours, the local Land Board, and a specially appointed Government commission. This proposal involves returning much of the control over land rights from Land Boards to tribal authorities and kgotlas. It is therefore politically contentious.

Step 2: Appointment of a Commission

87. Once the legislative basis for transferring control over communal resources to local communities has been prepared, a commission should be appointed by Government to adjudicate and register village areas.

Step 3: Adjudication and Registration

88. This procedure should commence in the proposed First Communal Development Areas, with those communities interested in securing a registered title to their land. This title would imply not only security against encroachment from outside, but restrictions on expansion from within.

89. From this author's limited perspective it seems that the most appropriate "local community" to deal with is the "village" with its headman or chief's representative and kgotla. Even though this community does not normally conceive of having a precisely bounded territory it is

usually possible, in collaboration with neighbouring communities, to negotiate and settle boundaries. The demarcated area should include, as far as possible, the residential area, the arable lands, the grazing areas and the water sources habitually used by the community, and preferably constitute a single block of land, though this will not always be possible. Under these circumstances the commission should attempt to negotiate the consolidation of village areas.

90. The traditional grazing areas, dinaga, are unlikely to provide a suitable basis for adjudication, and the ward system, which was associated with the dinaga, is institutionally too weak now to provide the strong administration needed for communal area management.

91. The "local community" is, as Gulbrandsen points out, a nebulous concept, since people who do not live locally may nevertheless have grazing or ploughing rights there. Also local communities often contain several different ethnic groups, some of whom may be considered to have weaker land rights than others. If access to land rights is to be through membership of a local community it is essential that the process of registration avoids the danger of excluding individuals, households, wards, or even larger groups from access to the land. Since, in practice, it is almost impossible to guarantee that this will not happen, it is necessary to have land and development funds in reserve for such unfortunate persons. Their resettlement, under any circumstances, is likely to be expensive and problematic. Every effort should therefore be made to include all who have recognised rights in an area being adjudicated, to provide all with equal rights, and to provide for the transmission of rights to future generations.

92. Adjudication will be resisted by most stock owners if it seems to cut off their safety routes to better grazing and water when drought strikes. As the Water Point Survey clearly shows the "fall-back" water sources are essential to survival, and these may be distant from the customary grazing grounds. A condition for the acceptance of the idea of exclusive grazing areas is therefore that local communities are still able to negotiate for water and grazing rights in other areas. This they must do at present, in any case, but as people become used to managing and protecting their own pastures and communal water sources it is likely that access by stock from other areas will begin to be restricted, say to so-many head for so-many months, in exchange for reciprocal rights, or payment.

Step 4: Land Use Planning

93. Land adjudication and registration on their own are, of course, insufficient to enable local communities to manage their own resources. Land use planning, carried out jointly by the community and a district planning team, is the next

step. The process might be modelled on the Matsheng experience[1/], though much reduced in scale and cost.

94. A characteristic of many communal grazing areas is the haphazard mixture of abundant pasture with patches of heavy trampling and overgrazing. A more even and productive use of this land becomes essential if the limitations imposed by the adjudication process are to be balanced, or outweighed, by the advantages of proper range management. It then becomes necessary to classify the various veld types available on the commonage, to work out a simple rotation with certain areas closed at certain seasons (as with Maboella in Lesotho), and to improve water availability in underutilised areas. It is to be expected that such a programme would encounter numerous practical difficulties. For a start, cattle are herded in the day and kraaled at night in Lesotho. If this were done in Botswana an immediate shortage of herdboys would impede progress, and night grazing, which is probably even more important than day grazing in hot weather, would be prevented. No immediate solution to the problem of how to confine the animals to a single grazing ground is apparent, though in some of the larger commonages, where there is little natural surface water, a rotation around boreholes or wells might be possible. Fencing is very expensive, though if drift fences can be used to separate arable from grazing land, they could, in principle, be used to separate one grazing area from another.

95. Land use planning must be related to the kind and intensity of use. The thorny problem of stock density on the commonage must eventually be confronted. By defining limits to the commonage and to the number of holders of grazing rights the scene is set for a realisation among stock owners that there are limits to growth, that restraint is essential (in the long run at any rate), and that what pasture they have must be conserved. A question that has always defied answer in Botswana is how to assign individual quotas of grazing rights so that overstocking is avoided, social and economic equity is upheld, and individual progress is possible. The Hebridean townships solved this problem by assigning to each croft a "souming" of equal value, the holders of which are free to lease parts or the whole of their quota to neighbours with more stock than their own souming. It appears that in Botswana the same tradition of equality prevails, giving every tribesman an equal right of access to the communal pasture, though, in contrast to the Hebridean souming, that right has never been defined or limited.

1/ Matsheng is a cluster of Kalahari villages where a comprehensive rural and urban development planning procedure is being evolved jointly by community members and planners.

96. The land use planners, with local authorities and stock owners, would assess the upper and lower limits to the carrying capacity of the village grazing area. The next step is to decide how the rights to graze this number of livestock would be divided among the people.

Step 5: Institutions for Communal Area Management

97. There are at present no local institutions experienced in pasture management and stock control. Some years ago Reynolds (1977) suggested that the local community be given the status of a "company", with its shares corresponding to the carrying capacity of the communal grazing area. In current terms this company would resemble an Agricultural Management Association, except that all community members would be members and share-holders. Each household with grazing rights in the area would be allocated equal shares. The sum total of shares (ie the current carrying capacity) would be reassessed each year at a public meeting, and at the same time those with shares in excess of their current requirements would put the year's lease on their surplus shares up for auction. At the end of that year the shares would revert to their owners.

98. Presumably the kgotla would provide the forum for these decisions and transactions and a sub-committee (called the Grazing Committee?) would deal with registration of shares and their lease, and the administration of the system. The distribution of shares among stock holders for the year would be on permanent public display to encourage mutual surveillance. The institution of the modisa might be revived.

99. This proposal is similar in many ways to the Hebridean system, but has the following differences: a) crofts are physical as well as social units and cannot readily be sub-divided. The numbers of crofts remains roughly constant. Households in Botswana are, however, constantly splitting and amalgamating, with a tendency to proliferate, which would become especially marked if one household could increase its quota by dividing into several units; b) the carrying capacity of the Hebridean pastures remains roughly constant from year to year, and the herbage is not very sensitive to quite large variations in stocking density. Thus the soumings remain more or less constant over long periods. Botswana's climatic variations make the optimal carrying capacity a matter for constant reassessment. The procedure for varying grazing rights annually is therefore bound to be relatively complicated.

100. A predictable difficulty is that in many Tswana communities Basarwa[1/] are not considered to have any real land rights,

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1/ (Ed.) The Basarwa are hunter-gatherers, sometimes known as Bushmen.

though occasionally the right to run a few stock or plough a small field may be granted. It is one of the major weaknesses of these suggestions for land demarcation and registration, for the registration of membership in communities, and for the allocation of rights to grazing and water, that Basarwa could end up far worse off than they are now. The institutional arrangements to prevent this occurring would have to be extremely rigorous and strongly backed by Government and District authorities, and even then there is no guarantee they would be fully effective.

101. Despite these difficulties Reynolds' broad approach has merit. It provides at least a basis for thought about controlling stock numbers in communal areas, though it needs much development and refinement before it becomes practicable.

Step 6: Funding for Commonage Development

102. It is possible and not necessarily immoral to use development funding as an inducement to good management. There is no point in providing funds for piecemeal development in communal areas as very often the construction of one facility restricts future options. For example, if water points are to be opened where none existed before they should be part of an overall plan for communal range management, since haphazard placing will make proper use of the various range types virtually impossible.

103. It should therefore be considered whether the granting of funds for first communal development areas should not be conditional on the community's ability to use and maintain their resources wisely for the long term benefit of all its members. A project which, for instance, results in an increase in the number of livestock kept on the communal grazing, without at the same time raising the carrying capacity of the range proportionately, will shortly defeat itself. Before new water points are installed, therefore, there should be tangible evidence that the local community has the capability to manage and maintain this facility and the pasture which surrounds it. If this condition is not met the new water source merely opens the way for the destruction of another few thousand hectares of Botswana's range lands, and the central problem of communal area management is one step further away from solution

104. The tendency to evade or postpone recognition of unpleasant facts is a fairly general human tendency, both for individuals and communities. In both cases the assistance of a concerned, disinterested and skillful outsider can help. In the development of Botswana's communal grazing areas the assistance of Government is essential, as few, if any, local communities show signs of working out their own solutions to their environmental problems. This assistance can be given firstly by helping to define the limits to expansion, and secondly by furnishing advice and support to well conceived programmes of development planned within those limits.

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LOCAL INSTITUTIONS AND MANAGEMENT OF COMMUNAL RESOURCES
LESSONS FROM AFRICA AND ASIA

by

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The Tragedy of the Commons[1/]

1. The concept of the "tragedy of the commons", popularized by Garrett Hardin in his 1968 article in Science, and endorsed repeatedly over the past decade, has deep historical roots. Yet until relatively recently in the history of mankind common lands provided the vast majority of resources utilised by local people around the globe. In the past two centuries in Europe and the last generation or two in many developing nations, there has been a clear trend toward privatization. The problem of uncontrolled access to communal resources, while debated actively in the 18th century during the enclosure movement in Britain and preceding the 19th century allotment programme in the USA, was clearly articulated a century ago as well by the Napier Commission in its analysis of livestock development and land tenure problems in Scotland. Napier described what happened during the winter when

> The fugitive features of individual occupancy were effaced, and the promiscuous (communal) herd ranged at large over the naked area of arable and pasture, blended in a common desolation.
>
> (Napier in Devitt 1981, 18)

2. In the developing world one early analysis of the problem of communal management was undertaken in 1954 by the Swynnerton Commission in Kenya, which began a call for privatization that still echoes across Africa today:

> Sound agricultural development is dependent on a system of land tenure which will make available to the African Farmer a unit of land, a system of farming whose production will support his family at a level, taking into account prerequisites derived from the farm, comparable with other occupations. He must be provided with such security of tenure through an indefeasible title as will encourage him to invest his labour and profits into the development of his farm and as well enable him to offer it as security against such financial credits as he may wish to secure from such sources as may be open to him.
>
> (Swynnerton in Devitt 1981, 1)

There is, as Devitt has noted, something very persuasive about this argument, particularly to Western ears, and it has been widely accepted among planners, development workers, and politicians around the world (Devitt 1981, 1).

1/ This and the following two sections draw heavily upon The Management of Communal Grazing in Botswana by my colleague Paul Devitt, to whom I am extremely grateful for his ideas and support. /Ed. Paul Devitt's paper referred to has now been issued as ODI Pastoral Network Paper 14d./

Is Privatization Working?

3. However compelling the arguments may be of those who follow Swynnerton and who rightly observe the deplorable state of communally managed grazing and forest reserves in many places, the evidence supporting privatization as a simplistic "cure-all" is less than encouraging. Certainly some private owners have made great successes of their holdings and are today managing them in an economically productive and ecologically sound manner. Boer farmers in South Africa and Namibia, and some of their elite counterparts in Zambia, Zimbabwe, Botswana, Kenya, and other African nations are doing very well financially without destroying the range. Many private and corporate forests in parts of India, Nepal, and Swaziland, and in several highly developed nations of the northern hemisphere have similarly turned considerable profits without producing environmental degradation.

4. At the same time, private ranches taken over by relatively wealthy but untutored tribesmen in Botswana and Kenya are showing extensive degradation, while group ranching efforts have proved dismal both organizationally and environmentally (M. L. Odell 1980, 33 - 50; Oxby 1981). In all of this one pattern is clear: a relatively wealthy few are cornering substantial resources while a very poor majority continues to make little or no progress at all. Those without very large resources at their disposal have a much less enviable record in private management than the very wealthy, heavily subsidized, or rigidly controlled few. As Devitt and Oxby note, the transfer of communal land rights to individual and commercial interests across Africa has exacerbated rural landlessness, poverty, and unemployment. Even massive resettlement and expensive subsidy schemes have only touched the surface of the problems that have resulted. (Devitt 1981, 27 - 29; Oxby 1981).

A Defined Body of People with a Defined Body of Land

5. Recent experience thus indicates that there is no superiority inherent in systems of private as opposed to collective land management. Private management has, naturally enough, proved most successful, in terms of both equity and environment, in such places as Western Europe and North America, where it has had the deepest roots. The issue, therefore, is one of determining the system most suited to the historical, political, social, and ecological foundations of the people and area concerned. The question is less one of private vs. communal management than whether the individual or a clearly defined community has a clearly defined right and authority to manage a clearly defined land resource. Where communities have such rights, authority, and boundaries which are well established, management can operate on an equitable and ecologically sound basis.

Local Management of Community Forests and Grazing

6. Despite increasing evidence that privatization of communal resources has led to neither equity nor resource preservation in the developing world, persuasive arguments still abound that because management and control of usage cannot be concentrated in a single individual, therefore stock numbers cannot be controlled, pastures cannot be managed, and forests cannot be harvested rationally on commonages in less developed countries. Yet the following examples indicate that communal resource management is possible within both a democratic and environmentally sound context.

7. 1. Forest Management in Pre-colonial India In the years preceding the spread of British control over India vast forest reserves were held by feudal princes. While many of these were set aside for the exclusive use of the royal family, many other large areas were scattered across the realm for the use of villages to meet their fuel, fodder, and construction needs.

> In most areas, villagers held customary rights of forest usefruct, "nistar", to satisfy their needs ... Rarely would those holding the land interfere with "nistar" rights.
>
> (Romm et al 1981, 4 - 5)

8. Local customary controls were exercised through traditional leaders under the Panchayat system. For centuries forest reserves were generally well maintained by communities which recognized their dependence on forest resources and the need for controls on their use. Under the British Raj, the powers of the princes were formalized, bureaucratized, and vested in local landlords, "zamindars", whose patterns of exploitation and arbitrary enforcement of traditional socially based sanctions led to increased tension within communities. With independence these controls were relaxed, but with serious consequences:

> ... the government displaced local customary controls and tended to treat "nistar" as a grant rather than an entitlement. Control (by the community) was lost and confrontation between villagers and the Forest Department, the agent of public authority, grew increasingly frequent.
>
> (Romm et al 1981, 4 - 5)

9. This shift from local to state control led, through a complex process, to the ultimate devastation of vast forest reserves across India. Today in Madhya Pradesh, which had the most extensive forests in India, almost 40% of the reserves have been reduced to shrubbery, grassland, and fields in the past two decades. While it must be pointed out that rapidly increased population pressures, political upheaval, and commercial exploitation by

speculators, private interests, and government officers operating irregularly have contributed substantially to the problem of preserving forest resources, it is clear that traditional customary controls of a communal resource that survived for centuries have almost disappeared in a few generations.

10. 2. Grazing Controls in Botswana Among at least two major and one minor tribe in Botswana, and perhaps among many others, traditional grazing management systems have functioned for many years. While these systems have been eroded by recent policies that have undermined the influence of traditional authorities, vestiges have been identified in many areas. Gulbrandsen and Hitchcock have found evidence of grazing managers with influence in defined areas of the open range, whose authority goes back to a system of overseers and grazing areas which were controlled by the chief in consultation with his tribe in the Tswana village council, "Kgotla". (Gulbrandsen 1980, 193 - 194; Hitchcock 1979, 1980, 18.)

11. Under a somewhat different system the Mbanderu Herero of north-western Botswana have placed controls over access to certain grazing areas while maintaining substantial latitude for individual decisions concerning livestock movements. Homesteads and grazing are allowed only where an individual has traditional rights based on blood lines. Furthermore, different pastures are used by different families in different seasons under clearly defined rules. While not particularly effective in preventing overgrazing under today's conditions of heavy pressure on the range, the system survives and has been seen by several observers as providing a foundation upon which modern controls are likely to find a firmer footing than those of alien origin proposed by many planners. (Almagor 1978; Devitt 1981, 24 - 26.)

12. These two examples, which will be analysed in some detail in the following section, are by no means unique historically or geographically. The Sherpas of Nepal long managed their forest resources systematically and democratically as did many of their fellow tribes in the Himalayas and their foothills (Haimendorf 1964). Scottish highland and island communities have ancient pasture management and stock control systems based on democratic principles of community management that persist today (Devitt 1981, 17 - 20). Amidst ecological devastation across Lesotho, tall stands of thatching grass and communal grazing areas dot the hillsides, which are relatively successfully protected, managed, and even being enlarged under local tribal systems based on consensus decision-making. As Devitt observes:

> Grazing regulations ... could not be enforced against the popular will. The fact that they are in such wide use, and are gaining strength in some areas, demonstrates the feeling of the ordinary herd owners that such regulations are wise and beneficial -- as

long as everyone concerned observes them.

(Devitt 1981, 22)

Local Action and Local Institutions in Managing the Commons

13. The above examples indicate the strength and persistence of several traditional systems which have grappled in the past with communal resource management, and even today provide some measure of control over communal resources, despite the tendency of modern developments to undermine them. All contain mechanisms which promote relatively equitable access to the resources by the weaker and poorer members of society and all depend on traditional local institutions. Recent studies examining the factors underlying success in a variety of endeavours to bring about rural development add validity to arguments that traditional local institutions potentially have a very important role to play in the future management of village commons.

14. Among these studies is one carried out by Development Alternatives, Inc. that examined 36 different development projects in 11 different countries around the globe. Overall it concluded that success in terms of increases in small farmers' incomes, agricultural knowledge, self-help capability, and the likelihood of the project becoming self-sustaining were most affected by the local action taken by small farmers to complement development management and resources from outside the community. By itself this factor explained 49% of the variation in overall success rankings. When the components of local action were analysed, community involvement in decision-making and resource commitment in labour and cash were deemed particularly important, together with "the involvement of local organisations" in the project. (DAI 1976, 309 - 318.)

15. In each of the case studies briefly outlined previously, local institutions have placed a key role in resource management of commonages. Quantitative research examining the success of rural development projects for small farmers further highlights the role of these institutions in promoting effective development programmes in general. Given both the overall importance which local institutions can play in development and the experience of some local institutions in managing communal resources in particular, it is appropriate now to ask what sorts of local institutions might be tapped for further development in management of the commons.

16. As the above examples attest, the most effective local institutions appear to be those in small communities where most people know each other, at least by sight, and which allow for community leadership and democratic inputs into local decision-making. Indian forests were under the jurisdiction of local leaders and the village Panchayat. Scottish pastures were managed by local grazing committees

within the structure of township government. Maboella thatching grass areas in Lesotho and grazing areas in Botswana both came under the jurisdiction of local headmen and the village council in which all tribesmen are represented.

17. In examining these local institutions the primary question that must be asked is whether they are up to the growing job at hand. Can they, with appropriate support, take on increased authority in the management of communal resources, or would other institutions do a better job? While such a question requires specialised research appropriate to the particular social, political, and environmental situation of each country or region where communal exploitation of resources goes on, two case studies of local institutions representative of those found throughout the developing world might be useful. The two presented here include the Kgotla system of Botswana, which has counterparts across sub-Saharan Africa, and the Panchayat system of India, which is similar to other institutions found in other parts of Asia. While it is not assumed that the experience of these two institutions will apply across the developing world, the results do challenge popular assumptions underlying the arguments of the "tragedy of the commons", about the morbidity of traditional local institutions, and about the inability of these institutions to manage communal resources effectively.

The Village Kgotla and Grazing Management in Botswana

18. Professor Isaac Schapera, the grandfather of social science research in Botswana, years ago described the activities of Kgotla in the context of tribal administration. His description, confirmed by researchers and field administrators, in most respects is as valid today as it was during the 1930's and '40's when he conducted his baseline studies of the Tswana:

> All matters of public policy are dealt with finally at an assembly open to all the men of the tribe ... Such assemblies are held very frequently, at times almost weekly, and they usually meet early in the morning in the tribal council-place, close to the chief's residence ... Since anybody present is entitled to speak, the tribal assemblies provide a ready means of ascertaining public opinion ... The discussions are characterised by considerable freedom of speech, and, if the occasion seems to call for it, the chief or his advisors may be severely criticised ... Such assemblies are frequently used by the Government as a means of informing the tribes about new legislation and other developments or of inquiring into local disputes ...
>
> Every family-group, ward, village, and section in the tribe has a recognised headman, whose position is

> hereditary. Within his group he has very wide authority. He is responsible for the maintenance of law and order, and adjudicates over disputes between any of his people or involving them as defendants ...
>
> (Schapera 1976, 53)

19. Beyond these basic administrative, consultative, and judicial roles of the Kgotla, the institution once had fiscal, land management, and development functions as well. For example, land allocations, land management decisions, and disputes concerning land rights for residential, ploughing, grazing, and commercial purposes were all administered through Kgotla. Furthermore, as noted above, the Kgotla, through overseers in remote grazing areas, appointed by the chief, placed limits on overgrazing through the consensus-based management of herds. Not only were grazing areas defined and well-understood, but when any area became overcrowded or overutilised, the local overseer would appeal to the relevant headman or chief through the Kgotla for allocation of additional grazing land or movement of some herds out of the area.

20. Although remarkably democratic institutions, it should be noted that Kgotlas have had their limitations. Until relatively recently they provided a forum primarily for male adults, with women seldom being expected or allowed to contribute to proceedings. Furthermore, non-tribesmen and members of servant or minority classes such as the Basarwa (Bushmen) have long been denied representation. In recent years this pattern has begun to change. By Independence women were beginning to attend Kgotla meetings in sizeable numbers and today, while still not participating as fully as the men of the tribe, women are increasingly speaking out - and being heard. Similarly, with Independence, tribal barriers were legally eliminated, those of subordinate status have begun to play a part in local political processes through the Kgotla, and the process of choosing a headman has become more democratic and less determined by blood lines. Nevertheless, full representation of women and minority groups within the Kgotla framework has not yet evolved.

21. While the powers of the Kgotla and presiding chief or headman were considerable, many of these were curtailed during the protectorate period and immediately after Independence. Action by the British and the new Botswana government repealed the entire African Administration Proclamation of 1956, which provided chiefs with legislative and executive authority, through the institution of Kgotla, which they had long held by virtue of Tswana law and custom. (Schapera 1943, 27 - 40; Proctor 1968, 59 - 69.)

22. The general finding of recent research, however, is that today, far from being either moribund or ineffective in development-related matters, the Kgotla, with its headman,

is central to communications and government at the local level. This research includes that carried out by Government and independent researchers including the government's Rural Sociology Unit (1981), Gulbrandsen (1980), Alverson (1978), Vengroff (1972, 1975), Picarda (1977), Wynn (1978), Hope (1980), Hitchcock (1979), Sutherland (n.d.), and Kjaer-Olsen (1978).

23. One study carried out was a survey of the full range of institutions in six villages. This was conducted during 1979 by sociology students of the University College of Botswana under the auspices of the Ministry of Agriculture. The Kgotla emerged as the best understood, most readily accessible, well-attended and effective of all institutions at the village level, as shown in Table 1. The modern Village Development Committee, and other local organisations, ranked far below the Kgotla on virtually every variable studied. Despite the fact that the headmen in some villages were old and uneducated, and occasionally incompetent, Table 2 illustrates that, overall, headmen emerged as the best known and most accessible leaders and the ones most likely and best suited to take charge of local development projects. Other studies by the Rural Sociology Unit in dozens of other villages across Botswana confirm these findings, indicating that the Kgotla and headman command more respect than other local institutions or leaders and are virtually always where people turn for satisfactory resolution of local problems. (RSU 1981; Odell 1980b.)

24. In support of these findings a recent Presidential Commission in Botswana, chaired by the current Vice President of Botswana, L. Seretse, observed the continuing trust that rural people place in their traditional institutions, noting the important role that they play in maintaining the basic fabric of a society:

> The Commission was impressed by the overwhelming weight of popular support for the Tribal Administration ... (and) is concerned about the decline of Botswana customs, tradition and manners which appears to have taken place in recent years ... It recognised that change in society is inevitable and not necessarily undesirable as more people adopt 'modern' ways of living. The answer does not seem to lie in superficial approaches such as sending young people into the villages to tape record traditional songs and dances. Often this has had the reverse effect by alienating the tribesmen. The Commission believes that the only sound way to preserve the nation's culture is to restore the people's faith in their own leaders and traditional society.
>
> (LGSC 1979, 3, 31)

25. One of the main functions of the Kgotla today is its judicial role as the Customary Court which conducts about 85% of all criminal and civil trials in the country. In 1979 there was a total of 203 registered courts operating in Botswana, of which 158 were run by warranted headmen or

TABLE 1 VILLAGE INSTITUTIONS

Institutions	Known to be Present 2/	Actually Present (Villages)	People Attended Meetings	People Attended Frequently	Active or Effective	Overall Scores 3/
Kgotla	100% 300	100% (6 villages)	91% 272	68% 203	75% 224	33
Village Development Committee	85% 254	100% (6 villages)	43% 128	31% 92	41% 124	20
Parent-Teacher Association	73% 219	100% (6 villages)	37% 112	22% 67	29% 87	16
Farmers' Committee	48% 95	67% (4 villages)	12% 24	5% 10	6% 11	7
Botswana Council of Women	73% 145	67% (4 villages)	19% 37	11% 22	27% 53	13
YWCA	76% 38	17% (1 village)	6% 3	4% 2	42% 21	13
Co-op	95% 95	33% (2 villages)	28% 28	19% 19	57% 57	20
Burial Society	45% 45	33% (2 villages)	30% 30	13% 13	30% 30	12
Land Board 1/	91% 272	0	4% 12	0	68% 169	17
District Council 1/	77% 230	0	5% 16	0	27% 53	10
Total Respondents: 300				Maximum Possible Score:		40

Source: Rural Sociology Unit, Traditional and Modern Local Institutions and Their Role in Development, Gaborone: Government Printer, 1981.

Notes:

1/ Land Board and Council were not actually present in the six villages studied, but data are provided for comparative purposes.

2/ Percentages are calculated only on villages where the institutions actually exist. Burial Societies, for example, are found only in two villages (100 respondents), so the proportion knowing of the burial societies is 45% (45 out of 100 possible respondents).

3/ Sum of positive responses in columns 1, 3, 4, and 5 (%), divided by 10.

TABLE 2 VILLAGE LEADERSHIP FACTORS

Leaders	Name Known	Met This Year	Effective or Active	Initiates Projects	Suited to Lead Projects	Overall Score 1/
Headman	100% 300	66% 199	70% 210	36% 107	32% 95	30
Councillor	72% 215	47% 141	51% 154	16% 48	30% 91	22
Agric. Extension Worker	65% 196	67% 200	40% 119	12% 37	6% 19	19
Health Worker	46% 139	57% 172	61% 184	8% 23	2% 6	17
Community Development Worker	39% 117	21% 63	46% 139	29% 88	20% 61	16
Member of Parliament 2/	44% 132	47% 140	31% 93	32% 95	35% 105	19
Total Respondents: 300				Maximum Possible Score:		50

Source: Rural Sociology Unit, Traditional and Modern Local Institutions and Their Role in Development, Gaborone: Government Printer, 1981.

Notes:

1/ Sum of positive responses in columns 1 - 5 (%), divided by 10.

2/ While MPs were not resident in or near most of the villages, these data are provided for comparative purposes.

chiefs, and an additional 45 courts of arbitration with paid but unwarranted headmen presiding. Given statistical data on the number of distinct communities in Botswana, it has been estimated that the number of informal courts operating at least equals those registered with the Commissioner of Customary Courts. This means that there are probably at least 400 - and perhaps as many as 1,000 - Kgotlas in Botswana at which 15,000 - 20,000 disputes are handled annually, witnessed by some 90,000 - 120,000 citizens - a number approximately equal to the total number of families in the nation. Altogether, on any given day in Botswana, a minimum of 500 - 800 people are involved in an estimated 60 - 75 Kgotla meetings. While obviously some people attend these meetings regularly or repeatedly, the number of person-contacts annually is at least 200,000 - 300,000, and could well be double that, an impressive number in a nation of fewer than a million. (Odell 1981, 17.)

26. This crucial importance of the Kgotla to development in Botswana has been identified by Gulbrandsen as he sought institutional means of tackling the problems of overgrazing in communal areas. Gulbrandsen identified the Kgotla as the most suitable local institution to take on the delicate job of organising and managing the commons under current conditions:

> The overall administration of the grazing areas should be divided between the different village Kgotlas ... The Kgotla itself has potential as an overall forum for (managing) the larger grazing areas, made up of numerous zones.
>
> (Gulbrandsen 1978, 52 - 54)

27. Recently a communal area land use planning and development programme in western Botswana has been undertaken. The Kgotla has been identified by local people, district authorities, and some central government agencies as the major forum and decision-making body at the village level. To quote the Kgalagadi District Council Project Memorandum:

> The village Kgotlas, as broadly representative and authoritative local institutions, will be the forums for discussion and agreement upon all land management programmes. Any grazing management system will require the sanction and support of the respective village Kgotlas, and the ongoing support of the Kgotla will be essential to enforcement of local grazing regulations. As such, the Kgotlas will continue to be the major consultative bodies for the project.
>
> (MLGL 1979)

28. These examples of projects which recognise the vital modern role of Kgotla and go beyond routine consultation to assign decision-making authority to the local body are, unfortunately,

still the exception rather than the rule in most rural development activities. Despite the long and deeply rooted history of Kgotla, it too often remains simply a convenient forum in which politicians and civil servants can communicate their own ideas or try to persuade local people to accept plans devised elsewhere.

Village Panchayats and Forest Development in India

29. Where in Botswana, as in many African states, village decisions have long been made by a single chief or headman with the entire tribe as his counsel, in villages in India decisions traditionally were made by a panel of five elders, known as the Panchayat, in consultation with villagers. This system was eroded with the rise of princely states and their legitimisation under the British Raj, and largely replaced by a "zaminder", landlord system. Following Independence this feudal system was in turn replaced with an adapted Panchayat system built upon the ancient foundation, but infused with democratic principles. Whereas the five elders traditionally had represented the more established, wealthier, and powerful segment of the village social structure, the new Panchayat consisted generally of 15 members democratically elected from the village at large and included statutory representation of women and disadvantaged sectors. In Madhya Pradesh, the site of this case study, a Panchayat today typically encompasses 4 - 5 small villages.

30. Recent programmes in Madhya Pradesh to re-establish forest reserves near villages for fuel, fodder, and construction purposes have recognised the critical need to have the full participation and support of local villagers to succeed. If local people see the Panchavans, as the new village forests are known, as incurring costs that outweigh the benefits that will accrue to them, then fences will disappear, trenches will be bridged, saplings will be destroyed by man or beast, and encroachment upon shrinking forest reserves will continue unabated. More precisely, local participation is deemed essential because it can promote the development, protection, and management of village forests, and assist in the equitable distribution of project costs and benefits, and because it aids in local conflict resolution and provides linkages to local and outside people and institutions. While several proposals for developing this participation have been considered, village Panchayats will probably play an important role in the future, although the amount of authority Government will ultimately give them is not known.

31. Panchayats and Village Forestry: Experience to Date While detailed historical information beyond that outlined above on the function of Panchayats in the management of forests in the centuries prior to the British Raj has not been examined for this analysis, a brief review of some recent attempts to involve Panchayats in the development of new forests might be useful. These efforts have taken several

forms which may provide clues as to how Panchayats can be involved in the future. They have included Panchayat involvement in project planning, site selection, Panchayat development, management and protection, and distribution of benefits. Except in the case of distribution of benefits, however, participation to date has been relatively minimal, with the notable exception of a few villages in Madhya Pradesh which have been given major responsibility for all aspects of their projects.

32. Under the pressure of a recent drought emergency that made it imperative to provide cash incomes to villagers in areas of crop failure, the Government of India allocated special "scarcity works" funds to local authorities for labour-intensive public works. The Forest Department took the opportunity to accelerate Panchavan development across Madhya Pradesh. To increase public participation and take an administrative burden off the Department, arrangements were made in some districts for funding to be channelled through Panchayat organisations, rather than directly through the Forest Department. Under these arrangements, several Panchayats had almost complete responsibility for hiring and managing local labour for Panchavan construction, maintenance, and protection. Under nominal Department supervision, village labour teams dug peripheral cattle-proof trenches and pits for trees, planted seedlings, watered young plants, and provided a local watchman to keep out stray livestock and mischief-makers. The hiring, payment, and general management of local work forces was left to the local Panchayat, usually through its chairman. The Forest Department in turn paid the expenses incurred on a receipt-reimbursable basis after inspecting to ensure that work was properly completed. Abuses and mismanagement appear to have been minimal and expansion of this approach is being considered.

33. The equitable distribution of benefits of all community forestry projects, as well as any costs they might impose on any sections of the community, will have a crucial bearing on project participation and long-term success. Those who see costs affecting them unfairly or see benefits that disproportionately favour others are unlikely to support Panchavan projects. Costs can include inconvenience, deprivation of grazing rights, disruption of a water or grass regime, or loss of the opportunity to cultivate land needed for household survival but over which rights may not be secure. Benefits beyond fuel, food, or fodder may include employment opportunities during project development or secondary employment based on plantation produce. Most arrangements relating to project benefits have been left to local Panchayats to sort out. These arrangements generally have focussed on access to grass during the plantations' early years, but are undoubtedly indicative of future solutions to the problem of fuelwood distribution. A variety of approaches have emerged including:

a) Open access on a first-come, first-served basis;

b) Access by permission of the Panchayat chairman;

c) Direct, free distribution by the Panchayat to villagers under criteria laid down by the Panchayat;

d) Sale by the Panchayat to villagers;

e) Forest Department cutting and distribution to villagers;

f) Plantations divided into plots for each household to manage.

34. Each of these alternatives - and there may well be others - has different implications for equity and management and reflects differing social and political forces. The objective here is not to assess or make recommendations on which is most desirable, but to point out several crucial issues:

First, relatively little is still known about the underlying question of distribution, and particularly how disadvantaged groups might be affected.

Second, still less is known about the equitable distribution of costs associated with community forestry.

Third, the experimental diversity implicit in these early efforts will be extremely useful in grappling with equity issues.

Fourth, it is not clear if villagers will have a full opportunity to discuss carefully all such alternatives and select options suitable to their unique situations.

35. One useful suggestion under consideration in Madhya Pradesh is that projects begin only after approved agreements with the Forest Department have been signed by all Panchayat members in order to ensure consultation with females and less advantaged community members who have the most at stake (Romm et al 1981, 30). While equity is obviously desirable in terms of social justice, here the very future of community forestry is at stake, for how all segments of the community perceive project benefits will determine their support of the programme. It is upon that local support that the future forest reserves of the nation depend.

36. The Risk of Elitist Domination If dependent almost exclusively upon local Panchayats for participation, is village forestry subject to domination by elites at the expense of the rural poor? In light of such an issue, two Cabinet commissions have been appointed since Independence to study and make recommendations on the Panchayat system, although concerns have gone far beyond forestry issues to include the whole area of rural development in a democratic context. The Ashok Mehta Committee on Panchayati Raj Institutions noted in 1978:

> ... there has been disappointment with the working of (panchayats) which is traced, in stronger or milder terms, to a number of inadequacies and failures ... (including domination) by economically or socially privileged sections of society ... the emergence of oligarchic forces yielding no benefits to weaker sections ... political factionalism ... corruption, inefficiency, ... - all these have seriously limited the utility of Panchayat Raj for the average villager.
>
> (Mehta 1978, 7)

37. Yet when all the evidence was in, both commissions came down unequivocally in strong support of the institution. Panchayats, they argued, could neither be held responsible for, nor be expected to change in a few short years an authoritarian, hierarchical social system that is rooted in centuries of tradition. Both democracy and rural development would be served, they argued, by devolving real decision-making authority upon Panchayats and providing them with the resources necessary to bring about village level development. Some excerpts from the 1978 report:

> The democratic process cannot just stop with the State level ... The poor suffer from many handicaps, but their asset is their large number. Democratic institutions ... provide the forum for the assertion of this strength ...
>
> The involvement of rural women in the development process has always been regarded as an integral part of the total development of the village community ... The Panchayati Raj has added another dimension to (this) role ...
>
> Part of the disappointment arises from the syndrome that (Panchayats) have not been assigned significant functions and tried continuously and with zest ... Developmental programmes (are) not channelled through them ...

38. Thus the conclusion of the commission's analysis in the context of community forestry is that, while imperfect, Panchayats are the most suitable mechanisms through which development efforts should be channelled, and that through these efforts they can be strengthened and helped to become better able to institutionalise democratic decision-making and management in rural areas. Village forestry not only can benefit from working through Panchayats, but Panchayats can also benefit from the experience gained in managing the complex social and economic issues of equity which village Panchavans put before them. If these general principles are accepted, then the issue that remains is whether Panchayats are administratively capable of meeting the enormous challenge that such programmes provide them.

39. The Administrative Challenge Village Panchayats cover over 97% of the rural population in every corner of Madhya Pradesh (Mehta 1978, 230). All Panchayat members are democratically elected by secret ballot, and at least two places are reserved for women, as well as seats for at least one or more representatives of scheduled tribes or castes, according to their proportion in a village's population. Each of the State's 16,000 Panchayats covers a population of about 5,000 people, or 1,000 families. (Mehta 1978, 203 - 301.)

40. Each Panchayat has a paid officer who maintains a register of vital statistics and land holdings and collects land revenues on behalf of the State. Most Panchayats also have a secretary, watchman, and occasionally additional paid staff to oversee the collection and disbursement of local revenues, record keeping for business and expenses, and minor issues of law and order. Most Panchayats have a bank or post savings account as well as a credit account held by district development authorities. Panchayats, as statutory bodies, have the power to sue and be sued, enter into contracts, and raise local taxes and fees from a variety of sources. Their local revenues averaged Rs. 2,500 in 1972/73 and were estimated recently to be running around Rs. 5,000 during 1980 1/. Supplemental grants and revenues from other sources for locally initiated or State-sponsored development projects brought their total budgets up to about Rs. 19,000 in 1968 and perhaps to Rs. 25,000 during the drought years of 1979/80 when special funds were channelled through them for labour-intensive public works schemes. (Odell 1981, 24 - 25.) While misuse of funds and inefficiencies certainly exist, the Mehta Commission found transgressions neither excessive nor unexpected in relation to most other departments and institutions. Projects satisfactorily handled by Panchayats and seen by recent observers in Madhya Pradesh include not only several dozen well-constructed Panchavans, but schools, minor roads, tank repairs, community halls, and guest houses. Several fish farming projects completely managed by local Panchayats and yielding them annual revenues from between Rs. 3,000 and 10,000 have been documented. Neither Forest Department staff nor senior revenue officials interviewed recently at the district, zonal, and state level saw problems in giving Panchayats management, protection, and fiscal responsibility for community forestry projects, provided the necessary funds were channelled through them during the early years of project development. (Romm et al 1981; Odell 1980a, 25.) Given the enormous constraints under which all rural development activities function in India, it is unlikely that village forestry projects could realistically find any better means of achieving their objective of developing a major programme to provide fuel and fodder to rural Madhya Pradesh with the active participation of the local people.

1/ (Ed.) 10 Rupees = US$1 (approx.).

Conclusions

41. Local institutions vary widely across the globe in their organisational, social, political, historical, and economic forms, as well as in the degree to which they have had or retain responsibility for the management of communal resources. Some, like the Panchayats of India and Nepal, have considerable financial autonomy including the power to raise local revenues and manage substantial funds, while they have few or no judicial functions whatsoever. Others, like the Kgotlas of Botswana or their equivalent in neighbouring African states, exercise significant judicial powers and have jurisdiction over the vast majority of the criminal and civil cases in their countries. Both types of traditional local institutions have in the past had modest roles in the management of communal resources for the public good, but neither has a particularly significant role today. If privatisation of resources has not been the great success that the United States' Allotment, Scotland's Napier, and Kenya's Swynnerton reports had prophesied, neither has communal management been the unmitigated disaster that many have proclaimed.

42. Communal management, as outlined here, can promote a measure of equity that private management, and even state management under circumstances such as those operating in the case of the forests of Madhya Pradesh, cannot always assure. For communal management to succeed, however, it must be provided with policy support appropriate to the task at hand. First, definition of the resource is as important to communal management as it is to privatisation: a clearly defined body of people must have a secure title to a clearly defined area of land. Legislation, supported by appropriate legal instruments such as deeds, and backed up by arbitration commissions where necessary, is generally required to establish such security in most communal areas. In most cases the communities concerned have a clear understanding, based upon traditional usefruct rights, of where boundaries are located and of what constitutes membership in their community, but these will often require clarification, arbitration, and registration before serious consideration can be given to management issues.

43. Second, communities must have the confidence that decisions reached, by consensus or majority rule, will be respected both by their own members and by outside authorities. Communities must be given real authority and allowed to make their own mistakes if they are to learn the hard lessons of communal management. While outside institutions may well provide guidance and support, intervening authority should be used with great restraint and only where serious problems have developed which appear unlikely to be resolved without outside action.

44. Third, while most communities have intuitive concepts of land use planning, evolved over centuries of local experience, they generally require assistance in formalising, rationalising, and strengthening their planning functions

for improved communal land management. Such planning will of necessity be based upon careful analysis of existing land use patterns and local value systems, as well as ecological factors.

45. Finally, on the financial side, communities must have the authority and power to raise local revenues and, where appropriate, be assured of any additional funding required by sound management which is beyond their capacity to provide. Once these basic building blocks are in place it will probably be necessary to provide institutional support upon which a management system can be constructed. When local communities have responsibility for, and authority over their natural resources, they will begin to understand the limits of those resources and develop the capacity to manage them in sound equitable and ecological terms.

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THE DESIGN AND MANAGEMENT OF PASTORAL DEVELOPMENT

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COMMENT ON PASTORAL NETWORK PAPER 12d

(Martin Fowler, "Overgrazing in Swaziland? A Review of the Technical Efficiency of the Swaziland Herd")

by

Lovell Jarvis[1/]

1/ Department of Economics, University of California, Berkeley California 94720, USA.

Lovell Jarvis writes:

1. An issue of some controversy in much of Africa has been whether cattle numbers in traditional herds have exceeded the optimum carrying capacity of pastures and have thus led to lower productivity than could be achieved were stock numbers somehow reduced. This issue has been debated in Swaziland, and a recent interchange between Doran, Low, and Kemp (DLK) (AJAE, 1979) and me (Jarvis)(AJAE, 1980, including reply by DLK) discussed the issue anew (among other issues)1/. DLK asserted that overgrazing was leading to a decline in cattle herd technical coefficients; I argued that the data presented on offtake and extinction rates (to 1975) were not conclusive and that the choice of period was crucial to the results obtained. Under one such choice it appeared that the herd extraction rate had increased rather than decreased in recent years. DLK disagreed.

2. Martin Fowler's study of Swaziland contributes to this debate by providing wider evidence on technical coefficients (calving rate, death rate, and extraction rate) and extends the latter to 1977; this evidence also suggests that livestock productivity has declined. Again, although the average extraction rate achieved in the years 1968 - 1977 shows no statistically significant decline relative to the average rates achieved in the previous two decades, the graphs provided by Fowler suggest that livestock productivity rose gradually from 1947 to 1964-68 (the sharp drop in 1965-66 makes it difficult to determine the peak precisely) and then began a decline. Insofar as livestock numbers rose steadily throughout the period, a reasonable supposition is that overgrazing gradually resulted and/or became more severe causing the productivity decline observed.

1/ Doran, M. H., Low, A. R., and Kemp, R. L. "Cattle as a Store of Wealth in Swaziland: Implications for Livestock Development and Overgrazing in Eastern and Southern Africa." American Journal of Agricultural Economics 61 (1979)41 - 47.

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Low, A. R. C., Kemp, R. L., and Doran, M. H. "Cattle as a Store of Wealth in Swaziland: Reply." American Journal of Agricultural Economics 62 (1980) 614 - 618.

3. Fowler's data are presented directly, and his discussion of them is thoughtful and sensible. I particularly liked his Paragraph 15, which sets out the key problem, and Paragraph 26, which indicates the need to limit administrative controls (if adopted) to those absolutely necessary. Still, to play the Devil's Advocate, I will offer a few cautioning comments and also reflect briefly on where we might go from here.

4. First, the conclusion drawn depends on there being a break in the data sometime in the late 1960's; herd productivity was previously rising and is subsequently falling. A clear understanding of the factors working on Swaziland livestock in recent years is only possible if we know what factors led to the rise in herd productivity as well as to the subsequent decline. This is particularly interesting since Fowler mentions that assertions regarding overgrazing have been made in Swaziland for over 50 years. Were these assertions incorrect? Or did livestock productivity increase despite overgrazing? If the latter, how? And why did this stop?

5. Secondly, although the rainfall data presented show no significant decline over the period, and Fowler believes that the rainfall data utilized are representative of Swaziland conditions as a whole, rainfall patterns in many countries are highly irregular across rather small regions. Some caution in this regard is probably wise in considering the results of this study. A brief look shows no correlation between the rainfall data and the abrupt deterioration in herd technical coefficients in 1965, suggesting that the rainfall data may not be the indicator sought.

6. Third, the cattle herd has expanded rapidly since the late 1950's; is there any corresponding evidence on the range available for pasturing or on forage obtained from special crops or crop residues?

7. Fourth, interesting evidence on the average herd size is presented, showing this to be constant over the period. A constant average herd per individual herder and falling animal productivity imply that average real incomes are falling. Is there corroborating evidence that this is true?

8. Fifth, assuming that herd technical coefficients have been declining as a result of overgrazing and that some reduction and/or control of herd numbers is advisable, what control should be sought and how ought this control to be achieved? Placing controls where they are not needed, or placing the wrong sorts of controls, can do as much damage as not placing controls at all. The history of intervention (even though I am often sympathetic to it) is not very favourable.

9. I believe it essential to understand why the overgrazing occurs before a control system can be designed. Are herders aware of the costs of overgrazing? If so, what do they perceive as means by which the problem could be alleviated

or solved? Is the problem principally a technical issue, or is it a political issue? What would have to be done to achieve a feasible cooperative solution, perhaps on a regional basis? Or is some externally imposed solution preferred? If the latter, how should it be carried out to have optimum productive and social impact?

10. Hopcraft (1980) and Runge (1981)[1/] have discussed some of the reasons why individual herders may not be able to limit total herd numbers to the optimal level unless they are able to establish some agreement among themselves. Both place great emphasis on the complex political-equity issues raised. Hopcraft points out that if stock numbers are to be reduced, it is not clear that all herder's herds should be reduced in equal proportion. A significant reduction in the more numerous smaller herds (assuming that the size distribution is not equal) might drop the smaller herds below a viable economic size. Yet those who own larger herds will surely oppose any greater than proportional reduction in their own herds, and these individuals often have disproportionate political power. Runge stresses the need for information and argues that a cooperative solution is preferred to an administratively imposed control, both because the cooperative solution is more likely to be based on correct information about production technologies and about individual situations, and because the cooperative solution is likely to be more flexible in response to changing circumstances and therefore both more appropriate and more durable. I do not know that these arguments are correct, but they merit close consideration, And they suggest that we still know very little about the situation. Fowler's study takes us one useful step forward, suggesting that overgrazing may be getting more serious in Swaziland. It now seems time to seek additional information and to talk very carefully with Swazi herders. I wouldn't want to study the problem to death before taking some action, but neither do we seem to know enough to proceed very far.

1/ Hopcraft, Peter N. "Economic Institutions and Pastoral Resource Management, Considerations for Development Strategy", in Galaty, John G., Aaranson, Dan, Salzman, Philip C., and Chouinard, Amy (eds.) (1981) The Future of Pastoral Peoples: proceedings of a conference held in Nairobi, Kenya, 4 - 8 August 1981. International Development Research Centre, Ottawa.

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Pastoral Network Paper 15a

January 1983

NEWSLETTER

1 Together with this Newsletter I am sending you three other papers, all of them relating to the Sahel:

15b by Penning de Vries entitled 'The productivity of Sahelian rangelands. A study of soils, vegetations and exploitation of this natural resource'.

15c by Greg Perrier and Paul Craig entitled 'The effects of the "development approach" on the long term establishment of a Grazing Reserve in northern Nigeria'.

15d by Camilla Toulmin entitled'Herders and farmers, or farmer-herders and herder-farmers'?

2. News of network members

Gunnar M Sørbø, of the Department of Social Anthropology at the University of Bergen, Norway joined the Board of Trustees of ILCA in January.

3. Recent/forthcoming pastoral publications

In the last Newsletter (14a paragraph 7) network members were asked whether they appreciated the section of the Newsletter in which recent and forthcoming pastoral publications were listed, and were told that a lack of response on this would be taken as evidence that the service was not appreciated. The response so far has been 8 positive replies! Please fill in the relevant section of the enclosed reply form, and appropriate action will be taken.

4. Future of the network

As a member of ODI's Pastoral Network you have been receiving, free of charge, copies of our Pastoral Network papers, the most recent of which - Series 14 - were dispatched in October 1982. I do not, however, seem to have had any sign from you that you are receiving these papers or wish to continue to do so. If you wish to continue to be a member of the network and to receive the network papers please fill in the enclosed form and return it to me by airmail as soon as possible. If we do not hear from you we shall be obliged to remove your name from the list. However if you feel that you get any benefit from being a member of the network we hope you will continue to be one. Membership of the network is free of charge and involves no obligation on your part or any responsibility for the activities of the network. We hope, however, that you will contribute ideas and papers to it and let us know from time to time whether it is of any use to you. It may be that the person to whom these papers are addressed has now left this address and that the network papers are being received and enjoyed by someone else. If this someone else would like to continue to receive the papers he/she should identify themselves on the enclosed form. (Members who have recently received a reply form from Stephen Sandford can disregard this form.)

5. The effective date of the Newsletter is 31 January 1983.

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Pastoral Network Paper 15b

January 1983

THE PRODUCTIVITY OF SAHELIAN RANGELANDS - A SUMMARY REPORT

by

F W T Penning de Vries[1/]

International concern has been felt about the productivity of the Sahelian Rangelands for a decade. From 1976-80 a major research project , entitled "Production Primaire au Sahel" (PPS) took place in Mali and its results have been published in F W T Penning de Vries and M A Djitaye (Editors) La Productivité des Palurages Sahelians, Centre for Agricultural Publishing and Documentation Wageningen (ISBN 90 220 08061). This substantial book, in French but with a 34 page integral summary in English, substantially advances knowledge on this subject. This present network paper was specially written by one of the main report's editors for the benefit of network members.

[1/] Centre for Agrobiological Research, PO Box 14, Wageningen, Netherlands.

INTRODUCTION TO THIS SUMMARY

0.01 What is the actual productivity of rangelands in the Sahel: in terms of quantity and quality? What is its variation from place to place and from year to year? Can productivity be increased? Is a further increase in the intensity of rangeland exploitation possible? Without overgrazing? What effect will that have on the soil? What kind of solutions to problems of exploitation and overgrazing is feasible, and what kind is not?

0.02 Such questions are discussed on the basis of our interpretation of data gathered by others and ourselves. Much emphasis is placed on the finding that soil fertility, in addition to precipitation, is a key factor in rangeland productivity, because it is the principal cause of the meagre production of forage, and its generally low quality.

0.03 Chapter 1 of the original report describes in general terms the problems of animal husbandry in the Sahel, one of them being low productivity of the natural rangelands. The systems approach, essential in our research of rangeland productivity, is presented in Chapter 2. Chapter 3 introduces the physical and plant ecological environment.

0.04 In Chapter 4 the potential of grassland production is discussed on the basis of the water balance of the soil, the botanical composition of the vegetation and physiological characteristics of plants. This potential level is not attained in the southern Sahel because of a shortage of plant nutrients. This is explained in Chapter 5. Chapter 6 compares many of the findings of the preceding chapters with field observations, and derives generalizations from them.

0.05 This information is used in Chapter 7 to formulate a methodology for surveying rangelands: to indicate quickly their potentialities, their actual conditions and how these may change after modification of the level of exploitation. Suggestions for improvement of the production and utilization of the forage are presented in Chapter 8. These options are discussed in the framework of improvement of the animal productivity in Chapter 9.

0.06 The structure of this summary is the same as that of the original French report, which contains a long summary in English, while its captions of tables and figures are bilingual. A textbook in French and English of a 4 week course on the same subject has been prepared by De Ridder, Stroosnijder and Cisse (Dept. Soil Science and Plant Nutrition, Agricultural University, De Dreyen 3,

Wageningen). The report results from the inter-disciplinary P.P.S. project (Projet Production Primaire au Sahel). The project was executed in Mali and in Wageningen by a large group of researchers from the Agricultural University and the Centre for Agrobiological Research in Wageningen, The Netherlands, and from the Institut d'Economie Rural in Bamako, Mali.

CHAPTER 1 ANIMAL PRODUCTION AND EXPLOITATION OF SAHELIAN RANGELANDS

1.01 The Sahel is one of the very large semi-arid zones of the world. About a quarter of the territory of the countries Chad, Mali, Mauritania, Niger, Senegal and Upper Volta can be characterized as Sahel. About a third of their total population lives in this zone. In these 6 countries there are about 22 million head of cattle, 36 million sheep and goats and 1.7 million camels. Almost all camels and 60-70% of the cattle are kept in the Sahel.

1.02 There are 3 principal forms of animal husbandry in the Sahel:

- Nomadism: the herds and the nomads stay in the Sahara or the northern Sahel all year, continually moving in search of forage and drinking-water.

- Transhumance: herds of cattle, sheep and goats are guided to fresh pastures in the northern Sahel in the rainy season, and return to the south in the dry season to avoid shortage of drinking-water. The annual production of cattle herds is about 12%, which corresponds to only 13 kg of meat per animal. Small ruminants produce annually 3-4 kg of meat per animal; annual herd productivity is about 25%. The transhumance system of husbandry is highly important for the Sahel countries.

- Sedentary animal husbandry: most cultivators in the southern Sahel and in the savannah keep a few animals for milk, draught power and as an investment.

1.03 At least 4 types of problems for production of animals, cattle in particular, can be distinguished:

- the degree of exploitation of herds is low;
- the production per animal is low;
- overgrazing occurs on many pastures;
- little infrastructure is present to support animal production.

Research has not concentrated on any one of these problems directly, but on a problem underlying at least

2 of them: the low production of forage on the rangelands, in terms of quantity and quality.

1.04 It is generally thought that precipitation, more than any other factor, determines plant growth in semi-arid regions. There are many indications of an almost linear relation between annual rainfall and annual productivity of rangelands: an average productivity of above-ground dry matter of 400-500 kg ha^{-1} is found in the northern Sahel (annual precipitation less than 200 mm); in the central part (200-400 mm per year) about 1000 kg ha^{-1}, and 1500 kg ha^{-1} in the south (400-600 mm per year). But the latter value, in particular, is much lower than expected on the basis of water balance research. The observed relation between rainfall and annual production is apparently an indirect one. This subject was investigated here in detail.

1.05 Elaborate descriptive studies of species composition and productivity of Sahelian rangelands have been published. However, the variability of the annual precipitation and vegetation from year to year and from place to place seriously limits the predictive value of these studies. With the research carried out in the P.P.S. project we aimed at understanding and predicting the average actual production and its fluctuations on a basis of knowledge about plant ecology, plant physiology, soil physics and soil chemistry. The principal result of our research is a scientific tool with which one can establish the actual production and the productivity potential more easily and accurately than was possible before. It may be helpful for planning of development projects and for preparing programmes of rangeland research.

CHAPTER 2 RESEARCH METHODS

2.01 In applied agronomic research attempts are often made to determine static and descriptive production functions. But with the exception of very simplified cases, no useful functions based on statistical data and practical research have been produced that have a reasonable generality. The use of dynamic simulation models provides a promising alternative. But our knowledge of basic processes is not yet far enough advanced to tackle questions about productivity of vegetations exclusively with models. That is why the modelling approach and the descriptive approach still have to support and reinforce each other.

2.02 Models are simple representations of systems, where we define a system as a coherent part of the real world. Models are necessarily simplifications of reality. With dynamic models, one imitates aspects of the behaviour in

time of the real world. If formulations of processes in the model are more or less analogous to those of the real world, one speaks of simulation models. To focus P.P.S. research to the most relevant questions, 4 systems of processes related to plant growth were delineated by distinguishing 4 levels of production. At each successive level, production is limited by a new factor. These levels are:

- Production level A: radiation limits plant production. This situation is found in well-managed, irrigated crop systems with ample use of fertilizer.

- Production level B: as for Level A, but the amount of soil water limits production. The water balance of the soil is an important part of any model at this production level.

- Production level C: as for Level B, but the availability of nitrogen from the soil also limits productivity. Crucial variables are the amount of inorganic and organic nitrogen in the soil, and important processes are those affecting the nitrogen balance; transformations in the soil, uptake by plants and fixation.

- Production level D: as for Level B, but the low availability of other elements, particularly phosphorus, reduces growth at some stage.

This order of production levels is followed in the report and in this summary.

2.03 Three successive phases of development of models may be distinguished: preliminary, comprehensive and summary models. Comprehensive models of the carbon balance processes of the plant and of the soil water balance have been used in the study to evaluate quantitatively our knowledge of the processes involved. However, as these models are very complex, summary models were derived from them and presented in full in the original report. Those models are particularly useful for instruction, and to a certain extent also for prediction. Preliminary models of the nitrogen and phosphorus balance processes in the soil are discussed in the report.

CHAPTER 3 GEOGRAPHY OF THE SAHEL AND OF THE EXPERIMENTAL FIELDS

3.01 The term 'Sahel' is employed for the zone receiving between 100 and 600 mm of rainfall annually. It is a band about 400-800 km wide and more than 5000 km long. Most of the research of the P.P.S. project was executed at a ranch 20-35 km east of Niono (14° 30' N, 5° 45' E), close to the dead Delta of the river Niger. Many of the ecological observations were made on a fixed north-south transect, extending from the 100 mm yr^{-1} to the 1100 mm yr^{-1} isohyet.

3.02 Of the meteorological variables, precipitation shows by far the widest variation from place to place and from year to year. The rainy period is limited to 2 months in the north and 4 months in the south, the rest of the year being completely dry. The potential evapotranspiration varies from 4 mm d^{-1} in the rainy season in the south to 6 mm d^{-1} in the dry season in north and south. Average daily temperatures range from about 25 °C to 30 °C. A considerable proportion of the annual precipitation falls at very high intensities: 20-40% in showers exceeding 30 mm, during which the intensity often exceeds 50 mm h^{-1}. The mean annual rainfall in Niono is 581 mm; its standard deviation is 160 mm yr^{-1}. This large variation is typical for the Sahel region.

3.03 Wet and dry years can be characterized as those extreme years that occur only once per 10 years. Our 4 project years in Niono were normal to dry. However, for plant growth studies, the characterization of 'wet' and 'dry' years makes little sense, because the composition and final biomass of the vegetation depends only indirectly on the total amount of rain as Table 1 shows.

Table 1. The total amount of rain received in 4 successive years in Niono, the amount of rain during the growing season and the average amount of biomass of annual pastures at the end of the growing season

year	total rain (mm yr^{-1})	rain in season (mm $season^{-1}$)	biomass (kg ha^{-1})
1976	587	372	2 500
1977	380	327	2 300
1978	453	371	2 000
1979	376	293	1 400

3.04 Three major groups of soils are distinguished: sandy soils, shallow detritic soils and fluviatile soils. These types occupy about 50, 30 and 20% respectively, of the total area of the Sahel. Sandy soils are deep, homogeneous and of eolic origin. Detritic soils have developed on laterite or sandstone. Most of them are loams, heterogeneous and have considerable runoff. Fluviatile soils are deep, clayey soils, or loamy-clayey subsoils covered with a sandy-loamy topsoil.

3.05 The only form of soil erosion is sheet erosion caused by runoff. It is considered to be of little importance. All soils in the Sahel are poor in carbon (organic matter), nitrogen, phosphorus and in other elements. The soils are generally slightly acid to neutral. Most sandy and loamy soils are covered with a crust, which causes 20-40% of the annual precipitation to run off.

3.06 As open grassland vegetation - steppe - is typical for the northern Sahel annual grasses dominate, but some annual dicotyledons may be important. Perennial grasses are rare. Trees generally do not cover more than 5% of the area. Fire occurs infrequently. The spatial distribution of the vegetation can be quite heterogeneous, particularly on a loamy substrate. Relatively humid spots provide a longer growing season and consequently have a more southern vegetation than drier soils that carry a more northern vegetation type.

3.07 The Sahelian zone is traversed by large rivers, such as the Niger and the Senegal. They flood annually huge surfaces. There the annual production can exceed the production of the rainfed rangelands considerably. Its vegetation consists primarily of perennial grasses. In the southern Sahel the savannah replaces the steppe: a vegetation with high perennial grasses, generally burnt every year, and with a considerable tree cover. Agriculture is common.

3.08 On the transect across the Sahel sandy soils dominate in the northern part, and clayey and loamy soils in the southern part. The ranch at Niono is located in the transition zone of steppe to savannah. On the sandy dunes, the grass species Schoenefeldia gracilis, Diheteropogon hagerupii and Cenchrus biflorus dominate. The annual biomass production is 2000-3000 kg ha^{-1}. The tree cover is about 10%. On the loamy soils tree cover is about 25% on average, but irregularly distributed. The herbaceous vegetation consists of the dicotyledons Borreria spp., Blepharis linariifolia and the grasses Elionurus elegans, Schoenefeldia gracilis and Diheteropogon hagerupii, with small spots with the perennial Andropogon gayanus. Its productivity varies from 1000 to 2500 kg ha^{-1}. On the clayey soils, the tree cover is regularly distributed and is about 30%. The

herbaceous layer is dominated by the grasses Loudetia togoensis, Diheteropogon hagerupii, Pennisetum pedicellatum. Its productivity is 2000-3000 kg ha^{-1}.

CHAPTER 4 THE PRODUCTION POTENTIAL OF SAHELIAN RANGELANDS

The Physiological Potential of Grasslands and Crops

4.01 The productivity of the grasslands north of the 200 mm yr^{-1} isohyet is always limited by the availability of water. This chapter gives the information required to characterize the productivity of these rangelands. South of the 400 mm yr^{-1} isohyet on soils with good infiltration; productivity of the vegetation is restricted by the low fertility of the soils. Fertilization will stimulate biomass production up to the level commensurate with water availability; this maximum level (Production level B) is considered in this chapter. But Production level A is to be considered first.

4.02 The growth rate of a closed canopy in the vegetative phase in conditions of Production level A is quite high: from 200 up to 350 kg ha^{-1} d^{-1}. Once a full soil cover is established, the weather is the only variable that determines the growth rate. The yield of vegetation or the crop is then linked directly to the duration of the growth period. Such rates of growth are 3-5 times higher than those under 'normal', sub-optimal Sahel conditions, where also the period of rapid growth lasts only briefly.

4.03 A simple summary model to calculate the rate of growth (GR) of a vegetation is: GR = (GP-ME) x CE. It states that canopy 'net' rate of photosynthesis multiplied with a conversion efficiency (CE) equals the growth rate. 'Net' photosynthesis equals gross photosynthesis (GP) minus the energy required for maintenance of the tissues (ME). The biomass formed is distributed over plant organs in a proportion that changes with the stage of phenological development of the plants.

4.04 Canopy photosynthesis is the sum of the contributions of the individual leaves. Leaf photosynthesis depends on the intensity of incident irradiation and on leaf characteristics. One important distinction between groups of species is based on the mechanism of photosynthesis: so-called C_3 species have about 50% lower maximum rates of leaf photosynthesis than so-called C_4 species. The rate of CO_2 assimilation of a closed canopy of C_4 species in the Sahel is therefore higher than that of C_3 species (about 850 and 600 kg ha^{-1} d^{-1},

respectively). Some of the glucose formed in the photosynthesis process is used for maintenance of the biomass present: about 1-2% per day of the weight of the biomass. The remainder is converted into 'structural biomass', consisting of protein, cellulose, etc. On average about 0.7 kg of vegetative tissue is formed from 1 kg of glucose (=CE).

4.05 Much knowledge of the processes of canopy photosynthesis, respiration, conversion processes and partitioning of assimilates, as well of transpiration, is integrated in the comprehensive simulation model BACROS. The degree of agreement between experimentally obtained data of field crops of rice and maize and the simulated data confirms that the model simulates these basic processes well, and that it can be a reference point for the models used in the following sections.

The Botanical Potential of Rangelands

4.06 To determine the availability of forage of rangelands, the species composition has to be considered, as it co-determines forage quantity and quality. Characteristics of species that are important in these respects are described.

4.07 Speed and homogeneity of germination determine the relative abundance of a species. The duration of the germination process depends on specific characteristics of the seeds and on the humidity of the upper soil layers. The precipitation distribution in time is therefore an important determinant of the germination pattern in a particular year. In the southern Sahel, up to 100 kg ha^{-1} of seed germinates annually; the amount is 10 or more times smaller in the northern part.

4.08 Many seedlings and germinated seeds die shortly after germination because of too long dry periods between rains. About 1500-15 000 seedlings per square metre is a normal result of germination; or average, about 10% survive. Rapid and homogeneous germination may seem too risky to be a good strategy for survival in the Sahel. However, one often finds that species with such properties dominate the vegetation: Cenchrus biflorus, Diheteropogon hagerupii and Schoenefeldia gracilis. If establishment succeeds, there is a large premium on being the first, while the heterogeneity of soil surface, seed depth and seed hardiness ensures that sufficient viable seeds always remain for new waves of germination, if necessary. Slowly germinating species are quite sure to succeed by avoiding drought periods, but they only dominate the biomass when the vegetation has been disturbed considerably.

4.09 The end of the growth period of annuals is often not determined by water and nutrients, but is strongly influenced by day length. Photoperiodism provides some assurance for completion of the reproductive phase. Two types of responses to day length were found and quantified.

4.10 The uncertainty of the availability of water during the reproductive phase causes the annual production of seed to be highly variable. The seeds make up 5-15% of the total weight of the biomass at maturity. Because the weight of individual seeds is relatively constant, the bigger the plant, the larger the number of grains it produces. In the order of 10% of the seeds produced in a certain year survive and produce seedlings in the next, but this fraction is highly variable. Factors that contribute to loss of viable seed are: grazing before seedfall, predation by ants, termites and birds, fungi, erosion, fire and pre-emergence mortality due to drought. In spite of such losses, the number of seedlings at the beginning of the growing season is usually not a limiting factor for biomass production, except for years with unfavourable distribution of early rains, and even more so in the north than in the south.

4.11 A 'nodal component analysis' of all our observations of vegetation compositions provides a characterization of the extent to which species appear in combinations in the field. It was used to develop a generalized scheme of changes in the vegetation composition that may be expected from changes in precipitation, exploitation intensity, fire, etc.

The Soil Water Balance

Production level B

4.12 The water balance of a soil describes the sum of the processes that contribute to its humidification and its drying: precipitation, runoff, evaporation from the surface and transpiration by plants. Deep drainage is only locally important, and it will not be discussed. Proper knowledge of the soil water balance is required to understand the development of the specific species composition of the natural vegetation and its growth rate during the rainy season.

4.13 Infiltration of water into the soil is a key process. The rate of infiltration into fairly homogeneous soils is usually high initially and tapers off soon. This pattern can be approximated by mathematical equations. Many soils are covered by a thin crust. The permeability of the dry crust is low, but increases after a few minutes of humidification. This phenomenon makes infiltration difficult to quantify from basic soil properties. Therefore measurements were made in the

field with a large rain simulator; single and double infiltration rings gave unsatisfactory results.

4.14 When the rate of precipitation exceeds the rate of infiltration, water ponds or runs off. The larger the shower is, the larger the fraction of it that does not infiltrate. Runoff is negligible on dunes of coarse sand, which consequently lack surface drinking-water for animals. On sandy loams and loamy sands, little runoff occurs on surfaces with a slope of less than 0.5%, but it is 20-50% of the annual precipitation when the slope exceeds 1%. On loamy plains runoff is locally equally important, as demonstrated by the presence of patches of perennials that need a long growing season. The small lakes, originating from runoff, provide a basis for exploitation of the zone. On lateritic formations, runoff is often very large and is a direct source for temporary lakes and local watertables near villages. Clayey or loamy plains that are completely flat often receive water from their surroundings. The infiltration capacity of soils on the ranch with and without vegetation was measured. Bare soils are less permeable. This implies that degraded areas carrying a sparse vegetation have more runoff than others, which can lead in turn to further degradation, reinforcing a negative spiral.

4.15 Evapotranspiration is the sum of evaporation from the soil surface and transpiration by the vegetation. The rate of evapotranspiration ranges from about 2.8 mm d^{-1} for natural rangeland, to about 5.1 mm d^{-1} for a rapidly growing vegetation on a fertilized soil.

4.16 Evaporation during a complete rainy season amounts to 80-90% of the evapotranspiration. Evaporation can occur very fast early in the rainy season: the air is dry, its temperature is high and the irradiation is intense: soil surface temperatures up to 60 °C (dry soils) were observed. Combination of model and measurements leads to a formula to quantify the rate of evaporation which is valid for most soils. Presence of vegetation reduces evaporation considerably.

4.17 Transpiration may be computed as the difference between the observed value of evapotranspiration and the computed value of evaporation. The rate of transpiration ranges from 1 mm d^{-1} (natural rangeland) to 4 mm d^{-1} (fertilized vegetation). The transpiration coefficient determined in this way is about 200 kg of water transpired per kilogram of dry matter formed.

4.18 On the basis of its effect on the water balance, the rainy season can be divided into 4 parts:

- Before frequent showers: until June or July. One or more waves of germination, high rates of evaporation.
- Beginning of frequent showers: July. The earlier this period falls, the longer the period of vegetation growth can be.
- The growing season: August and possibly a part of September. The growth rate of the unfertilized, natural vegetation is in the order of 35-50 kg ha^{-1} d^{-1}.
- End of the growing season: The onset of the brief reproductive phase of annual grasses is generally determined by photoperiod. The more water falls in this period, the more will remain in the soil, to be used only by trees or lost slowly by evaporation.

The Potential Production of Rangelands

4.19 The term potential production is used in the sense of 'growth without nutrient shortage' (Production level B). It concerns therefore natural rangelands in the northern Sahel, and fertilized rangelands in the south.

4.20 The growth pattern of vegetations can be divided into an exponential, a linear and a maturation phase. The exponential phase of growth of vegetations lasts till an aeric mass of about 1000 kg ha^{-1} is reached, when mutual shading of plants becomes important. Under optimal conditions, annuals may grow at a relative rate of 0.5 g g^{-1} d^{-1}. When water limits growth temporarily, the average relative growth rate during the exponential phase was about 0.2 g g^{-1} d^{-1} (on natural pastures with nutrient shortage, the relative growth rate is about 0.1 g g^{-1} d^{-1}). In the northern Sahel the aeric mass of the biomass never exceeds 1000 kg ha^{-1}.

4.21 During the period of linear growth, the daily dry weight increment is more or less constant: 200-250 kg ha^{-1} d^{-1}. Depending upon the amount of water that has infiltrated into the soil, this leads to an aeric mass of biomass of 6000-12 000 kg ha^{-1} in the southern Sahel.

4.22 Of particular interest is the corresponding rate of transpiration. Most rangeland grown plants probably have stomata that optimize their aperture. The transpiration coefficient during the rainy season can then be derived theoretically to be about 210 kg of water transpired per kilogram of above ground dry matter formed in C_4 plants and about 330 kg kg^{-1} in C_3 plants. (The stomatal conductance is below its maximum value when the rate of growth of the vegetation is reduced by nutrient shortage. This indicates that the regulation mechanism of stomata remains also functional under nutrient stress. This confirms that pastures with low growth rates, i.e. unfertilized pastures, utilize water at a lower rate than fertilized pastures.) In models, the constancy of this coefficient is used such that canopy photosynthesis times the coefficient yields transpiration if plenty of soil water is available, but that photosynthesis equals transpiration divided by this coefficient with water shortage.

4.23 Especially for grasses, flowering often marks the beginning of the final growth phase, which lasts for annual grasses 10-20 days. Some species flower prolifically till late in the growing season if conditions remain favourable.

4.24 Roots deserve special attention for the extent to which they explore the soil for water and for nutrients. Rooting patterns of annual grasses in experiments with and without fertilization are surprisingly similar: most of the roots are in the upper 20 cm, though some extend down to 1 m or more. Some roots go as deep as the soil is humid, so that roots can exhaust the total stock of soil water. The minimum rooting density required for efficient absorption of nitrate is roughly the same as that for water, so that nitrate can also be absorbed efficiently. For phosphorus, however, the normal rooting density in the upper layers is insufficient to exploit more than about 50% of the soil volume.

4.25 The comprehensive simulation model ARID CROP, which was developed before the P.P.S. project, was adapted for simulation of vegetation growth in the Sahel. To evaluate its performance, the model was used to simulate different experiments on the ranch where growth was observed. Agreement between simulation and observation is discussed in the original report and is fairly good. For instruction purposes, however, a simple model was derived from ARID CROP. Only a hand calculator is needed to use it. The model does provide realistic values of growth, evaporation, transpiration and runoff.

CHAPTER 5 THE PROCESSES DETERMINING THE ACTUAL PRODUCTIVITY OF SAHELIAN RANGELANDS

Introduction to Production Levels C and D

5.01 The actual productivity of rangelands is generally well below their potential level. It is therefore necessary to study the way in which shortage of plant nutrients reduces the productivity, the degree of shortage of the nutrients in the field and the reasons why there are shortages. One may then ask whether shortages can be relieved, and by what means.

5.02 Application of potassium, calcium, magnesium and sulphur on rangelands did not show any response. Limited experimentation with application of trace-elements, such as molybdenum, copper, cobalt and manganese, to leguminous plants did not show any response either. But application of nitrogen and/or phosphorus stimulated growth considerably.

The Actual Production and the Role of Nitrogen and Phosphorus

5.03 The biomass at flowering and at maturity, and the total amount of nitrogen (N) and of phosphorus (P) absorbed at flowering were investigated. The response curve of the production of a natural vegetation to fertilization with N (in presence of sufficient P) is shown in Fig. 1. The response curve of productivity to N absorbed (Ne), rather than to N applied, goes through the origin and has an upper limit that equals the potential productivity in that situation. The initial slope of the curve is generally equivalent to 1000 kg of dry matter per 5 kg of N absorbed. Quadrant 3 of this figure shows the linear relationship between the amount of N absorbed and the amount of N applied. A similar set of response curves can be drawn for productivity in case of application of P (in presence of sufficient N). The upper asymptote is identical to that of the former graph, the initial slope is about equivalent to 1000 kg biomass per 0.5 kg of P absorbed. The aspects 'soil' and 'vegetation' of these crucial relationships are analyzed below.

5.04 Plant species are not characterized by specific concentrations of N or of P. Such concentrations depend almost completely on the fertility of the soil and plant age. The average concentrations of N and of P in the above ground dry matter of plants change in time. For C_4 grasses, that grow with lower N and P concentrations than legumes and other dicotyledons do, the minimum concentration of N ranges from 1.5% in young plants to about 0.5% in mature plants. At any stage, values up to about 4 times as high are found in plants with ample nutrient supply. Values for concentrations of P are about 10 times lower. Absorption of N after flowering is negligible: the biomass may increase by about 60% between flowering and maturation, but the amount of N absorbed remains constant. The total amount of N absorbed by the vegetation during a growing season is in the order of 10-20 kg ha^{-1}. Even less N is absorbed in the northern part of the Sahel and in overexploited areas, more can be absorbed in the south on relatively favourable spots.

5.05 Results of experiments on different locations showed that the recovery of fertilizer N over 2 years is 60-80% on all soil types. Interestingly, there is also a relationship between the richness of the natural soil and the recovery of fertilizer N: the poorer the unfertilized soil, the better fertilizer recovery the first year after application.

5.06 An experiment in the northern Sahel (150 mm yr^{-1} isohyet) showed no response of biomass or its N and P concentration to fertilization. In fact, those

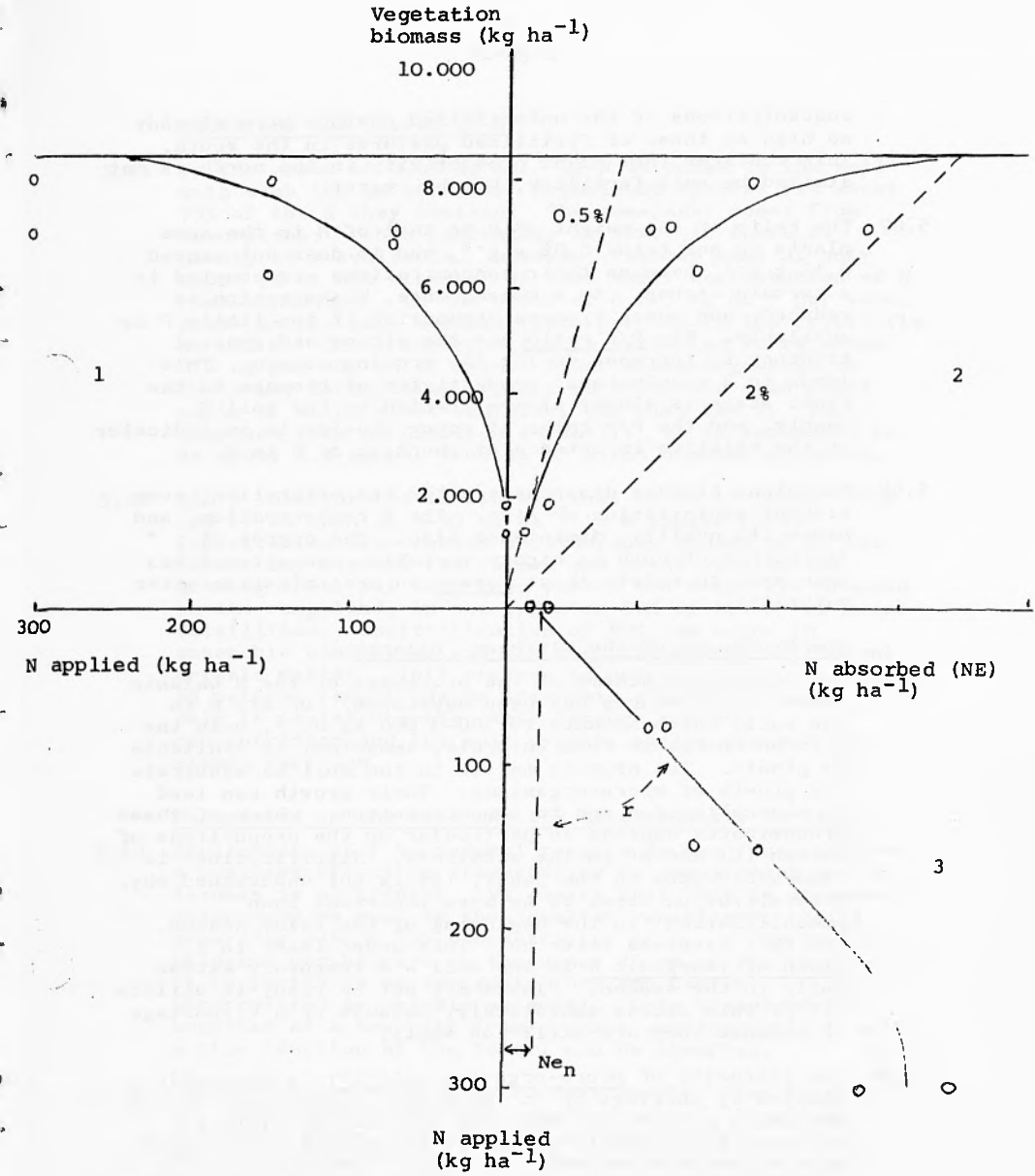

Fig 1. Some relations between the biomass formed, the amount of fertilizer applied and the amount of N absorbed (Ne) under the condition of high availability of P. The trial was on a clay soil on the ranch in 1977, with a vegetation of *Diheteropogon hagerupii*, harvest at flowering. The potential productivity there was 8500 kg ha^{-1} which is indicated by a horizontal line. The dots represent individual observations; the curves were fitted by hand. The minimum (0.5% N) and maximum (2%) levels at flowering are indicated as are the amount of N absorbed without fertilization (Ne_n) and the N recovery (r).

concentrations of the unfertilized pasture were already as high as those of fertilized pastures in the south. This confirms that plant productivity in the north is not limited by soil fertility, but by water.

5.07 The ratio of the weight of P to that of N in the same plants is not below 0.04 g g^{-1}, and it does not exceed 0.15 g g^{-1}, because their concentrations are coupled to a certain degree. As a consequence, N absorption is reduced, and hence biomass production if too little P is available. The P/N ratio has the strong and general tendency to increase during the growing season. This leads to 2 conclusions: productivity of biomass in the final stage is almost always limited by the soil N supply, and the P/N ratio of young grasses is an indicator of the relative importance of shortage of P to N.

5.08 Rangeland biomass disappears after its maturation, even without exploitation or fire. Its N concentration, and hence its quality, diminishes also. The degree of diminution of both is highly variable. An attempt has been made to relate those losses to precipitation after maturity.

The Processes of the Nitrogen Balance

5.09 A quantitative scheme of the processes of the N balance of natural pastures has been developed. Of all N in the soil, which amounts to 300-3 000 kg ha^{-1}, only the N in an inorganic form (nitrate, ammonium) is available to plants. The organic matter in the soil is substrate for growth of micro-organisms. Their growth can lead to mineralization and to immobilization; which of these predominates depends in particular on the proportions of carbon (C) and N in the substrate. Nitrification is remarkably slow in the Sahel; it is not understood why. Mineralization seems to be more important than immobilization in the beginning of the rainy season, but this reverses later on. This order leads to a flush of inorganic N in the soil - a temporary excess early in the season. Plants may not be ready to utilize all of this excess immediately, because of a P shortage or because they are still too small.

5.10 The intensity of micro-organism activity is generally limited by shortage of C. This may be the cause of the temporary excess of N early in the season. This is relieved to a certain extent by decomposition of roots and root exudation later on. About 1000 kg ha^{-1} of C enters the soil each year as organic debris, and the same amount leaves the soil as CO_2. This is a considerable amount compared to the mass of C in the soil, which ranges between 3000 and 15 000 kg ha^{-1}. An imbalance of the C balance processes that lasts for several years will therefore lead to a considerable loss of soil organic matter.

Additions and Losses of N

5.11 In the order of 0.65 kg ha^{-1} of N is added to the soil with each 100 mm of rain. Leguminous species fix about 75% of the N they contain. The remainder comes from absorption; this percentage is lower if there is plenty of N available. However, legumes make up only about 5% of the biomass, so that their contribution of N remains modest: in the order of 0.2-3 kg ha^{-1} per year. Algae on the soil surface (incorporated in the crust) fix aerial N. Their contribution is estimated to be about 0.2 kg per 100 mm of rain. Other micro-organisms in the soil, decomposing organic material and dead plant parts or using plant exudates, can also fix N. Their combined rate of fixation is small: it is estimated to be about 0.2 kg per 1000 kg of plant biomass produced.

5.12 All N incorporated in biomass that burns is lost. This can be as much as 5-30 kg ha^{-1} in a single fire. Exploitation also causes considerable losses of N: the animal may deposit its faeces and urine outside the grazing area, but even when faeces and urine are dropped on the rangeland, in the order of 50% of the N in urine volatilizes. Denitrification of NO_3^- can occur in anaerobic conditions and in the presence of sufficient organic matter. This process is probably unimportant on natural rangelands as anaerobic conditions occur only in isolated spots, and because the NO_3^- concentration and the soil organic-matter content are always very low.

Phosphorus in the Soil and its Accessibility to Plants

5.13 Application of P to natural rangelands was found to have a positive effect on productivity in many cases and on legumes in particular. We expect that this is a common phenomenon on most of the Sahelian rangelands. Soils generally have a low concentration of P: a few hundred kilogram per hectare in the upper 20 cm of the soil. It is partly in an inorganic form and partly incorporated in organic material. Only dissolved P, supplied at a low rate from organic and inorganic P and a tiny fraction of the total, can be absorbed.

5.14 The balance of P in soils is less complex than that of N: there are no processes analogous to N_2 fixation, denitrification, loss by fire or supply by precipitation. On the other hand, the dynamics of the cycling of P in inorganic and organic forms is much less understood. In an equilibrium situation, the same series of processes with the same intensity repeat themselves each year. In such a situation, 4-20% of the total P is in an inorganic form, a fraction which is directly proportional to the productivity. A real equilibrium does not exist at any level of exploitation:

there is always some export of P, leading to a very slow decrease of the soil P content. This reduction is estimated to be about 0.1 kg ha^{-1} yr^{-1} on the Niono ranch. This may seem slow, but it will exhaust the pool of most available P within a few decades.

5.15 Depending upon conditions, vegetations generally absorb P at an annual rate of 0.3-2 kg ha^{-1}. Various methods exist to estimate the capacity of the soil to dissolve P and make it available to roots. However, the most accurate and direct method to measure availability of P from the soil remains the harvesting of the vegetation and the determination of the absorbed P. For absorption by roots, their total length and the absorption per cm are important. The latter depends directly on the rate at which P dissolves and diffuses over a very small distance (fraction of a mm) to the root surface. The degree of exploitation of the soil volume by the root system is probably about 50%. The extent to which mycorhiza increase the volume searched by roots could be considerable.

5.16 The fertilizer triple super phosphate (TSP) and the Malian natural rock phosphate from Tilemsi (PNT) have been applied at different rates. Recovery of TSP-P in the first season after application by the rangeland vegetation was up to 0.5 g g^{-1} at low doses, and decreasing at high doses. The maximum efficiency of PNT-P was only about 0.03 g g^{-1} in the first year after application. Its low recovery can be compensated for by high doses, which will remain effective for many years.

The Actual Productivity in an Equilibrium Situation

5.17 The growth of vegetations is usually limited at the end of the growing season by the availability of N. A first discussion of productivity in the equilibrium situation should therefore concentrate on the equilibrium of the N balance. In an equilibrium, the amount of N that enters the system equals the amount that leaves it. This situation may be hypothetical for any individual year, but it merits attentions as it leads to very useful insights. The annual influx of N equals the amount related to rainfall plus an amount fixed by legumes and micro-organisms. The latter fractions are proportional to the legume biomass and the total biomass, respectively. Even without any exploitation, there is loss of N, particularly due to volatilization. With exploitation, the fraction of the N in the biomass lost annually is much larger. The fraction of the N contained in the biomass at flowering (N_b) that is lost annually by all processes combined is called f; f N_b (in kg ha^{-1} yr^{-1}) equals the amount lost. N_b appears in both the equation for input of N and for loss of N, so

that they can be combined and N_b made explicit:
$N_b = 0.0085 \times Pl / (1.025 \times f - (0.02 \times L + 0.038))$
in which Pl is the precipitation (in mm yr^{-1}) and L the percentage that legumes make up of the biomass. The report gives sets of values of N_b, f and their product at the 500 mm yr^{-1} isohyet.

CHAPTER 6 ACTUAL PRODUCTION OF RANGELANDS IN RELATION TO ENVIRONMENTAL FACTORS AND HUMAN INFLUENCES

Production of Perennial Grasses and Trees

6.01 Production of perennial grasses usually exceeds that of annual species considerably. But this difference in production is not nearly as important as it seems, because cattle make most use of the small amount of regrowth of perennials during the dry season. The large biomass at the end of the growing season is too low in quality: only about 1000 kg ha^{-1} of it can be exploited without overgrazing, and the quality of this amount is just sufficient for maintenance of the animals.

6.02 Another reason for overestimating the importance of perennials is that their annual uptake of N seems to exceed that of annuals. However, a fraction of the N in the above ground biomass stems from a stock of N in the root system, which is transferred to the leaves early in the season and transferred back at the end. Perennial grasses are sensitive to overexploitation because of exhaustion of this stock of N and because of elimination of growing points.

6.03 Trees and perennial grasses survive the dry season by dependence on the little water in the soil that the annual plants have left. This makes perennials particularly sensitive to relatively dry years, when annuals leave little or no water. Like perennial grasses, trees can use water from a large depth on the few places where this occurs. In general, however, trees compete with grasses for most of their water and nutrients. This is the basis of the inverse relation of tree leaf production (as a measure of tree growth) to grass production.

Leguminous Species

6.04 Legumes make up about 5% of the biomass over the whole Sahel, but they tend to be more common on places with much runoff. Legumes are probably not much more important because they are weak competitors with grasses. Vegetation consisting almost exclusively of the legume Zornia glochidiata is common on soils with a high runoff. Such soils are enriched with N. As a result, their

vegetation does not respond to fertilization with N, but strongly to fertilization with P.

Precipitation and Forage Production of Rangelands

6.05 The amount of N in the biomass in an equilibrium situation can be calculated with the equation given above when the fraction of legumes, the annual precipitation and the fraction of N lost are specified. The agreement between the values calculated for the north-south transect and the schematized, observed values is good. The way in which the composition of the vegetation is related to the availability of water is depicted by key species; the direction of change of the composition as a result of the 1969-1973 drought is indicated. The effect of the vegetation composition, through the length of its growing season, on biomass production is also shown in the original report. The effect of yearly variations in rainfall is probably fairly small in the northern Sahel (when expressed in kg ha^{-1}): it is considerable between the 200 and 500 mm yr^{-1} isohyets, and it is relatively small again at higher levels of precipitation.

6.06 The concentration of N in plants is higher the lower the level of precipitation is: the concentration of N at the end of the growing season is higher in the northern part of the Sahel and low in the south, although local variations are large. Fig. 2 is a schema of the relation of production and biomass N concentration to rainfall; Fig. 3 is a schema of the relation of productivity and N concentration.

Substrate and Vegetation

6.07 The term 'substrate' is used as the sum of geomorphological aspects and physical and chemical soil characteristics. The most important of these are the compaction of the surface layer, which leads to formation of a crust, affecting the soil water balance, the seed balance, and soil fertility. The landscape is of prime importance in determining whether there is runoff, influx of water or neither of them. Plant characteristics to be especially considered are the relative rate and homogeneity of germination, the resistance to drought of seedlings and the productivity of the species in terms of biomass and seeds.

6.08 The relation between substrate and vegetation composition in any year is not very strong. The vegetation of a region should thus not be characterized on the basis of observations of a single year. However, the average frequences of species on particular substrates differ clearly. A better picture evolves when species are grouped on the basis of physiological characteristics. In the landscape it is important to distinguish:

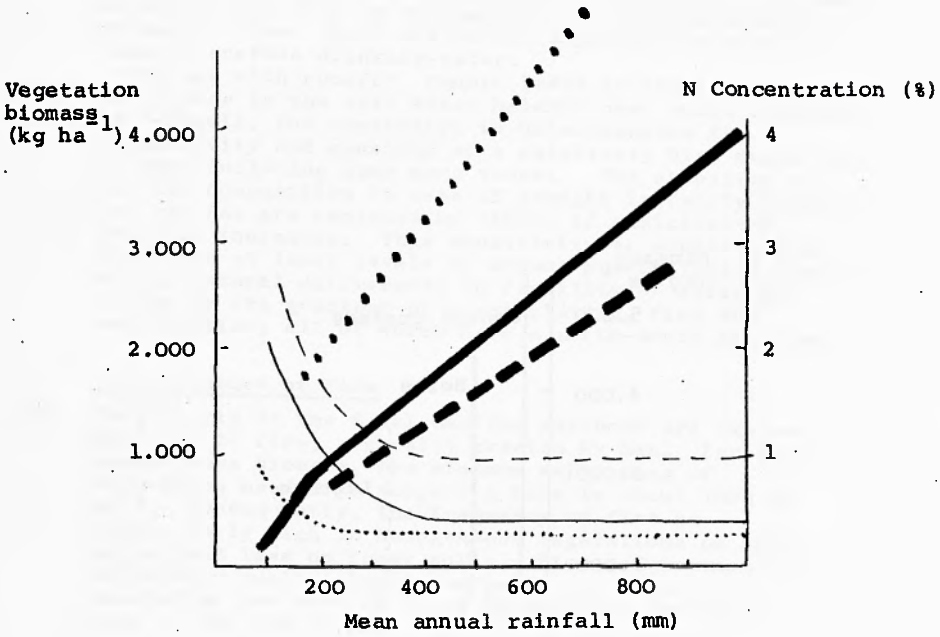

Fig 2. The mean biomass and its N concentration in relation to the mean rainfall, for 3 species groups:
(.....) perennial grasses,
(————) C_4 annuals
(- - - - - -) C_3 annuals;

fat lines: biomass, thin lines: N concentration

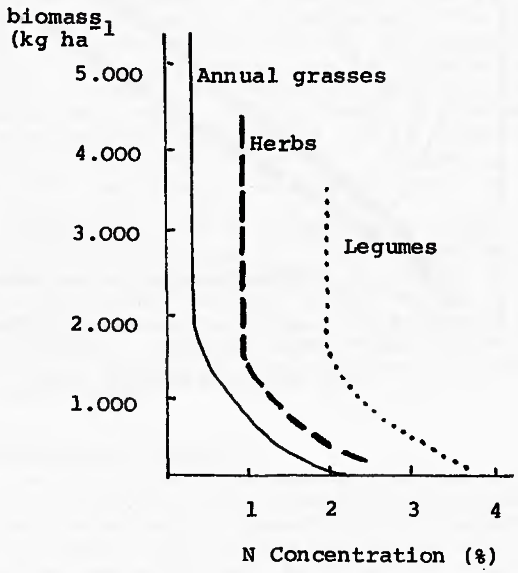

Fig 3. The relation between the biomass at the end of the growing season and N concentration, for 3 species groups.

- Regions where infiltration equals precipitation: the vegetation is quite homogeneous throughout hill tops and valleys, and is often dominated by rapidly germinating grasses. These zones are little exploited because of lack of surface drinking-water.
- Regions with runoff: runoff leads to considerable difference in the soil water balance over short distance. As a result, the vegetation is heterogeneous in productivity and consists of a relatively high number of species including many more trees. The stability in species composition in case of drought is fairly large, but species are replaced by others if exploitation pressure increases. This sensitivity to exploitation increases at lower levels of annual precipitation. Many of the natural differences in fertility of soils are masked by the gradient of precipitation, fire and exploitation, all of which have a north-south gradient.

The Influence of Fire

6.09 Large parts of the Sahel and the savannah are exposed annually to fire, generally created by man. For a dry, homogeneous biomass, the minimum aeric mass of vegetation needed to support a fire is about 1000 kg ha^{-1}. Consequently, the frequency of fire is particularly high in homogeneous vegetations on sandy soils, and less on loamy soils. Fire is uncommon on relatively small, clayey depressions because their vegetation has not yet dried up when the surrounding area is dry and burns.

6.10 For cattle, fire has a positive effect on the productivity and on the botanical composition of savannahs. By volatilizing N and sulphur (S), fire has a negative effect on the fertility of the soil, though it can be positive for the availability of P. The positive effects outweigh the negative effects in the actual animal production system. The positive effects of fire on early regrowth of perennial grasses seems to be that of elimination of shade only. Very important is also that fire makes the new sprouts more accessible to the animals.

Exploitation

6.11 While it is possible to relate total biomass production to the soil and environmental factors without much emphasis on the species that make up the vegetation, this is not so for the use that animals make of it. Morphological features (spines), chemical features (taste, digestibility) and the stage of development of the plants influence what is available to cattle. Soil fertility, through its effect on the N content of plants, affects biomass digestibility because protein content and digestibility are closely correlated. The average

quality of the biomass is often too low for animals at the end of the growing season. Field heterogeneity, which results in a fraction of the biomass having a much higher N concentration and exceeds the minimum quality level, is therefore very important.

6.12 These ideas have been translated into a set of simplified cases for different zones in the Sahel and are presented in the original report. Some conclusions are given here. The amount of forage of a fair quality and available to cattle appears not to increase as much as precipitation when going from north to south. Forage availability reaches its maximum in September in the northern Sahel, and later further south. The most difficult month in the south is May, while it is July and August in the north. The forage situation on the flood plains is quite different: the worst is around January-February, the best in July.

6.13 Exploitation influences the rangelands negatively through biological, physical and chemical processes. The structure of the soil can deteriorate and crust formation is enhanced by elimination of vegetation. These have a negative effect on the water balance. It is estimated that a biomass of about 700, 1600 and 2000 kg ha^{-1} at the end of the growing season is the minimum biomass required to protect the most sensitive soils against further degradation at the 250, 400 and 500 mm yr^{-1} isohyets, respectively.

6.14 The botanical composition of the biomass also changes under exploitation. This is related particularly to the increase in runoff. As a consequence, annuals replace perennials, species with a low and heterogeneous germination pattern dominate and the vegetation becomes heterogeneous. Trees and shrubs are often much stimulated by intensive exploitation because the grass vegetation is then insufficient to exploit fully the soil water.

The Carrying Capacity and Degradation

6.15 Application of the equilibrium situation equation described above leads to the unorthodox view that any increase in the intensity of exploitation results in a lowering of the production of the rangelands and to a lower equilibrium level of rangeland production. To indicate the current carrying capacity of the rangelands and to what extent it changes due to exploitation, it is necessary to determine to what degree the factors water, N and P are limiting productivity in that particular case. For cases where N limits productivity, the notion of an equilibrium situation provides the key to the carrying capacity: the annual input of N into the rangelands equals the amount lost by grazing, fire, volatilization, etc. The amount of biomass that

corresponds with this level of influx of N can be calculated. The carrying capacity can then be found by dividing the amount of biomass with a suitable concentration of N by a standardized daily intake of animals (6.25 kg TLU^{-1} d^{-1} at a maintenance level of the cattle, or a higher level if one aims at growth, TLU = Tropical Livestock Unit). The fraction of the biomass available as forage is that with a concentration of N equal to or exceeding 1.2%.

6.16 For the cases where P limits productivity, calculating the carrying capacity from the fraction of biomass with a concentration of N exceeding 1.2% overestimates its value because animals require about 0.2% of P in forage, while plants often contain lower values. The biomass at the end of the growing season should be used to calculate the carrying capacity. Its value will diminish from year to year as a result of exploitation.

6.17 When water is the limiting factor, the quality of the biomass is high and all can be used. The carrying capacity is then also calculated from the biomass at the end of the growing season. The amount of biomass required to protect the soil is relatively large, and should receive particular attention.

6.18 The method developed has been used to calculate the carrying capacity of pastures in the Sahel for typical situations, to draw conclusions for normal and dry years. It turns out that the carrying capacity is 10-20 ha TLU^{-1} and does not depend on the average annual rainfall up to a certain amount of annual rainfall and increases rapidly at higher precipitation levels. The dependence upon actual precipitation starts at the 400 mm yr^{-1} isohyet in normal years, and at the 250 mm yr^{-1} isohyet in dry years. Such conclusions agree with other reports. Traditional methods for estimating the carrying capacity do not take into account the reduction in biomass due to exploitation. Therefore, they overestimate the carrying capacity considerably if the calculations are based on data of little-exploited areas. In addition, they do not recognize that the carrying capacity may remain more-or-less constant in relatively dry years, because the fraction of good quality forage is then larger.

6.19 The process of degradation of rangelands is continuous at almost any degree of exploitation. On sandy soils, particularly in the north, local degradation leads to barren sand enclosed in a ring of species with a very short growth cycle. On loamy soils, degradation in its final stages leads to basically barren plains with a hard crust, carrying only few microdunes with vegetation. However, a zone should not be labelled 'desert' if shortage of precipitation is not the cause of absence of

vegetation. As there is no indication that the annual precipitation diminishes, degradation in the Sahel should not be called '<u>desertification</u>'. To do so would be to misrepresent the situation, which leads to inadequate countermeasures.

CHAPTER 7 A SURVEY OF THE POSSIBILITIES OF A ZONE

7.01 This chapter of the P.P.S. report gives an indication of how to determine the actual average productivity of rangelands with a minimum of field observations, and how to calculate changes in average productivity that will result from a change in the intensity of exploitation; a manual that explains in detail how to go about doing this is being prepared. Several aspects of productivity are considered: productivity, quality, the fraction of biomass available to animals, the minimum value of this fraction during the year and the availability of drinking-water.

7.02 A first rough evaluation of a large zone can be based on interpretation of data from literature about the physical and biological environment, and on generalized relationships presented in the original P.P.S. report. A detailed evaluation of a large zone requires the same type of data as for the rough evaluation, but in more detail. Aerial photographs are particularly helpful, while the area has to be visited to describe relief and texture of the upper soil layers. Similarly, an impression of the vegetation has to be obtained. A rough evaluation of a limited zone is to be based on similar data as indicated for large zones. In addition, more attention is to be paid to the biomass and its N and P content, on more locations, also during the growing season. The data collected are to be exposed to average data presented in the P.P.S. report, to see to what extent the zone deviates from an average situation. The analysis should be repeated for a dry year.

7.03 For a detailed evaluation of a <u>limited</u> zone, rather than repeat the observations suggested above, it seems more useful to make additional observations, in particular about the frequency of fire, or do some experiments, such as fertilization trials, to establish the availability of N and P from the soil(s).

CHAPTER 8 TECHNICAL OPTIONS TO IMPROVE THE PRIMARY PRODUCTION OF RANGELANDS

Technical Options

8.01 Suggestions evolved during this study on how to improve productivity, quality and utilization of rangelands. In the following sections of this chapter we consider the most obvious economic aspects of the most promising technical options for improvement, excluding sociological and political points of view. The direct cost of inputs and labour for the options is calculated on basis of 1978 prices in Mali, expressed in Franc Malien (FM; 500 FM = 1 US $ *). The economic result is calculated in terms of meat, valued at 600 FM kg^{-1}. The conversion of plant biomass into meat is typically in the order of 200 kg dry biomass per kg fresh meat in traditional animal husbandry systems, but this ratio can be up to 5-10 times more favourable in intensive, modern systems.

Installation of Watering Points

8.02 Two methods need to be distinguished: wells and surface-water storage. The first have the disadvantage that output is not related to the biomass production of rangelands, so that overgrazing is easily induced. Moreover, wells can only be installed where the water-table is not too deep. The amount of water stored in temporary lakes or reservoirs is related to the amount of biomass produced in that year, because both are dependent upon rainfall. This diminishes the risk of overgrazing.

8.03 Cattle usually drink once every 1-3 days, so that the area exploited around a single watering point is 100-1000 km^2. About 50% of the territory of Mali has a water-table that can be tapped by wells. Wells cost in the order of 10 million FM and have an average output of 12 $m^3\ d^{-1}$, which is enough for a herd of about 500 TLU for 9 months per year. Overgrazing can be avoided, unless wells are installed too close. Opening a virgin area with wells to exploitation with cattle is quite profitable.

8.04 As an alternative, rain-water can be stored in open or closed reservoirs. Collection of water could be done in areas with a natural slope. However, in all these cases the cost of intervention appears to be too high to be economic for animal production. Improved maintenance and management of natural water catchments is feasible.

*[Ed. At end 1982 FM = US $1]

Fertilization and Irrigation

8.05 In zones with an annual rainfall of more than 450 mm, fertilization with N and P on rangelands, and also P fertilization on legume monocultures, can be considered. To make good use of the forage, it should be made into hay. In the order of 5000 kg ha^{-1} of a good quality hay can be obtained. However, hay making requires labour at a time that it may also be needed for growing crops on agricultural fields.

8.06 Irrigation of rangeland in the rainy season is hardly productive. Irrigation in the dry season leads to low yields because the soils are poor, and the biomass produced is of a very low quality. Irrigation plus fertilization permit intensive cultivation with some 10 mowings or 2-3 harvests of an annual crop per year. The cost of water is then about 25% of the total production cost, the cost of fertilizer 50%, and that of labour 25%. Legumes provide the same biomass for less fertilizer and are thus cheaper than cereals or grasses; but they grow at a lower rate. Estimated yields and cost per kilogram of forage for production with irrigation and/or fertilization are calculated in the report. It appears that the cost of all improvements seem to be too high to be economical for extensive animal husbandry systems. Fertilization of rangelands is still one of the best alternatives, also because relatively little infrastructure is needed. The use of P fertilizer for good legume crops seems promising, particularly for farmers close to a market. Irrigation without fertilization is always relatively expensive. Irrigation with fertilization for production of forage as a main product or as a by-product might be worthwhile to pursue in an agricultural context.

Stimulation of Leguminous Species

8.07 The number of leguminous species in the Sahel is high, but their contribution to the biomass in natural rangelands remains generally low. To stimulate their growth, the shortage of P in the soil must be eliminated. The expected profit in terms of additional animal intake was calculated, assuming that stimulation of legumes can increase its fraction to 7.5%, or even up to 15%. It shows an increase in animal production of 10-30% at 7.5% and about 100% at the very high level of 15% legumes. However, both levels still do not compensate for the financial investments to be made.

Regeneration of Degraded Soils

8.08 Most of the barren soils in the southern part of the Sahel are loamy soils or lateritic soils. Loamy soils can be regenerated to carry a normal vegetation;

lateritic soils are generally too shallow and are therefore not considered here. Complete protection of the zone leads to regeneration, but only after 5-10 or more years: because the crust on the surface causes much runoff and loss of seeds, the vegetation has difficulty in installing itself. Scratching the surface superficially does not yield good results; complete tillage of the soil gives good results, provided that sufficient seeds are available from natural propagation or sowing to permit a full vegetation to develop. To ensure that the regenerated area does not degrade again soon, all of the surface should be tilled and a biomass should be obtained that equals at least the amount needed for protection of the degradation-sensitive soil. It should be realized that barren, loamy soils can be regenerated, but also that they remain as sensitive to degradation as before. The operation will only be successful when the cause of overgrazing is eliminated as well. If this precaution is not taken, the soil will be barren again soon, and, chemically, in a poorer state than before.

CHAPTER 9 RANGELAND IMPROVEMENT

The Systems of Animal Production in the Sahel

9.01 The productivity of systems of animal production is determined to a large extent by the availability of drinking-water and forage of good quality. The quantity and quality of forage changes in time very much and in different ways on different locations. A first quantification of such aspects has been attempted. This leads to the view of animal production systems that the quality of the forage never poses a problem in nomadic systems, but there is just little of it. Drinking-water is always scarce. For the transhumance system, the quality of the forage is too low for 8 months of the year, and growth of the animals is only possible for 2-3 months. This period could be longer if drinking-water shortages on the migration routes are solved. For sedentary cattle, the forage is for 10 out of 12 months of a very poor quality, and even in the remaining period the quality is lower than that in both other systems. A basic problem for animal production in the Sahel is therefore how to find food for the increasing number of animals, without further degradation of the environment. Where and to what extent technical options to improve rangeland productivity can be of practical use is considered here.

9.02 On the basis of criteria discussed in the report, 4 possible strategies are identified:

- To increase the efficiency of transformation of invested N into N in meat and milk. The actual efficiency of transformation, averaged for cattle and small ruminants, is estimated to be 5%. The absolute maximum efficiency in intensive production systems is about 20%. This is extremely high, and a maximum attainable level of 10% is more likely.
- To minimize the losses of N through volatilization, fire and insects. Volatilization from plants can be avoided by making hay; this yields the highest equilibrium biomass. An alternative way to avoid losses by these processes is to increase grazing by cattle to a high intensity. Reduction of losses of N from the biomass grazed seems only possible by increasing the degree of retention of N by the animals.
- To increase the annual input of N into the system. The fraction of legumes in the biomass cannot be stimulated above a level of 7.5-15%. This makes the potential gain of that option too small. In principle, stimulation of perennial grasses may also increase the annual influx of N, and possibly to the same level as that of legumes if the perennials dominate the vegetation completely. The input of N can also be increased by means of manure and fertilizer.
- To increase the grazed area by installation of wells in the north or elimination of tsetse from infested areas in the south.

9.03 The following comments may be made about those 4 strategies.

- The maximum results that can be achieved by such measures range from 0.3 to 15 kg ha^{-1} yr^{-1} of meat N, but most are less than 1.0 kg ha^{-1} yr^{-1}.
- Lowering the overall intensity of exploitation will be difficult to achieve in practice: although the productivity of the pastures will increase and possibly also that of individual animals, the total animal productivity will probably decrease slightly. The major advantage will thus be a more stable environment.
- Replacing nomadism and transhumance by sedentarism will have a very negative effect on animal productivity. The most promising measure seems to be harvesting of the vegetation at the time of flowering, feeding it and returning the manure to the rangeland. However, this does not seem to be feasible in practice.
- Fire prevention is profitable for the environment, but must be accompanied by other measures to make good quality forage available to animals early.
- To expand the area of grazing is the most direct way to improve availability of forage. But it should be remembered that in doing so the annual production of biomass of unexploited areas will always decrease under exploitation and that a concomitant increase in forage should occur for that part of the year that the herds are away from the new pastures.

- Regeneration of completely degraded rangelands does not seem profitable. Reconstitution of perennial grasses and a tree population will increase animal productivity only little, although the environment will be more resistant to degradation. However, such reconstitutions are only effective at relatively low levels of exploitation, and hence of animal production.
- Introduction of legumes does not seem profitable at the current prices.

9.04 To investigate how much improvement of management of herds can increase productivity, a comparison of animal productivity per hectare, per hour of work and per amount of fossil energy was made. By comparison with livestock production systems in other parts of the world, a transhumance system in Mali was found to have a high productivity per unit landsurface, but a low productivity per labourer. The productivity of this system as such cannot be increased by further intensification, because it is the low and decreasing fertility of the rangeland soils that forms the ultimate limit to the animal production. When fewer persons are involved, the transhumance system could produce its output cheaper, but at the expense of increased unemployment.

9.05 Innovations have been proposed in the P.P.S. report to intensify the system and to raise its secondary productivity. An example is the 'integration and stratification strategy', which implies that young animals are produced in the transhumance system and finished in intensive systems in the southern Sahel or savannah. This strategy seems feasible in the long run, but it will lead to minimalization of prices of young cattle, sheep and goats, to replacing pastoralists by fences, and to further degradation of the environment.

9.06 As an alternative, it is proposed to stimulate agriculture in the southern Sahel and savannah, among others by using fertilizers. By-products that are relatively rich in protein will then become available for supplementary feeding of animals. The only way to combat further degradation is improvement of rangelands and simultaneously assuring pastoralists of a living. Only then does intensification of animal husbandry lead to a substantial increase in production and avoid further degradation of the environment.

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THE EFFECTS OF THE 'DEVELOPMENT APPROACH' ON LONG TERM ESTABLISHMENT OF A GRAZING RESERVE IN NORTHERN NIGERIA

by

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Introduction

1. Recent work by the Livestock Project Unit and the National Animal Production Research Institute (NAPRI) on the Ruma-Kukar-Jangari Grazing Reserve in the Sudan Zone of Northern Nigeria has revealed the importance of the 'development approach' in project planning and implementation. The term 'development approach' includes the project's working assumptions, the project's goals, and the attitude of the project's administrative, technical, and junior staff towards the livestock producers using the grazing reserve. This paper gives a brief developmental history of the reserve, outlines problems created by the development approach adopted on the reserve over the last twenty years, and discusses recent changes made in the development approach aimed at alleviating these problems.

History of the Reserve

2. Pre-Civil War: in 1960 the Nigerian Government redesignated 121,761 hectares, that had previously been two forest reserves located west of Katsina in northern Nigeria, as the Ruma-Kukar-Jangari Grazing Reserve. Grazing and wood cutting had been prohibited in these reserves, but as the area of crop cultivation expanded in the Katsina province at the expense of grazing lands, the government was forced to open them to Fulani livestock producers. In the early sixties the Ministry of Animal and Forest Resources and the Local Native Authority, with the help of the United States Agency for International Development (USAID), established a program that they hoped would ensure the proper development of this grazing reserve (Jones 1963). This program included a deferred-rotational grazing system, the construction of reservoirs for water development, a controlled burning plan that involved the construction of fire breaks, the construction and upgrading of access roads, offices and staff housing, and the collection of fresh milk for processing at a local project dairy. To encourage the cooperation of the local livestock producers a Local Grazing Committee was established, made up of ten influential livestock producers, project staff, and local government officials.

3. To implement the grazing system the reserve was divided into ten ranges. The system was initiated on ranges four through seven, each of which was further divided into four pastures (Awogbade 1981). Each of these four pastures was to be grazed for three months of the year. The stocking rate was controlled by the use of grazing permits and patrolling range guards (Bates et al. 1975).

4. Post Civil War: progress on the project was interrupted in 1967 by the Nigerian Civil War and the resulting government reorganization both of which imposed strains on financial and high level government commitment to the program. The Civil War also led to the early termination in 1968 of USAID involvement in the program before professionally trained Nigerians were able to assume responsibility (Bates et al. 1975). Though the State and local governments continued to maintain staff on the reserve, the level of motivation and interest in the project of these staff was generally low. This is exemplified by the fact that grazing control broke down with grazing permits being sold indiscriminately (Bates et al. 1975) and the fact that the grazing system was never initiated on the remaining six ranges. However, there was no indication of overgrazing in 1968 (de Leeuw 1968).

5. Excessive grazing at Ruma-Kukar-Jangari seems to have appeared after the Sahelian drought in the early seventies which forced large numbers of livestock south into the area. Poorly planned water development allowed excessive livestock to continue grazing and the construction of a tarred highway nearby also made the reserve more attractive to livestock producers (de Leeuw per. comm).

6. Currently range 10 has been designated for development as a government ranch, while the development of two ranges has been taken over by the Livestock Project Unit. On the remaining ranges the original program is nominally being continued though very little development is actually being effected. By 1981 the Local Grazing Committee was still meeting, the project's dairy was still functioning though relying heavily on imported powdered milk, and government staff responsible for the reserve's management were still stationed at the Headquarters. But now, due to overgrazing, the rangeland on the reserve is in a very deteriorated state.

Livestock Project Unit's (LPU) involvement

7. In 1976 the semi-autonomous LPU was established within the Federal Livestock Department of the Federal Ministry of Agriculture to implement the first National Livestock Development Project. This project is jointly funded by the Federal Government of Nigeria, various state governments and the World Bank under loan agreement UNI - 1091. LPU has several components aimed at increasing livestock production through the provision of credit and technical services to producers in the private, public and traditional sectors.

8. Soon after its establishment LPU assumed responsibility for the development of ranges 8 and 9 on the reserve using field staff provided by the Kaduna State Ministry of Animal and Forest Resources. In June 1977 LPU prepared a set of development proposals which recognized the 'very deteriorated' state of the existing range and planned to 'a) begin to revitalize the range with the establishment of areas of strip sown legume and deep ripping of scalded hardpans, b) establish sufficient water points to ensure maximum use is made of available fodder for as long as possible into the dry season and c) construct minimum necessary stock handling and administrative facilities to establish good herd management and maintain control of cattle numbers within each grazing unit'. The proposed development approach and interventions differed little from the earlier attempts by USAID.

9. The initial progress realized from LPU's involvement was limited due to a slow start and a change in management. However, work on staff housing, offices, stores, a cattle dip, four dams and access roads got underway by late 1979. In 1980 a small seed multiplication plot was started and has become established. During the rainy season of 1980 some strip sowing of stylo (Stylosanthes guianensis) and gamba grass (Andropogon gayanus) was carried out and during the rainy season of 1981 a major effort was made to establish stylo and gamba grass by strip sowing. However, erratic rainfall, competition from the weed Cassia tora, and uncontrolled grazing resulted in complete failure of these seedings.

10. At the end of the rainy season in 1980 the reserve staff carried out a human and livestock population survey which was repeated at the end of the following dry season. These surveys gave a good estimate of the stocking rate of the reserve, the number of livestock producers regularly using the reserve, the seasonal grazing use patterns, and helped the project staff identify the locally influential livestock producers.

11. Except for these surveys the project staff's contact with the livestock producers was confined to repeated yet futile attempts to persuade them not to graze the seeded areas. The realization of the total lack of involvement or cooperation by livestock producers with the project and the failure to establish any improved pasture or to control grazing on even the smallest area of the reserve led LPU to review its development approach.

Problems in the Initial Development Approach

12. Working Assumptions: development on the Ruma-Kukar-Jangari Grazing Reserve over the last twenty years was based on two assumptions: 1) provided that the project's professional staff had an adequate understanding of the existing range-livestock production systems on the reserve they could identify and implement interventions in these systems that would result in the achievement of project goals, and 2) that the professional staff had an adequate understanding to enable them to identify and implement such interventions. Regardless of the accuracy of the first assumption the complexities of the numerous ecological, cultural, social, and economic factors involved in grazing development in northern Nigeria prohibited the professional staff from ever acquiring an adequate understanding of the systems involved to allow them to implement appropriate interventions.

13. Working with the erroneous assumption of adequate understanding, the professional staff developed project plans that were often inappropriate. An example is the project's stress of fresh milk sales over the existing practice of sour milk sales (the additional profit from the sale of the butter removed from the sour milk and the fact that it is acceptable to dilute the sour milk with water make the marketing of sour milk much more profitable for the livestock producers). As a result the dairy found it impossible to acquire an adequate supply of fresh milk.

14. Several other inappropriate development activities illustrate the professional staff's inadequate understanding of the existing systems. Reservoirs, constructed to provide livestock water, allowed the livestock population to exceed the carrying capacity of the reserve contributing to overgrazing; internal grazing boundaries created in the ranges had little relationship to local social and political boundaries; and livestock producers holding the title of Sarkin Fulani were expected to convey directives from the project staff to the livestock producers, though the Sarkin Fulani actually have very little influence over other livestock producers (Rottjers 1982).

15. The erroneous assumption of an adequate understanding had at least one further effect. The professional staff had the infrastructure required to implement the project's interventions set in place well before the appropriateness of these interventions was ever determined. Once grazing boundaries were cleared and reservoirs, roads, buildings and fences were constructed it became extremely difficult to alter the project plan once it proved to be inappropriate. This inflexibility along with the inappropriateness of certain aspects of

the project plan placed the field staff in the difficult position of having to enforce project directives that were unacceptable to the livestock producers on the reserve (Awogbade 1981).

16. Goal Conflicts: the project had the following goals 1) to increase both beef and milk production on the reserve, 2) to encourage sedentarization of transhumance livestock producers, 3) to establish a deferred-rotational grazing system so as to maximize the forage resource and 4) to construct the required infrastructure to meet these goals. Basically the goals of the project coincided with those of the livestock producers who also want to realize an increase in livestock production and maintain an adequate forage resource for this production. The livestock producers were pleased with the water development and improved veterinary care provided by the project. However, on several points the goals of the project and those of the livestock producers were in conflict: LPU's surveys have shown that over 90 per cent of the livestock producers on the reserve keep small ruminants; for many livestock producers these constitute a very important economic resource; so while the project concentrated on cattle production, the livestock producers were actually much more interested in a mixed cattle, sheep, and goat production.

17. A further goal conflict resulted from the grazing system imposed. The livestock producers using the reserve minimize their production risk in the unpredictable environment of northern Nigeria by using a seasonal transhumance grazing system and maintaining very flexible intraseasonal grazing orbits. The goal is to place the livestock on the best forage resource available within the limits of logistic, economic, animal health and personal constraints. The four-pasture-deferred-rotational grazing system implemented required livestock to remain on the reserve year-long and to be restricted to a specific pasture for a three month period. The reduction in the livestock producers flexibility resulting from this system made it unacceptable to them and created a major goal conflict. The livestock producers were not interested in establishing sedentary grazing systems.

18. Attitudes Towards Livestock Producers: many of the field personnel involved in range, livestock, and grazing reserve development in Nigeria have an antagonistic attitude towards the Fulani livestock producers. This attitude has resulted in part from the livestock producers failure to cooperate with interventions they feel are inappropriate and in part from the working assumptions of the development personnel.

19. Due to goal conflicts and to the inappropriate nature of parts of project plans, livestock producers have invariably refused to cooperate fully with development efforts on grazing reserves in northern Nigeria. Instead of viewing this behaviour as a logical response to unacceptable demands, development personnel have tended to believe that such behaviour is due to the basic nature of the livestock producers, who are seen as being unreasonable, uncooperative, and generally very difficult to work with. Another factor contributing to this antagonistic attitude is the working assumption, previously discussed, that having an adequate understanding the project staff could manipulate the factors on the reserve to achieve the project's goals. A result of this assumption is that the livestock producers are seen as just one of many factors that can be manipulated. This view excludes the producers from any serious participative role in the development of the reserve, and reinforces the existing image of the livestock producers as an obstructive element on the reserve that has to be removed or changed before any improvement can be realized.

20. On the Ruma-Kukar-Jangari Grazing Reserve this hostile attitude still exists and is exemplified by comments from the project staff such as 'the Fulani are bad people", "you can not trust them', 'they are not willing to cooperate', and 'you will never understand them' (Rottjers, 1982). Such an antagonistic attitude by the staff does not go unnoticed by the livestock producers who, commenting on the staff, say 'those people, they hate us'(Rottjers, 1982). Since the livestock producers are seen as being unreasonable and difficult the development staff has made no serious effort to consult or cooperate with them on project implementation. Though nominally the beneficiaries, the livestock producers have little understanding of the project and see the project as a hindrance to their activities, asking 'What are all those people and all those machines doing here' (Rottjers, 1982).

21. This attitude is exemplified by the meetings of the Local Grazing Committee set up in the early sixties. The committee's initial function was to provide a two-way flow of information and ideas between the project staff and the livestock producers. However, the committee quickly evolved into a forum at which the livestock producers received directives from the project staff (Awogbade, 1981). Dissenting views expressed by any of the ten committee members from the livestock sector were abusively denounced. This situation deteriorated to the point where these ten members were informed that any dissension would lead

to their replacement. The hostile attitude of the project staff prevented any free exchange of information and ideas and destroyed the committee's usefulness.

22. With the wisdom of hindsight it is evident that the development approach initially taken acted as a major obstacle to realizing real improvements in livestock production or range condition on the Ruma-Kukar-Jangari Grazing Reserve. The poor understanding of the existing production system which led to inappropriate project activities, the goal conflicts between the project and the livestock producers and the hostile attitude of many of the project staff to the livestock producers created a situation that was not conducive to sound development. These problems are all interrelated and acted to reinforce each other. The total lack of serious involvement of the livestock producers in the management of the project resulted in the fact that the project was not self-supporting once the initial development effort was reduced, following the beginning of the Civil War. The large uncontrolled influx of livestock into the reserve in the early seventies swept away any gains made by previous efforts.

Alterations to the Development Approach

23. In 1981 the senior staff of LPU involved in the development of the Ruma-Kukar-Jangari Grazing Reserve decided to re-evaluate their development approach. This exercise was conducted in consultation with research staff at NAPRI, a research institute affiliated with Ahmadu Bello University. The broad conclusions accepted by LPU were as follows:-

a) the livestock producers are experienced and competent in animal husbandry and are interested in realizing improvements in their animals and forage resource.

b) the livestock producers on the reserve, and not LPU, are effectively managing the reserve, that is to say their decisions, rather than those of LPU, are determining the utilization of the reserve.

c) for any long-term developments to be realized, the wishes and opinions of the livestock producers need to be known and respected and the livestock producers need to be actively involved in the development of the reserve.

d) the forage resource on the reserve is deteriorating, soil erosion is increasing and the prospects for the reversal of these

trends are poor so long as there is no control over grazing.

24. Since few improvements can be realized until grazing is controlled, LPU made controlling grazing its main goal for the reserve and set about working closely with the livestock producers to determine an appropriate means to accomplish this. LPU accepts that at this time it is not a livestock owning family's interest to rest vegetation, as any benefit to the vegetation is lost through the grazing of the livestock belonging to others. In addition, meetings with the livestock producers revealed that the existing social infrastructure did not allow the livestock producers or any other group to effectively control grazing.

25. It was decided that control of grazing was a two step process. First, a specific group of livestock producers would have to be identified, be given recognized use rights to a specific piece of grazingland, and be given the power to enforce their use rights. Following this, animal numbers and the grazing of the many individually managed herds owned by the livestock producers with use rights would need to be adjusted so as to achieve maximal long-term forage production and increased livestock productivity. To accomplish the first step LPU had to first determine:

a) what would be the most appropriate group of livestock producers to receive use rights.

b) what would be the most appropriate nature and size of the grazingland that this group will control.

c) exactly how are the livestock producers going to effectively enforce their use rights to this grazingland.

d) what is to be done for the livestock producers who do not receive use rights.

26. To answer these questions LPU reviewed the information from the surveys held in 1980-1981, held meetings with the livestock producers, and posted an anthropologist to the reserve for four months to get a more accurate understanding of the problems on the reserve, the opinions of the livestock producers, and the range of appropriate actions LPU could take. The surveys revealed that there are four livestock producers recognized as holding a position of influence (Sarkin Fulani). These people were appointed by and are responsible to the head of the village having the land in which the two ranges (8 and 9) lie. The Sarkin Fulani act as a go-between this Village Head and Fulani livestock producers in the reserve. Each Sarkin Fulani

is responsible for a specific area within ranges 8 and 9. However, since there is a fair amount of mobility by livestock producers between these specific areas the Sarkin Fulani are not considered responsible for specific livestock producers.

27. Once these four Sarkin Fulani were identified a meeting was held at the reserve headquarters with all the Sarkin Fulani and about twenty other influential livestock producers. Following this, additional meetings were held at each Sarkin Fulani's compound so that all livestock producers would have a chance to attend and contribute. The approach taken at the meetings was to ask the livestock producers what they see as their problems and what they see as the solutions.

28. From these meetings it was found that use patterns on the reserve are very complex. Besides the resident livestock producers, who have farms in the area and graze livestock in the reserve each rainy season, there are numerous other livestock producers coming from many different areas who do not have farms in the area and who graze livestock in the reserve on an irregular basis depending on forage and water availability elsewhere. The livestock producers recognized the downward trend in range condition on the reserve and several of them attributed this to overgrazing. However, the resident livestock producers felt unable to force the irregular users to graze their livestock elsewhere. The proposal to give use rights to groups of resident livestock producers and the problems involved with this were discussed. The resident livestock producers were in favour of limiting the use of the reserve to their livestock but felt that they would need a lot of help to organize and enforce this.

29. The initial report of the anthropologist was submitted to LPU in September of 1982 (Rottjers, 1982). The report points out that livestock owning Hausa farmers residing near the reserve will have to be included in the groups having use rights since these farmers commonly graze their livestock in the reserve. The report further states that the Sarkin Fulani are no longer very influential and should not automatically be considered as heads of the groups receiving use rights. The anthropologist felt that more consideration needed to be given to the effects on the irregular users of denying them use of the reserve. The report concluded by stating that the appointment of a Fulani person to act as a go-between between the livestock producers and LPU should be considered as a means of alleviating the very serious problems caused by staff hostility towards the livestock producers.

30. During the 1982-1983 dry season, LPU hopes to initiate four groups on the reserve and provide each group with use rights to one of the areas corresponding to the areas assigned to each Sarkin Fulani by the Village Head. Every resident livestock producer who grazes livestock on the reserve at least some time during the year will be allowed to join one of these groups. It is envisaged that, at least initially, a small number of livestock producers can be elected by each group to form a management committee that can act as a decision making body for the whole group. The members of each group will each be issued a plastic credit card that proves their use rights on their group's part of the reserve and eventually will allow them access to LPU's livestock service centre and small farmer credit. Mounted range guards have already been hired by LPU and are to help the livestock producers enforce their use rights. The staff attitude problem and the project's effect on the irregular users are matters still being considered. LPU's role will be to provide appropriate proposals, technical assistance and access to credit to help the livestock producers to form these groups, control grazing, improve the forage resource, and increase livestock production.

Conclusion

31. There is no assurance that LPU's current efforts will meet with any greater success than the earlier efforts by LPU and others. However, it is felt that by identifying problems in the old development approach and changing the development approach to avoid these obstacles the current efforts have a greater chance of success. By imposing the limitation on development that the livestock producers are to be viewed as the actual managers of the livestock on the reserve it is hoped that more appropriate development options can be identified, that the goals of the project can be kept in line with the goals of the livestock producers and that eventually the antagonism between the staff and livestock producers can be reduced. Instead of working against the livestock producers, requiring them to make changes unacceptable to them, the new development approach aims to work with the livestock producers so that by mutual effort real improvements can be realized on the Ruma-Kukar-Jangari Grazing Reserve. Regardless of the outcome of LPU's current efforts it is now evident that development approach is an important consideration in grazing reserve development in northern Nigeria.

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HERDERS AND FARMERS

OR

FARMER-HERDERS AND HERDER-FARMERS?

by

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The fieldwork on which this paper is based was carried out by Duncan Fulton and Camilla Toulmin from March 1980-82, as part of the research programme of the International Livestock Centre for Africa in Mali. A draft report containing preliminary results and analysis has been written by the two researchers, and is titled: 'An Socio-economic Study of an Agro-pastoral System in Central Mali', September 1982.

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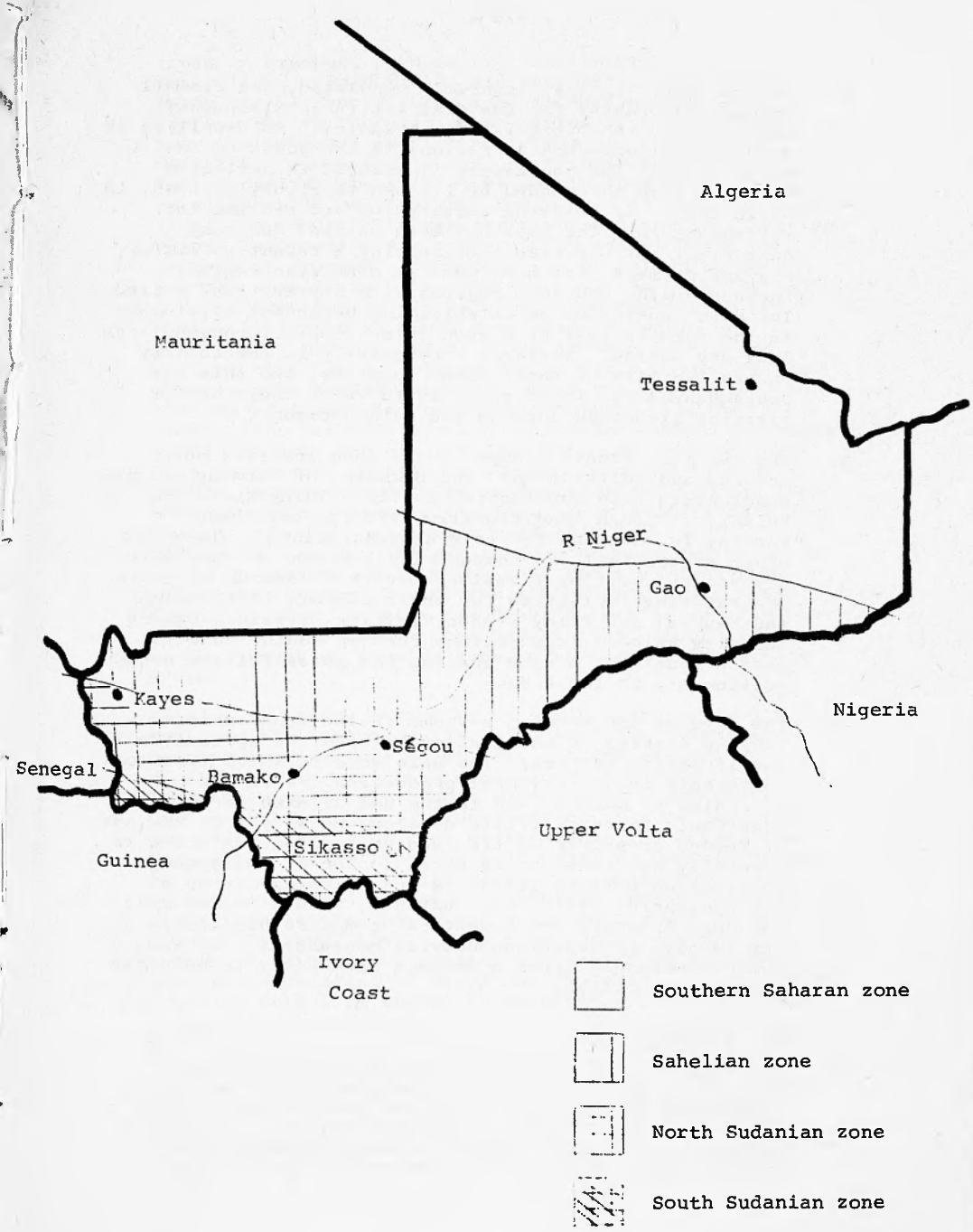
1. The aim of this paper is to describe the recent evolution of cropping patterns in Kala, an agro-pastoral village in Central Mali, and to look at the economic strategies of herders and farmers in the region. The paper will also look at the growing competition between different groups for access to land and water in the context of (a) an increasing direct involvement by pastoral groups in cultivation, (b) the attraction of short-cycle crop varieties in regions with a short and highly variable rainy season and the importance of manure in assuring high yields of these varieties and (c) the consequent desire of different groups to acquire and maintain control over a supply of water at which livestock may pass the long dry season, during which manuring of fields takes place. The paper will concentrate on the Bambara community of Kala, and the means by which it has asserted its right to control access to water by livestock within its territory so that farmers can acquire the manure they need to expand production of fast growing varieties of millet. This village's experience demonstrates some of the advantages of the integration of crop and livestock activities and points to the internal adaptability of traditional farming systems in a region where there are high production risks, due largely to climatic variability.

2. The paper will begin with a description of the zone studied, of socio-economic aspects of the agro-pastoral system and the climatic context within which there has been a growing emphasis on rapid crop varieties. Some comparisons will be made of returns to land and labour between short and longer cycle millet varieties. The sources of manure available to farmers will then be considered, and in particular the investment in digging wells by villagers in Kala will be discussed. These wells are dug to enable farmers to establish manure-water contracts with livestock owners. Finally, some of the consequences for the relationship between herders and farmers of the increased value of manure within the cropping system will be discussed.

Zone of Study

3. The zone studied lies to the north of the River Niger in the Ségon Region of Central Mali (see Map 1). With an annual rainfall of between 400 and 500 mms., this zone may be considered as transitional between the true Sahel to the north, peopled mainly by pastoral herding groups, and the better-watered Sudanian region to the south where a higher and more reliable rainfall allows for settled cultivation by peasant communities. The distinction between herders and farmers is, however, not clear-cut; many herders cultivate sizeable fields of millet, and some cultivators own large cattle herds.

MAP 1 MALI: Climatic Regions



4. The zone is relatively sparsely populated, the overall population density for the district (Arrondissement) being only 7 inhabitants/km^2, in contrast to densities of 20-30 inhabitants/km^2 in regions to the south of the River Niger.[1] The population is grouped in nucleated villages each surrounded by its own territory of bush, in which there is shifting cultivation and grazing for village herds. The area has been settled for many centuries, but has been experiencing a recent influx of migrant farmers from more densely populated regions further south, and from regions with heavier clay soils. The main constraint on establishing permanent settlement in the zone is that of a good water supply throughout the long dry season. Villages vary greatly in the quality and reliability of their water supplies, and this has consequences for their capacity to water their own or visiting livestock outside the rainy season.

5. The two main ethnic groups in the area practise both herding and cultivation; the Bambara, of farming origin, nonetheless have substantial cattle holdings, and the Fulani, although traditionally herders, have been farming in the zone for several generations. There are other groups that are temporarily resident in the zone: dry season visiting livestock-owners in search of grain and watering facilities for their animals (both Fulani and Maures) and rainy season visiting livestock-owners (usually Fulani) from regions further south, come to pass a couple of months grazing the grass fallows around settlements in the area.

6. The herding and farming systems in the zone exhibit varying degrees of integration between the agricultural and livestock sectors. The main ways in which livestock contribute to agricultural production are in the provision of manure, and in the use of oxen for plough traction. There is little development as yet of the use of fodder crops for cattle, and what fodder is grown is carefully harvested to be given to horses and donkeys. Integration between livestock and cropping may be at the household level - for instance, when a farmer uses the dung from his own livestock to manure his land - or may involve transactions between households - as when a Fulani household hires a Bambara work-party to help him harvest his millet.

The Farming System

7. The main crop of the zone is millet, although small quantities of groundnuts, sorghum, maize and sauce vegetables are also grown. There are two main millet varieties of different cycle lengths; a long-cycle 120 day millet, 'sanyo', grown on unmanured shifting bush fields, and a short-cycle 60-80 day millet, 'souna',

grown on manured, permanently cultivated fields around the village. Bush fields are abandoned after 4 or 5 years of cultivation, and left in fallow over 30 or 40 years. Because population densities are low in this zone, fallows are sufficiently long to regenerate fertility. However, in regions further to the south fallow periods are very short and in some cases all land is permanently cultivated. Soils in this zone are fairly light and sandy, although there are patches of a heavier clay. Sandy soils are particularly sought after by farmers at present, since they can be relied on to produce some grain even when rainfall has been low and poorly distributed. It is only in years of high and well-distributed rainfall that the clay soils are preferred to sands. Cultivation is done by hoe and plough. The key activities are an early sowing of the crop to make maximum use of a short growing season, and weeding of fields in subsequent months to reduce competition for moisture and nutrients between the young millet plants and other vegetation. Ox drawn ploughs were introduced and widely adopted from the 1940's and 1950's onwards, especially in association with the rapid expansion of peasant cultivation of groundnuts as a cash crop. Although originally used only for the preparation of land before sowing, ploughs are now also used for weeding of both the long and the short cycle millet varieties. Ox-ploughs are as popular with the Fulani as they are with the Bambara, and it is probable that their introduction has had an expansionary effect on the amount of farming done by predominantly herding groups.

8. Because the rainy season is so short, farmers need to mobilize all labour available to meet the sowing and weeding requirements of millet. In the absence of any significant market for hiring labour for farming, households must rely almost entirely on their own family members, although work-groups may be of some importance for particular tasks such as threshing the grain, An indication of the importance attached by Bambara farmers to devoting all available labour to agriculture is shown by the widespread use of hired Fulani labour for herding of village cattle, sheep and goats during the rainy season, to keep animals away from crops. In the dry season, however, most animals are left free to wander once the harvesting of crops has finished. The problems faced by Fulani in trying to maintain a crop-livestock economy may be met by hiring labour from neighbouring villages. This is sometimes paid for in cash - for instance when the village youth association, ton, is hired - or it may be part of an exchange relationship established with a Bambara household. In Kala, for instance, two Bambara households that owned no plough-team of their own obtained access to a Fulani plough-team in exchange for time spent weeding the owner's millet field.

9. Farmers aim to reduce risks to farm output and household food supplies by (i) cultivating millet of different cycle lengths in the hope that both crops will not fail in any one year, (ii) storing surplus grain in good years to supplement food supplies in future deficit years, and (iii) investing surplus farm output in livestock, particularly cattle, that may be sold in times of need to finance grain purchases or other cash expenses.

Social Structure

10. Kala is an old Bambara village of over 500 people, divided among 29 households. This gives a mean household size of nearly 19 people, a relatively high figure, indicating the persistence of large extended family groups. The village is composed of several lineages, of which the founding lineage holds the chieftaincy. Each lineage is usually made up of a number of households, which act as the everyday production and consumption unit. These households are however not completely independent from each other, and there is much co-operation at the lineage or at the village level for particular tasks such as threshing and winnowing the grain. Households vary enormously in size, from the smallest nuclear family unit to an association of males claiming a common ancestor several generations back, along with their mothers, sisters, wives and children - which may total in the larger cases some 50 to 60 people. The benefits of large household size are appreciated in terms of production advantages; a larger household has greater possibilities of diversifying activities during the dry season - allowing some young men to go on migration and some to stay to help water cattle and clear land for the next cropping season. Large households also have greater resilience when faced with the illness or death of one of their members, whereas a nuclear family may find it almost impossible to continue if the household head or his wife is seriously incapacitated.

Climate Past and Present

11. Sahelian rainfall is characterized by extreme variability, both in the amount of rain received from one year to the next, and in its distribution over space and time in any one year. Rainfall tends to be especially variable and localized at the start and towards the end of the rainy season. This means that crops with a long growing cycle are subject to considerable risk from lack of sufficient rain at crucial moments, such as when the grain is filling out.

12. The Sahelian region gained prominence in the early 1970's following a series of years of low rainfall, culminating in the drought years of 1972 and 1973. While there is still considerable debate as to whether or not this

drought was unprecedented in length of time and scale of the affected region, there is some evidence to suggest that the impact of the drought was accentuated by the experience of the preceding 15-20 years which were characterized by above average rainfall. It seems that since the end of the drought in 1973, Sahelian rainfall patterns have returned to those more typical of the first half of this century. Farmers themselves contrast the short and variable rainy seasons of recent years with those of the 1950's and 60's, when days of continuous rain could threaten to reduce houses to a pile of mud and rafters, and when rain continued well into October, permitting good harvests of longer-cycle crops such as beans and peanuts. This relatively well-watered period before the drought also saw the introduction on a wide scale of peanut cultivation, and the adoption of ox-drawn ploughs. Profits from peanuts provided many households with the means to buy cattle; young heifers to serve as breeding stock, and bullocks to be trained for ploughing. Many of the cattle currently owned by farmers in this region are the offspring of animals bought during this period of favourable rainfall and high peanut prices.

13. The recent swing back to short and erratic rainy seasons has encouraged farmers to shift their attention towards shorter-cycle crops, in order to make maximum use of the little rain that falls. A further development following the drought has been the much greater involvement of herding groups in farming. This is due to not only a loss in livestock numbers during these years of drought, but also a desire of herders to provide for at least some of their grain needs, thus reducing their dependence on markets for grain. As Rupp[2] notes in describing the economy of Fulani in the Dilly-Nara area of Central Mali (some 100-200kms north of Kala), although the Fulani have always had a small plot to farm, agriculture is becoming increasingly important to them:

'la tendance actuelle, en milieu éleveur, est de faire de la culture une activité de plus en plus importante, afin de pouvoir couvrir au moins partiellement les besoins de la famille, même en periode de mauvaises récoltes' (Rupp, p.31).

She also mentions a change in emphasis in cropping patterns since the recent drought towards short-cycle millet and maize, and that the Fulani have almost completely abandoned longer cycle crops such as groundnuts, dah and cowpeas.

Requirements of Short-cycle Crops

14. The rapid variety of millet grown by herders and farmers in this region matures in 60-80 days, as compared with 120 days or more for the longer cycle millet. To reach maturity in this short time, the rapid variety of millet

is more demanding in terms of fertility, and in the pattern of rainfall received during its growing season. The rapid variety is also more susceptible to drought and less able to withstand an extended dry period during its growing season because it has a less well-developed root system. This means that there is only a limited period during which the short-cycle millet can be usefully sown, once the rainy season is well-established and the risks of a dry spell lower than at the start of the rains. The longer cycle millet can however be sown with the first rains, since it is better able to survive the probable subsequent period of drought.

15. In the almost total absence of chemical fertilisers, a farmer's possibilities for fertilizing his land depend on his access to manure. As his supply of manure grows, so does his ability to grow more short-cycle crops. Apart from its fertilizing effects, it is also probable that manure has a beneficial impact on the structure and water-retention capacities of these soils. These effects give manure certain advantages in comparison with chemical fertilizers. Farmers are however aware of the disadvantages of heavily manured soils in years of low rainfall, describing the effects of the manure as 'burning' the millet, due to the 'heat' provided by the manure. Similarly, heavier clay soils are perceived as responding less favourably to high levels of manuring than lighter sands in years when rainfall is low and poorly distributed. This means that in villages with mainly heavy clay soils there is less impetus to gain control over manure supplies than in cases like Kala where soils are sandy. There are even some cases of villages that have been more or less abandoned because of their hard clay soils, and their population has migrated temporarily or permanently to villages where soils are lighter.

16. Kala has a relatively high proportion of land under short-cycle millet. In 1981, the proportion of land under different crops was as follows: long-cycle millet 71%, short-cycle millet 25%, other crops 4%. The area under short-cycle millet grew by 34% between 1980 and 1981, so that the share of the total farmed area under this variety increased from 19% in 1980 to 25% in 1981. The underlying reason for this increase in the importance of short-cycle millet has already been mentioned, namely the variability of rainfall. The particular reason for such an increase in area cultivated between 1980 and 1981 in this village lies in the increased capacity to manure land that followed the digging of wells by several households in the dry seasons of 1980 and 1981. This investment in digging wells in Kala will be looked at in more detail later on.

Yields of the Two Millet Varieties

17. Yield data for the two millet varieties in Kala in 1980 and 1981 show a marked difference, their mean values being in the proportion of 1:5 in favour of short-cycle millet. In 1981, the mean yield over the 29 households was:

long-cycle millet	215 kgs/ha.
short-cycle millet	1,010 kgs/ha.

It should be noted that the villagers considered that both 1980 and 1981 had been exceptionally good years for short-cycle millet and rather poor years for the longer-cycle variety, since an early end to the rain in both years prevented the grain filling out properly in the latter crop. Comparison of these mean yields with those of a neighbouring village shows in the latter case a much less marked difference in yields between the two millet varieties, mean yields being in the proportion of 1:2 in favour of short-cycle millet. The lesser contrast in mean yields in this second village was due to a much lower yield of the short-cycle millet (only 520kgs/ha.) as against a slightly higher yield per hectare of the longer-cycle millet (at 242kgs/ha.) in comparison with Kala. These figures from a second village are given to illustrate the combined effects on short-cycle millet yields of a lesser quantity of manure available, heavier clayey soils and a lower rainfall total particularly poorly distributed. It should also be mentioned that there is very considerable variation in both villages in yields per hectare for different households. In Kala, for example, yields of short-cycle millet varied from as little as 250kgs/ha. for a plot with no manuring to over 2,000kgs/ha. for a well-manured field.

Labour Requirements for the Two Millet Varieties

18. If the labour requirements of the two millet varieties are considered, it is found that there is little or no difference between the number of mandays spent per hectare for the two crops during the cultivation period. Long-cycle millet may even require higher labour inputs per hectare in some years, though this depends on the pattern of rainfall and subsequent timing of operations in any one year. Thus, short-cycle millet is not more demanding than the longer-cycle variety in terms of total labour required per hectare for its cultivation. The marked difference in yields per hectare but similar labour requirements per hectare for the two millet varieties found in Kala means that there are large differences in implied yields per manday worked for the two crops. For example, in Kala, dividing output per hectare by labour input per hectare for the cultivation season for each millet variety gives the following implied yields for one manday's work in 1981:

long-cycle millet variety 17.5 kgs/manday
short-cycle millet variety 72.8 kgs/manday.

These figures indicate the attraction of growing short-cycle millet on sandy, well-manured soils and they explain the importance given by farmers to gaining a supply of manure so that the area under this variety may be expanded. High returns per manday for the short-cycle millet make it particularly attractive as a crop to households with a small, or elderly work-force. This is especially the case with herding groups who have limited time to spend during the rainy season on cultivation and have access to manure for some period of the year. A further advantage of short-cycle crops for herders is that the harvest comes early, freeing labour to care for animals earlier in the dry season. Several authors[3] have noted at this time of year that livestock-keepers who also farm have tight labour constraints in relation to harvesting, guarding crops, keeping animals away from the fields of other farmers, and the need to begin drawing water for livestock.

Manuring Contracts

19. Throughout the West African Sahel one finds manuring contracts between farmers and herders. The details of these vary: a farmer may feed a herder and his family for as long as he stays with his herd on the farmer's field, or the farmer may pay him in cash or in grain according to the number of animals and the number of nights that he passes on the farmer's field. In some areas where pasture is scarce, a farmer may bargain access to his crop residues (millet stalks and groundnut hay) for the herder's animals against their passing several nights on his fields. However, the relations between herders and farmers have been changing over time. One author[4], writing about Northern Nigeria, notes that with the increasing availability of chemical fertilizer and expansion in dry season cropping, farmers are less interested in allowing herders access to their harvested fields, and thereby risking damage to dry season crops by cattle, in order to gain manure.

The Water-Manure Exchange

20. The principle on which control over a supply of manure is established in much of the zone studied is based on rights of access to a water source for livestock. In the rainy season, water is freely available in ponds in the bush. Since these ponds are not the property of any particular group or individual, the owners of any livestock watering there are free to dispose of manure from their animals during this period. Commonly, animals are corralled at night during the rainy season and the dung deposited there transported to the fields at the start of the dry season. Alternatively, the

corral area itself may be sown the following rainy season with a crop such as maize that requires a lot of manuring. Once ponds in the bush dry up, however, and there are no longer free water sources to be tapped, livestock owners that do not own rights in a well must make a contract with a well-owner. Typically, such contracts involve the exchange of the two commodities, water and manure. Thus a well-owner will allow a herd-owner to water the herd at his well, and in return the animals must be corralled at night on the well-owner's land. In this way, by investing in digging a well, farmers can gain access to dung for fertilizing their land whether or not they themselves actually own any livestock. Thus a farmer has two possible sources of manure, from his own livestock and from livestock belonging to others.

1. A Household's Own Livestock

21. This is usually limited to cattle, since sheep and goats are commonly women's property and responsibility, and their droppings are used to fertilize the women's own small plots of millet, maize and vegetables. (A distinction should be made between the fields that a household farms communally, and the small plots farmed by individuals in their spare time.) However, ownership of cattle is not a sufficient condition for getting all their manure, since if the owner does not have rights of access to a water source through the dry season he will not gain their manure during that period. For example, cattle-owning farmers in villages with inadequate water supplies are forced to send their animals to a neighbouring village during the dry season, to the benefit of the fields of the neighbouring village.

2. Livestock Belonging to Others

22. If a farmer has no livestock, or if he wishes to expand the area of manured land that he farms beyond that which his own livestock can fertilize, he must come to some arrangement with a herd-owner to get manure on his land. Such herd-owners are usually transhumant pastoralists, Fulani and Maure in the zone studied, who bring their herds to water at village wells throughout the long dry season. These transhumants usually have a rainy season cultivation hamlet some distance to the north which they occupy for 5 or 6 months during the farming season. At the end of the rainy season, as ponds in the bush dry up, pastoralists and their herds start moving southwards towards more reliable pasture and water supplies, where they hope to pass the 6 or 7 months until the start of the next rainy season. Once millet harvests are safely stored in the granary, the fields around many farming villages in this region are dotted with the huts, tents, flocks and herds of visiting livestock-keepers.

Well-ownership

23. Wells are usually either owned communally at the ward or village level, or are owned privately, that is by an individual household. The extent of private well-ownership varies between villages, and is closely related to the ease with which water can be found. Where wells must be dug very deep, and through hard, rocky strata, it is commonly only by pooling resources among a number of households that the work can be accomplished. Similarly, where rapid subsidence of the well-shaft is likely and concrete rings must be used to support the walls of the well, the expense is more than any but the richest households could bear, so this work is usually done at the village level. In a number of villages, including Kala, a relatively reliable water supply is reached at 20 to 25 metres, through easily dug sand and stone, which means that a well can be sunk in a month or so using a household's own resources.

History of Water Development in the Zone

24. The relative scarcity of water supplies in this region north of the River Niger has always been a key factor in settlement patterns, and establishing control over a source of water has been of great importance. Oral history commonly attributes the abandonment of villages and towns in the area to the drying up of wells. The most widely quoted legend is that of the fall of Wagadu, capital of the ancient kingdom of Ghana, reputed to have been abandoned when its well dried up, following the slaughter of a many-headed serpent living in its depths. Further indication of the importance of owning a water-supply is given in the epics sung by praise-singers of the warlords of the 18th and 19th century state of Segou, in which 'owner-of-water' (jitigi) is included along with other attributes of power and importance, such as 'owner-of-men' (maatigi), 'owner-of-gunpowder' (mugutigi), used to describe Segou's warrior-kings.[5]

25. During the colonial period, the French re-affirmed the authority of local chiefs by giving them sole authority to grant rights to dig wells within the village's territory. Such a policy was in line with the general tendency of the colonial government to try to bolster the position of often weak, elderly chiefs in Bambara village society, where the main decision-making body has traditionally been the meeting of family heads. The confirmation in the chiefly lineage of monopoly rights over water source exploitation gave this lineage effective monopoly access to the manure brought by dry season visiting livestock watering at village wells. Other households had to rely exclusively on the manure produced by their own livestock. On Independence in 1960, however, the Malian government enacted a law allowing free access to water, land and pasture resources

by all and annulling the 'de jure' control over water exercised by chiefs. Such a change in the legal position encouraged the investment in digging wells by individual households, where this was feasible, both to water the household's own livestock and to use as a means to establish manure-water contracts with visiting herd-owners.

Well Development in Kala

26. In the case of Kala, private investment in wells has grown rapidly in recent years. At Independence in 1960 there were 4 wells that provided for the domestic water needs of the villagers and the dry season watering of villagers' livestock. By 1982, there were 36 wells, of which 29 were privately owned and of the 29 households in the village, only 7 did not have their own well. Seven households now have two private wells, the second one dug to enable them not only to water their own livestock but also to engage in manure-water contracts. Non well-owning households tend to be small and poor and own few livestock, and they therefore have limited means to invest in a well. With little manured land under cultivation, these households without wells are more subject to poor grain harvests and their limited resources are used to supplement food supplies, rather than accumulated for investment in a well.

Returns to Well-digging - The Case of Barama

27. An illustration of the returns to digging a well may be seen in the case of one villager of Kala, called Barama. In 1980, he paid a labourer 40,000MF* to dig his well and was able to triple the area of manured land that he cultivated between 1980 and 1981. His total harvest grew from 1,900 kgs of millet in 1980 to 4,700 kgs of millet in 1981; of which the short-cycle variety made up 60% in 1980 and 80% in 1981 of the total crop harvested. This increase in output of 2,800 kgs between 1980 and 1981 was worth 280,000MF (taking one kg of millet as worth 100FM, a fairly low estimate). Even keeping in mind the possibly exceptional yields of short-cycle millet in 1981, this calculation does show the substantial benefits that can accrue to a farmer by gaining access to a manure supply.

* Note: 100 Malian francs is equivalent to 1 French franc.

Limits to Successful Investment in Wells

28. It is not every village that can follow the example of Kala, nor can all families pursue Barama's course. In some places water may be difficult to find at any depth and the limited supplies available may barely cover household water needs. Where soils are heavier clays, the effects of manuring while still significant, are far less marked than on lighter sandy soils in years of low rainfall, so that returns from controlling a supply of manure are less substantial. Also, where grazing is limited and alternative water sources are available, such as a river, farmers have a weaker bargaining position vis-à-vis herders, and may need to provide other benefits in order to get manure on their land. Barama may have broken out of a chronic, yearly grain deficit because he can now grow more short-cycle millet, but it was only by very considerable hardship that he became a well-owner. Barama had to hire someone to come and dig his well, since he himself was too old and his teenage son too young to get much of the work done. But to get the cash needed to pay the well-digger meant selling most of his already inadequate harvest that year. The family was living from hand-to-mouth for many months, barely managing to feed itself: the son was sent out to work for others during the farming season in exchange for grain, they collected wild fruits in the bush for food, and small quantities of millet were begged and borrowed in Kala and neighbouring villages. It was a very uncertain and gruelling time for all the family, and not an experience that many other families might wish to follow. Some families can get a well dug much more easily; if they lack sufficient young men to do the work, they can sell an animal to get the cash needed to pay the wages of a well-digger. But families like Barama's, small in size and without cattle, are faced with severe problems in the short run if they decide to invest in a well.

Herder-Farmer Relations

29. Herder-farmer relations are inevitably affected by an increase in the value of manure as an input into the cropping system. On the face of it, the increased value of manure consequent on the emphasis now placed on short-cycle crops should lead one to expect a closer symbiosis of farmers and herders. While such a development might be the case where the two activities are practised exclusively by different groups, the situation becomes more complex where no strict dichotomy exists between a sedentary farming community owning few livestock, and a mobile pastoral group that does not farm to any significant extent. Relations between herders and farmers in the Sahel are usually viewed within the literature as oscillating between conflict and complementarity. Thus, Gallais describes relations:

'La situation actuelle des relations entre ces deux groupes chargés de signe contraire est faite d'attirance et d'opposition alternant, d'abord selon un rythme saisonnier' (p.303).[6]

Conflict arises during the cultivation season from the encroachment of farmers' fields on pasturelands and the damage done to crops by poorly guarded cattle, whereas exchange of products between the two groups once the harvest is over forms the complementary aspect of the relationship.

30. However, in the zone studied, as elsewhere in the Sahel, there is now a less clear-cut division between the Bambara as farmers and the Fulani as herders than perhaps was the case formerly. Some of the reasons for this have already been discussed and include the investment of surplus farm product in cattle by villagers, and the increased importance of farming to herders, particularly following the drought of 1972/3. Gallais observes a tendency towards the emergence of a common agro-pastoral system in the Sahel 'par un processus de lente homogénéisation' (p.313)[7], of communities traditionally based on either farming, or herding. Thus, while damage to crops remains a worry for the cultivator, it is as often the fields of the Fulani and the cattle of the Bambara that are involved as the converse.

31. Disputes between the Fulani and the Bambara increasingly revolve around the question of access to land and water. Several factors need to be taken into account when describing the wider context within which such rights are in dispute. Firstly, there has been a steady increase in human populations throughout the Sudano-Sahelian zone of West Africa. This is currently estimated at around 2.5% per annum for the Bambara farming population of the Arrondissement in which Kala is found[8], whereas rates of growth for the Fulani population are probably somewhat lower. Secondly, there has been a migration of farming populations towards the north from areas of high population pressure further to the south. The zone of study in particular has received an influx of migrant farmers looking for sandier soils, and fleeing areas close to the irrigation scheme of the Office du Niger where crops suffer bad damage from birds. Thirdly, there has been an extensification of farming practices, as a result of the breakdown of nucleated farming villages - originally formed for defensive purposes - into dispersed cultivation hamlets. This dispersion has been aided by the recent widespread acquisition of donkey-carts, with which large quantities of water can be transported to areas that do not have sufficient water supplies of their own. Fourthly, an expansion of cultivated area followed both the introduction of cash crops such as peanuts, and the

widespread adoption of the ox-drawn plough. All these factors have led to an extension of cultivated areas and have put increased pressure on land.

32. Despite the currently low population densities in the region around Kala, farmers are aware that there has been an acceleration in the take-up of bush land into cultivation, and they know of the disappearance of fallowland due to human population pressure in farming settlements around Segou. The zone studied has traditionally been an area under Bambara control, having been within the boundaries of the Segou state of the 18th and 19th centuries. Any group or household wishing to settle must obtain the permission of the chief and council of the village within whose territory the chosen site of settlement falls. Reluctance to grant land for cultivation to other groups, and to herd-owners in particular, is based on the desire of villagers to:
(i) limit use of village lands for cultivation, especially by groups that are not planning to settle in the village and become part of the Bambara village community;
(ii) avoid the increased risk of damage to crops likely to result from the establishment of a settlement by a herd-owning group within the village's lands;
(iii) maintain monopoly control over water resource exploitation and thereby supplies of manure. For example, a herd-owner once partially settled and involved in farming, would probably want to dig his own well at his farming site to satisfy at least some of his dry season water requirements. Livestock would then not need to be brought to village wells and farmers in the village would lose control over a supply of manure. Not all herders are equally interested in having access to manure over a long period, and may only require the amounts of manure produced during the rainy season for the limited amount of cultivation that they undertake.

33. In considering the nature of relations between the Bambara farmers of Kala and different herding groups, it should be noted that this village is different from many others in the zone studied. The soils around the village are predominantly sandy, and in years of low rainfall are still able to produce a harvest. Water is in relatively easy supply for livestock and for domestic needs throughout the dry season. The village is surrounded by a large expanse of bush, providing standing hay throughout the dry season for village and visiting livestock. Thus the village of Kala is in a strong position to attract herd-owners because of its good pasture and water resources. Finally, the village is very little Islamicised and has an active traditional fetish cult, which causes some degree of friction with the universally Islamicised herding groups.

34. Relations with Local Fulani Herders: a number of Fulani families have been long established in the zone studied. Often of fairly mixed ethnic background, they have always done some farming to supplement food needs. Such cultivation has increased with the introduction of the plough. The gradual monetisation of the peasant economy and the closer linkage between village and urban grain markets that has led to higher millet prices at village level, may also account for the desire by herders to be less reliant on the purchase of grain for their food needs. In many cases the Fulani community is settled in close proximity to an already established Bambara village. In other cases such as Kala, there is no independent Fulani settlement associated with the village, and the only Fulani permanently resident and given land to farm are those that are contracted to herd the villagers' cattle. The villagers of Kala do not want the establishment of Fulani settlements within their village territory, ostensibly because of the risks of damage to crops from herds. Other reasons given include that such settlements would reduce the already small stocks of remaining game to be found in the bush, and that a Fulani settlement once established would act as a pole of attraction for many other families in the region, thereby becoming a rival centre of local political importance. Although not explicitly expressed, it is also probable that the villagers want to maintain a monopoly on dung and water supplies in the region. It was even claimed that the Bambara traditional religion of Kala was sufficiently powerful to prevent any unauthorised wells from finding a good supply of water.

35. Relations with Maure Herders: relations between the Maure herders and the farmers in Kala tend to be much warmer than those with the Fulani. This may be partly because the Maures who visit Kala are of originally peasant stock, so that they evince none of the feelings of racial superiority vis-à-vis the Bambara that are occasionally found among the Fulani. These Maure herders pass the rainy season in cultivation hamlets some 50 to 100 km to the north of Kala, arrive in January or February, once the millet harvests are over and therefore cause fewer cases of crop damage than do the local Fulani. The Maures also commonly perform various tasks for the villagers, like threshing and transporting grain and clearing of fields in exchange for payment in grain or in cash. Another reason given for the relatively good relations between the Maures and the Bambara of Kala is that the Maures have no intention of settling to cultivate within the region, preferring the isolation of the north for reasons both of pasture availability and of distance from administrative centres. Thus the Maures are not competing with the Bambara for access to land, water and manure in the same way as the Fulani, and describe

themselves as guests of the Bambara rather than their co-residents.

36. Relations with Fulani Herding Labour: in Kala, the great emphasis on mobilising all household labour for farming during the short rainy season has prompted the widespread use of contract labour for herding of village livestock during the rainy season. The success of short-cycle millet cultivation in this village has had two effects on the nature of the relationship between the Bambara and their hired herders. On the one hand, Bambara farmers have even greater incentive to allocate all available labour to farming - as long as reasonably satisfactory care of livestock is assured by hired labour - since as was seen earlier, the implicit yield of a manday's work spent cultivating short-cycle millet was over 70kgs of millet in 1981. Thus, in some senses the Bambara are more than ever dependent on hired herders to care for their herds. On the other hand, there are particular advantages that accrue to a Fulani household that is employed to herd village cattle in Kala that mean that many herders want to come and work there. Payment of hired herders is made both in kind - grain and milk - and in terms of access to a plot of manured land by means of which the herder can supplement his herding fees. For most hired herders in Kala in 1981, grain harvested from their small millet fields was of equal if not greater importance than that received as wages from the herd-owner. Jobs herding cattle in Kala are thus relatively sought-after, because this work permits the herder to farm land around the village.

Discussion and Conclusions

37. The case of Kala throws light on two inter-related issues that have been the subject of some discussion in recent literature on the Sahel. These are: (i) the problems faced by households that both farm and keep livestock, because of the demands made on labour by combining the two activities, and (ii) the extent to which it is useful to interpret relations between different groups in the region as being based primarily on the opposition between farmers on the one hand, and herders on the other.

38. On the first issue, researchers such as Delgado[9], who worked in the village of Tenkodogo in Upper Volta, have been concerned to explain the lack of integration between livestock and cropping activities at the village level, and in particular the slow rates of adoption by farmers of ox-drawn plough technologies. The explanation he gives is mainly based on the high opportunity cost of labour incurred, in terms of forgone agricultural output in the rainy season and

migration earnings in the dry season, when a member of the household labour force is delegated to the care and maintenance of a pair of work oxen. In his case-study, the potential benefits from using an ox-drawn plough - expansion of area and increased yields per hectare - cannot be realised because of shortages of labour to carry out the weeding and harvesting of this larger crop output. In addition, the possibilities for manuring of land are low because a shortage of fodder and water means that the animals must be distanced from the village for much of the year. A comparison of Kala with Delgado's case-study of Tenkodogo would point to three main factors that would account for the considerable integration of livestock and crop activities in Kala, and in the widespread take-up by farmers in this village of ox-drawn ploughs. These factors are:

39. (i) Labour availability: While not denying labour to be a major constraint to the expansion of production by farm households in Kala, labour constraints are perhaps less tight than those identified by Delgado in Tenkodogo. This is probably due to (a) the large household size in Kala, averaging nearly 19 people, in comparison with a farm household size of 8 persons in Tenkodogo, giving certain economies of scale in the former village when one member of the household labour force must be allocated to the care of livestock (b) the existence of various forms of co-operative labour exchange between households in Kala, especially during the harvest period, and (c) the availability in Kala of resident Fulani labour for herding of village cattle, usually in herding units that group the animals of several owners.

40. (ii) Pressure on land and the availability of forage and water in the dry season: the region to the north of the River Niger at Segou is still relatively sparsely populated. Village herds do not need to be taken long distances to find sufficient forage, although poor supplies of water may force the migration of herds from some villages for part of the dry season. Where cattle can be kept close to the village for much of the year, the owner can benefit from the manure they provide. In addition, since the herds are kept within a short distance from the village during the rainy season, oxen can be returned to the Fulani herder's care as soon as their use for cultivation has finished. This means that labour from the farm household need only be devoted to looking after the work-oxen for the couple of months during which they are actually being used in the field.

41. (iii) Widespread ownership of labour-saving technologies to cope with weeding and harvesting labour 'bottle-necks': Delgado found in his study of Upper Volta that the introduction of an ox-drawn plough to prepare land

before sowing merely shifted problems of labour shortage from the land-preparation period to those of weeding and harvesting the crop. In Kala, a one-bladed plough is used to weed millet fields, and carts drawn by donkeys or oxen greatly speed up the work of transporting the crop at harvest-time. The widespread ownership of such equipment in Kala means that farmers can weed and harvest the extra crop output made possible by the use of an ox-drawn plough in preparing land before sowing.

42. The rather pessimistic conclusions that Delgado reaches on the limited degree of integration possible between livestock and cropping on farms in the Sahel should thus be seen, as he does himself in a later article[10], as a function of the specific conditions faced by the farmers that he studied in Tenkodogo. His conclusions are not necessarily applicable to the extensive farming systems found to the north, in the more truly Sahelian regions, where there has also been an added impetus to combining livestock and cropping activities because of the vital role that manure plays in the cultivation of short-cycle crops.

43. On the second issue, the case of Kala tends to confirm the general trend noted throughout the Sahel of an increased involvement of herders in farming, and the converse development of farmers investing in cattle, such that 'it cannot be too strongly emphasized that the somewhat artificial polar types, sedentary/non sedentary, and crop production/livestock production do not adequately describe the economic orientations of ethnic groups'.[11] The conflict that occurs between, in particular, the Bambara and Fulani communities in the region studied should not be seen primarily in terms of farmer versus herdsman, since this obscures the real point at issue, that is, who should have rights to settle, to cultivate land and to dig wells within what is traditionally conceived of as the Bambara village's territory. The question of rights to dig a well are of especial importance since a livestock owner without a water supply of his own must cede control over the manure produced by his animals to the owner of a water source during the dry season. The question of who can get access to a supply of manure and on what terms is of growing importance within a context of (a) a deterioration in rainfall conditions in comparison with the pre-drought period, and (b) an increased involvement by pastoral groups in cultivating sufficient grain for their own food needs. This has meant that access to particular types of land - sandy soils are currently much in demand - and ownership of a well capable of watering livestock have become assets of great importance to both the Fulani and Bambara. This is because of the relatively high yields of short-cycle millet that can be harvested from manured, sandy soils in comparison with yields from the same variety of millet grown on clayey, less

well-manured soils, or with longer cycle bush field millet grown on unmanured shifting bush fields.

44. In regions where there is a clear distinction between a livestock-keeping and a cultivating population, the relations between the two groups may be seen as reflecting the possibilities for conflict and complementarity as described by Gallais.[12] The potential for conflict which arises from crop damage by livestock or the cultivation by farmers of areas traditionally used for grazing is moderated by the mutual advantage both groups have in exchange of their respective products - manure and milk against water and grain. As pastoralists expand their own agricultural activities and as farmers establish cattle herds of their own, the basis for a mutually beneficial exchange between the two groups becomes more tenuous. The example of Kala demonstrates some of the issues that arise under circumstances in which both the Fulani and the Bambara have fairly similar economic strategies, combining both livestock-keeping and farming. Competition between the two groups for resources is highlighted in the case of manure because of its high value within the cropping systems of both groups. Maintaining control over access to land and in particular over the digging of wells is therefore a major element in Bambara political strategy.

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PASTORAL DEVELOPMENT NETWORK

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Paper 16a

July 1983

NEWSLETTER

1 Together with this Newsletter we are sending you three other papers:

16b by Moses Awogbade explores the Fulani herdsmen's views about the Ruma-Kukar-Jangarai Grazing Reserve, near Katsina in the very north of Nigeria, which was the subject of Network Paper 15c by G K Perrier and P S Craig.

16c by M Ibrahim, N Nwude, Y Aliu and R Ogunsusi discusses some Fulani traditional concepts of animal disease and treatment and their relationship to scientific terminology used by veterinarians.

16d by P J van Dooren analyses the different credit arrangements used with animal husbandry activities, with examples from Tunisia and Lesotho.

2 News of network members

Stephen's book is out! See page 10 for details.

3 Network membership

There are at present 517 members of the pastoral network, located in the following countries.

Breakdown of members by country and region

Europe	
Belgium	1
Denmark	1
Ireland	2
France	20
Italy	18
Luxemburg	1
Netherlands	10
Norway	5
Portugal	1
Sweden	7
Switzerland	2
UK	110
W Germany	4

Middle East and N Africa	
Algeria	2
Egypt	2
Iran	9
Iraq	1
Israel	3
Saudi Arabia	4
Syria	5
Tunisia	1

E and C Africa	
Cameroon	1
Chad	2
Ethiopia	11
Kenya	48
Rwanda	1
Somalia	5
Sudan	9
Tanzania	28
Uganda	2
Zaire	1

W Africa	
Gambia	1
Ghana	5
Mali	8
Mauritania	1
Niger	2
Nigeria	23
Senegal	6
Sierra Leone	1
Togo	1
Upper Volta	6

S Africa	
Botswana	11
Lesotho	1
Madagascar	3
Mozambique	2
S Africa	2
Swaziland	2
Zambia	1
Zimbabwe	1

Americas	
Brazil	1
Canada	6
Chile	1
USA	70

USSR and S Asia		SE Asia and Australasia	
Afghanistan	4	Australia	2
Bangladesh	2	China	3
India	17	Japan	2
Nepal	1	New Zealand	1
Pakistan	3	Philippines	1
Sri Lanka	2	Taiwan	1
USSR	5	Vanuatu	1
		Total	517

We will be issuing a handbook of network members shortly, including information about their current work and interests in the field of pastoral development. PLEASE FILL IN THE ENCLOSED FORM and help us to give up-to-date information.

Membership of the network is open to anyone who has a special interest or experience in pastoral development including animal production, range management, livestock sector policy, the sociology of herding peoples, and so on. Membership is free of charge and members receive copies of pastoral network newsletters and papers. New members wishing to join should apply to Fiona Harris, Agricultural Administration Unit, ODI, giving details of their work and interests in pastoralism.

4 Conferences

3-6 August 1983 Overcoming constraints to Livestock Development in Subsaharan Africa Sponsored by the Center for African Studies and the Institute of Food and Agricultural Sciences, University of Florida. Held at Holiday Inn, University Center, Gainesville, Florida. Papers in the fields of agricultural economics, animal health, animal science, anthropology and ecology will eventually comprise chapters of a book to be entitled Livestock Development in Subsaharan Africa: Constraints, Prospects, Policy and to be published by Westview Press. For more information please contact: James R Simpson, Food and Resource Economics Department, McCarty Hall, University of Florida, Gainesville, FL 32611, USA.

14-25 August 1983 IXth International Congress of Anthropological and Ethnological Sciences to be held in Canada (Phase 1 in Quebec and Phase 2 in Vancouver). Includes a workshop on animal husbandry in the north of Eurasia. Contact Dr Bela Gunda.

21-23 September 1983 The Application of Remote Sensing Techniques to Arid Range Management to be held at The National College of Agricultural Engineering, Silsoe, Bedford, UK. Further details from Mr M A Keech, National College of Agricultural Engineering, Silsoe, Bedford, England MK45 4DT.

12-18 February 1984 Advancing Agricultural Production in Africa Organised by the Commonwealth Agricultural Bureaux and the Government of Tanzania, to be held at Arusha, Tanzania. Includes one session on 'Livestock production, protection and utilization'. Further information from the General Secretary (Advancing Agricultural Production in Africa), Commonwealth Agricultural Bureaux, Farnham Royal, Slough, SL2 3BN, UK.

23-27 July 1984 Kew International Conference on Economic Plants for Arid Lands Organised by the Royal Botanic Gardens, Kew and co-sponsored by ICASALS, Texas Tech University. To be held at the Jodrell Laboratory, Royal Botanic Gardens, Kew. Further information from KICEPAL, Royal Botanic Gardens, Kew, Richmond, Surrey, TW9 3AE, UK.

5 Appeal for network papers in English or French

Members, particularly those who have not yet written a paper, are encouraged to send in papers or reports which tney think may be appropriate for publication as a network paper, either in their present form or in an abbreviated version. Papers should be not more than 7000 words but could be as short as a couple of pages. Ideally they would draw attention to an issue in the design or management of some aspect of pastoral development and illustrate with details from a particular project/programme/region. Papers in French would be sent out with an English summary. Any suggestions welcome.

6 Recent publications and library facilities at ODI

Earlier this year a questionnaire was sent out asking members whether they appreciated this section of the newsletter and by now we have had a very favourable response. The following list is the result of quite an intensive search for material which has come out over the past couple of years. In following issues this section will revert to its usual shorter length.

Nearly all of the following items are available in the ODI library which has built up over the last few years, thanks to Stephen Sandford, an impressive collection on pastoral issues. All items are catalogued by author and subject. ODI receives the main development journals; and it has in addition a special section including reports, series and unpublished papers: 800 of these are within the subject of pastoral development. The library is open to all, and any network member who is passing through London is encouraged to come and make use of its facilities. The library is open every weekday from 9.30am to 5.00pm.

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Stephen Sandford

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7 Free copies available

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Please write to Fiona Harris if you would like a copy.

8 Format of this newsletter and network papers

We are considering binding together all of the papers of each issue (eg. 17a, b, c, d would all appear as 17) so that it takes on the appearance of a journal rather than separate papers. Please indicate your reactions to this by FILLING IN THE ENCLOSED FORM. Many thanks.

The effective date of this Newsletter is 5 August 1983.

Signed: Clare Oxby, Editor

Fiona Harris, Administrator

Agricultural Administration Unit

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PASTORAL DEVELOPMENT NETWORK

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Paper 16b

July 1983

PASTORAL FULANI REACTION TO GRAZING RESERVE DEVELOPMENT: THE CASE OF RUMA-KUKAR-JANGARAI, KADUNA STATE, NIGERIA

by

Moses O Awogbade*

* c/o Centre for Social and Economic Research, Ahmadu Bello University, Zaria, Nigeria

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This is an abbreviated version of a study which originally appeared in June, 1982 as Report No. 9 of the Centre for Social and Economic Research, Ahmadu Bello University, Zaria, Nigeria.

Background to the study

1. The proposal to conduct a comprehensive study on the socio-economic problems relating to the modernisation of the traditional cattle industry in Nigeria was initially planned and later discussed at the inter-disciplinary meeting with representatives from the Centre for Social and Economic Research (CSER), Nigeria Animal Production Research Institute (NAPRI) and the Department of Agricultural Economics and Rural Sociology, Ahmadu Bello University, Zaria, Nigeria, in 1978. At the meeting proposals relating to various socio-economic problems facing the livestock sector, and particularly cattle production, were discussed exhaustively; and areas which appeared to have a direct link with government policy on livestock industry were earmarked for immediate study. Briefly stated, these were:

   1) the management of economic problems facing alternative cattle production systems in Nigeria;

   2) the feasibility of 'stratifying' cattle production into the various stages of cattle breeding, raising young stock and fattening for beef and dairy production;

   3) the comparison of costs and returns in relation to beef and dairy production and various distribution channels;

   4) the relationship between supply and demand in Nigeria's urban centres; and

   5) an appraisal of the problems relating to the sedentarisation of pastoral nomads, particularly in the context of the development and management of grazing reserves.(1)

   It was in the light of proposal 5 that the meeting unanimously commissioned CSER to conduct a piece of research using Ruma-Kukar-Jangarai as a case example. This reserve was chosen because it represents one of the few developed grazing areas in the savannah zones of Nigeria. Moreover, it has sought to encourage the settlement of the transient Fulani herdsmen for decades.

2. Using Ruma-Kukar-Jangarai to demonstrate Fulani reaction to government development policy is another way of looking at the government policy objectives contained in the Second and Third National Plans, which had already laid emphasis on the establishment of grazing reserves, and on capital-intensive, large-scale production schemes. It is also a way of assessing differences of opinion among the participants at the meeting regarding the role of grazing reserves in any of the prospective solutions, which range from simply preserving areas of natural range to encouraging urban settlement and arable cultivation through the establishment of centres of permanent pastoralist settlement with commercial livestock husbandry, under group or individual land tenure systems.

3. This paper therefore contributes to the ongoing debates on the problems associated with developing a viable livestock industry in Nigeria. Discussion will be focussed on the pastoralists' reactions to Ruma-Kukar-Jangarai management and operational procedures; and on the role of the reserve in the context of cattle needs and rangeland use and development. It is within this framework that the aims, merits and overall strategy for the development and improvement of the rangelands, in Jangarai and elsewhere in Nigeria, can be evaluated and analysed. The successful development of grazing reserves will depend on their careful integration into the existing land use systems in the savannah zones of Nigeria. The question is, to what extent will it be possible to integrate the reserves into the existing land use pattern in Nigeria's savannah regions, where the effect of drought, inadequate feed resources for the national herds, and the continuous dwindling of uncultivated bush and fallow lands, are becoming apparent constraints to any meaningful livestock development? (2)

4. Government efforts to improve the cattle industry

Recent policy statements on the development of the livestock sector may throw some light on what is happening or going to happen to this vital sector of Nigeria's economy. The first indication of direct involvement by the Federal Government in livestock development can be traced to the policy objectives contained in the Second (1970-74) and Third (1975-80) National Plans. The two plans emphasised the establishment of capital-intensive, large-scale production schemes, such as ranches; and research institutions to look into all aspects of livestock development and grazing reserves. To ensure that the objectives outlined in the Second and Third Development Plans were realisable, funds were channelled to the ten northern State Governments, in the form of grants, for investment in:

(a) the management of the existing reserves;
(b) tsetse eradication and vaccination programmes;
(c) ranch development;
(d) livestock investigation and breeding centres;
(e) the promotion of projects aimed at innovating and modernising the traditional system through the injection of inputs and expertise into local industry; and
(f) encouraging full participation of primary producers (see Table 1).

5. Range development: Ruma-Kukar-Jangarai Reserve*

Runka Reserve lies within the Sudan savannah zone of Nigeria. It covers an area of 121,712 ha. Its features include low rainfall (700-800mm) and a very high grazing pressure of one animal unit per four ha. during the wet season. The predominant species of grass are Andropogon gayanus and Loudetia togoensis, in wetter upland areas. The low level of vegetation cover exposes the area to rainfall thereby causing

* Known as Runka Reserve after the name of the administrative centre for the reserve, Runka.

Table 1 Fund Allocation: Livestock Development Programme 1975-80 (in mn naira)

		FLD*	NLMA**	N.States	Total
1.	Development of grazing reserves	48.4	-	37.6	86.0
2.	Tsetse eradication	8.7	-	-	8.7
3.	Feed processing and supplementation	3.0	3.0	6.7	12.9
4.	Assistance to primary producers	-	12.0	-	12.0
	Total	60:1	15.0	44. 3	119.6

Source: Third National Development Plan, 1975-80
* Federal Livestock Department
** Nigerian Livestock Marketing Authority

large tracts of sheet erosion. Also, heavy grazing has facilitated the spread of weed grasses, not useful for grazing. The major characteristic of this region is the high population density of both cattle and humans, which exacerbates the difficulties associated with intensifying livestock activities.

6. Following the establishment of Runka Reserve in 1960 and subsequent allocation of funds for its development, specific projects, including its demarcation into ten ranges, have been implemented. Four of these ranges have been subdivided into four blocks or cells each. This it to allow for the introduction of rotational grazing and reseeding the overgrazed areas with legumes. Thirty dams and six tapkis (ponds) have been constructed. There are also fire traces in the ten ranges. In range 1, Kaduna State Government has established a beef improvement centre with an offtake of 107 Red Rahaji and Azuak stocks. In range 10, there is a 7,500 ha. ranch which can accommodate over 500 Bunaji and White Fulani. In ranges 8 and 9 the Federal Government, with World Bank assistance, is embarking on a pilot project whose objective is to develop a model grazing reserve, cattle ranch and smallholder fattening scheme. The area is also to be used to educate Fulani herdsmen in modern methods of animal production. There are also two enclosures of 32.38 ha. each to provide forage during the dry season for suckling dams and heifers in calf. Besides, attempts are being made to increase the number of pasture improvement centres, particularly in the ranges where the Fulani are concentrated. Already seven of these have been established on 472 ha. of land. The only Bull Holding Centre is located in range 6, while range 7 has a dipping well for animals suffering from acute skin diseases. A veterinary clinic is located near Runka Management Centre. There are other sub-clinics located at various settlements adjacent to the reserve. There is also a dairy processing centre.

Management and organisational system in Runka Reserve

7. When the reserve was demarcated into ten ranges in 1976 for controlling grazing, the need for effective use of its resources became one of the cardinal programmes for grazing reserve officials. It was on this basis that 10 Fulani Ardos (chiefs) were appointed, one for each range. The principal role of the chiefs is to act as mediators between, on the one hand, the herdsmen and, on the other, the Councillor for Agriculture and Animal Resources and Kaduna State officials, in such areas as the dissemination of official directives on policy matters and the maintenance of law and order. They are also required to help collect cattle taxes for the Dutsin-ma Local Council. In political terms, they act like village heads, even though each one of them is formally under the jurisdiction of village heads. Unlike the village head who has considerable political power over his subjects, the ten chiefs operate primarily through moral persuasion; this can be very difficult to operate because of the independent nature of Fulani herdsmen on pastoral matters. Again, the fact that livestock owners are dispersed in several villages surrounding the reserve is another constraint for the elected chiefs, since there are often operational difficulties in transmitting news about range policies. Perhaps this may account for the political decision, made by range officials, to form the local Grazing Committee, whose role is advisory.

8. The formation of this advisory committee in itself implies a certain sharing of managerial responsibilities. This is particularly necessary in the case of herd owners, who possess considerable authority and vast experience over decisions about animal movements, use of ranges and the like. Their experience, in real terms, becomes the crucial link between the management and policy objectives. It could be assumed that the monthly meeting was started in order to link the planned objectives with the wishes and aspirations of Fulani herders using the reserve. It was foreseeable that not all the Fulani would find attending the monthly meeting convenient, because of their frequent movements. However, some Fulani interest groups did see the meeting as an avenue to air their views on matters connected with the management of the reserve. The proceedings of the meeting reflect the basic objective of the advisory committee: namely, to facilitate communication and to interpret to the Fulani what the government intends to achieve on such matters as: conditions in the ranges; staffing problems; herd and stock control; use and preservation of infrastructure; pasture development and provision of supplementary feeds; veterinary services; and the maintenance of law and order.

9. The Committee has not conformed to the ideal described above; indeed, according to the records of the deliberations, the contrary was the case. For instance, in a meeting called to discuss the issue of rotational grazing and how to implement it, a Fulani chief raised an objection about some

forest guards and range officials. Before he had completed his speech he was asked to keep quiet, and he refused. A confrontation ensued, and he walked out. It was at this stage that one of the officials gave a warning to the effect that 'any Fulani chief who disregards or disagrees with government policy would be changed'. On another occasion, a Fulani raised a serious issue concerning a confrontation between a herdsman and some forest guards which led to the death of the former. The matter was brought to the notice of the reserve officials for an inquiry. The latter agreed but did nothing. When the matter was raised again by the Fulani, the officials refused to open discussion on it. Also, allegations of favouritism were often made against reserve officials,especially in relation to the distribution of free supplementary feeds. The most serious allegation was that the Fulani were being excluded from the conception and formulation of policy matters. The policy on rotational grazing was cited as an example.

10. The attitude of the Grazing Committee, as well as Fulani opinion leaders, clearly represents one of the most crucial and fundamental challenges facing development efforts in the area. And it borders on the issue of how to win grass-roots political support to back up rural transformation policy (see Awogbade, 1980). Only this can ultimately guarantee collective leadership and sharing of responsibilities; unfortunately the local Grazing Committee has not yet achieved this.

11. One would have thought that the reasons for forming the Grazing Committee were as follows:

    1) to eliminate the contradictions inherent in the master/servant relations existing within the community;

    2) to reduce the costs of conveying managerial instructions to the herders, through effective use of Fulani institutions;

    3) to encourage range officials to carry out an assessment of the existing social institutions, so as accurately to determine their suitability (or otherwise) for some form of managerial role where feasible; and

    4) to inculcate in the Fulani an attitude to development in line with their desire to improve themselves and their economic interests.

12. Another dimension which needs to be highlighted is the apparent deficiency in the day-to-day management of Runka resulting from inadequate work programmes. As at 1979, there were 32 officials representing local and state government (see Table 2). These officials (all categories) managed the 121,762 ha. reserve (54,554 head of cattle entered the area in 1978 alone). Most of them were recruited locally and all have the basic linguistic competence to work effectively with herdsmen using the reserve. The problem

was that a considerable proportion of them were responsible for too many activities, some of which were in areas beyond their training or competence. For example, grazing

Table 2 Strength of Staff: Kaduna State and Dutsin-ma Local Government

Designation	Kaduna State	Dutsin-ma L/G	Total
Range attendant	-	1	1
Stockman	1	-	1
Herdsman	1	-	1
Grazing control assistant	5	-	5
Range assistant	5	-	5
Range guard	-	17	17
Range superintendent	-	1	1
Higher range superintendent	1	-	1
			32

assistants, range attendants and guards were also performing the function of veterinary assistants. The dangers here are twofold: (1) the range officials are forced into a role conflict situation, and (2) this interferes with their basic functions as range officials. The role they perform now (range officials with veterinary extension duties) certainly requires a high degree of confidence between them and the herdsmen they serve. An example of such a role conflict occurred during the introduction of rotational grazing in 1978. At one time the range officials performed policing functions, as grazing control assistants and guards; and at another time they performed welfare functions, as veterinary innoculators. This dual role is certainly a threat to the objectives for which the reserve is established - the generation and diffusion of information on improved methods of land utilisation and improved animal production.

13. There is also the issue of the location of grazing reserve officials' homes. Of those interviewed, 17% live inside the reserve in quarters provided by the government. The remainder, 83%, live outside the reserve; for these there is the additional burden of commuting from their home base to the reserve daily either by foot, bicycle or motorcycle. Since access roads to the reserve are often unusable in the wet season, the effectiveness of the performance of the change agents has become a matter for concern. In fact, they are hampered in their job; their extension function, in particular, is not adapted to the transhumant nature of Fulani pastoral activities.

Range utilisation and herd development

14. The various groups utilising the reserve can be grouped into three: firstly, those who stay in the reserve throughout the year, practising animal husbandry but no arable farming; secondly, those who reside in the villages surrounding Runka practising animal husbandry and arable farming - these 'mixed farmers' have title (through purchase) to the land which they cultivate and cattle rearing still remains their major preoccupation. Thirdly, the seasonal graziers, who normally migrate to the reserve at the onset of the rains in June, and withdraw to their permanent base at the onset of the dry season in September/October.

15. In assessing the level of grazing efficiency or range utilisation, the cattle population between 1960 and 1977 was used as a base (see Table 3). The recorded figures were conservative estimates, nonetheless they helped to ascertain a crude assessment of the pattern of range utilisation. No attempt was made to consider each range separately since there was no way of controlling stocking rates on them and there was a constant movement of herds between ranges.

Table 3 Cattle population: Ruma-Kukar-Jangarai 1960-77 (wet season only)

Ranges	Cattle population
1	32,700
2	38,200
3	44,400
4	76,800
5	47,500
6	76,300
7	68,500
8	49,900
9	27,500
10	25,800

Source: Range Management Centre, Runka

Table 3 shows that the reserve carries a large load of cattle: the density of cattle population per grazable unimproved land (or stocking rate) is one animal per four hectares (1:4) (3). The largest concentration of livestock in the reserve occurs during the wet season (June to October). From November, when the quality and quantity of herbage declines due to intensive use, leaching, accidental or intentional burning of the ranges, cattle are moved to farmlands where crop residues and stubble are available. With the declining fodder situation, some herders often decide to remain for a longer period, feeding their animals on upland dry herbagesthat do not contribute significantly to their protein requirements. Dry season upland herbage contains negligible digestible crude protein (2%) which falls far below the grazing animals' daily protein needs. Due to this factor, grazing animals are deployed to low-

lying land (fadama), burnt areas where forage regrowth is available with browse plants. The intensive use of crop residues begins in December when harvesting of crops ceases. This is the time when most of the ranges are deserted. Often, herds are divided at the onset of the dry season with half sent southwards. Traditionally, access to crop residue fields is on the basis of reciprocity - cattle dung in return for residues. Presently, this type of exchange relationship is becoming a source of revenue for some farmers. The traditional principle of cow dung residue privilege is breaking down gradually, and farmers are now asking high prices for the residues.

16. In a survey conducted by us, 62 households of mixed farmers, pastoralists, and transient pastoralists were asked to rank their expenses on the maintenance of their cattle during the year. The primary objective was to determine the obvious connection between input and output factors in livestock maintenance, particularly during the dry season. In doing this, the amount realised from cattle sales for the 1978/79 grazing season was taken as the independent variable, while expenditure on crop residues, fencing, supplementary feeding on concentrates, ropes, water troughs and medicine, feed mineral troughs, herd boy wages, veterinary services, were regarded as the dependent variables. A multiple regression linear model was obtained from the data. For details see Appendix 1. The most important explanatory variable was the amount of money spent on crop residues; this alone accounted for 35.6% of the variation on the income or amount realised. Next was expenditure on herd boy wages (23.5%), and supplementary feeding on concentrates (3.1%).

17. Heavy investments are an indication of large household herds. This is based on the assumption that a relatively balanced protein intake by the grazing herds will have the tendency of minimum risk of diseases and invariably less psychological stress for herders themselves. Whereas, in households with large herds but low expenses on inputs, the attendant risk of diseases will have undesirable effects on their holdings. It is clear from the data sheet that the latter households are usually the first to move out southwards to avoid loss of cattle and psychological stress.

18. With the introduction of rotational grazing in June/July 1978, the management saw an opportunity to change the traditional herd deployment system of free range, into one in which groups of herders would be confined to a range at a particular time. This resulted in open conflict of interest. There ensued a coalition of interests on the means by which this system must be operated, and the ends to be achieved. The majority of those who resisted the change were permanent residents who still wanted to adhere to the old transhumant husbandry system.(4) In solidarity, the seasonal graziers joined them. This forced the 'management' to bring in law enforcement agencies to arrest the situation with the aim of enforcing the new system.

of cattle'. There is thus a certain consensus that settlement is desirable, but the means of achieving it seem to be the bone of contention. Furthermore, settlement is not seen in terms of the modernisation of livestock production activities.

27. We also ventured into issues relating to the management of the reserve. We wanted to find out who the Fulani felt should be actively involved in the determination and operation of Runka policy objectives. For this we selected six institutions which we believed could be directly involved in the management, operation and determination of policy objectives. These institutions were ranked and weighted (see Table 4). Grazing leaders from 45 randomly selected cattle camps were requested to identify and rank the three most preferred institutions. These institutions are: Fulani opinion leaders, all pastoral Fulani, representatives of the State Government, representatives of the Federal Government, representatives of Dutsin-ma Local Council, and an all people's committee (Fulani and non-Fulani).

Table 4 Herders' preferences for institutional involvement in Runka Grazing Reserve

(institutional involvement score in %, rounded up)

	1 most active (wt x mark)	2 2nd most active (wt x mark)	3 3rd most act (wt x mark)
1. Fulani opinion leaders	40	33	18
2. All pastoral Fulani	33	11	11
3. Rep. of State Government	18	31	24
4. Rep. of Federal Government	7	20	47
5. Rep. of Dutsin-ma Local Council	-	4	-
6. All peoples' c'ttee (Fulani and non-Fulani)	2	-	-
	100	100	100

Fulani opinion leadership scored relatively high in categories 1 and 2, but relatively low in category 3. Representatives of State Government performed well in categories 2 and 3 but not so well in 1. All pastoral Fulani performed creditably in category 1, and poorly in 2 and 3. In general, the order of ranking is as follows: Fulani opinion leaders, followed by

representatives of the State Government, and lastly all pastoral Fulani. Interestingly, we had expected Dutsin-ma Local Council to perform more creditably being the nearest public informant to the Fulani. The contrary was the case. The reason perhaps may not be unconnected with the tense situation at the reserve at the time we were conducting the survey. Also it may be due to the roles and activities of the local grazing committee which precipitated the recent crisis in the reserve and in which a young Fulani herdboy lost his life. The performance of the all people's committee (2%) is not unexpected. Its total rejection is quite understandable. They are not pastoralists, hence non-starters in husbandry management affairs.

28. The day-to-day running of the reserve is also relevant to the issue of using the reserve as a stepping stone to encourage settlement. The difficulty here is clearly a function of Fulani perception of what constitutes good livestock management procedure, and what does not. This re-echoes Fulani attitudes towards the manner in which reserve officials handle delicate administrative activities, and the officials' perceptions of how the area should be administered. A questionnaire was designed for the above purpose, and administered to 47 heads of cattle camps in the reserve. It was structurally ranked as to indicate Fulani feelings towards some administrative measures connected with: the provision and distribution of inputs (supplementary feed or concentrates), rotational grazing, abuse of official privilege, 'management' interest in the welfare of Fulani cattle, and interpersonal relations between officials and herdsmen. Responses were also divided into four categories: strongly favourable; moderately favourable; moderately unfavourable; and strongly unfavourable. 43% of the herdsmen were strongly unfavourable; 12% were moderately, unfavourable; 20% were strongly favourable and 25% were moderately favourable. The same rank-ordered categories were used for the reserve officials: 68% of them were strongly favourable about their own management activities and their interpersonal relations with the Fulani, 14% were moderately favourable, 16% strongly unfavourable and 2% were moderately unfavourable.

29. The Fulani and the reserve officials thus have opposing views: the former feel strongly dissatisfied with measures introduced to forestall free movement within the ranges, and to involve law enforcement agencies in the disputes between them and the administration. The officials, on the other hand, feel that the way in which they control the use of the reserve is within the rules laid down for the correct management of the reserve.

30. Five areas of dispute between Fulani and range officials can be identified: first, 64% of the Fulani respondents felt that the present arrangements on deferred rotational grazing and distribution of inputs did not live up to their expectations; second, 52% felt there was an abuse of official responsibility, particularly in the day-to-day relationships;

third, 62% felt that the officials, as public informants, should listen to them when discussing problems arising from the use of the reserve; fourth, 76% were of the opinion that the present system of control was gradually eroding the existing group and family solidarity and socio-economic organisation; fifth, 89% objected to the use of the present cadre of officials, who are not Fulani, as the main channel of communication between them and the government on livestock policy matters.

31. These areas of dispute are further complicated by Fulani concern about the long-term viability of the area. The herders are worried about how to cope with the long-term grazing requirements of herdsmen, and with the imminent threat of both human and bovine population increase. They are also concerned about the suggestion to encourage mixed farming within the reserve; and they foresee future socio-ecological problems resulting from the increase in the population of animals and humans consistent with the intensification of land use in this low rainfall area. These issues raised by the Fulani are fundamental for the eventual success of rangeland development in Nigeria. Fulani assessments and complaints are based on four inseparable needs within the traditional animal production system: agreeable social relations, security, philosophy of free rangeland use, and livestock needs (particularly with the present ecological deterioration in the reserve and the low rainfall characteristic in this region).

32. It should be noted that the grazing reserve is presently being accorded recognition as an important pastoral development project for the 1980s. Also, it is being suggested as the obvious solution to the complex problem facing nomadism and livestock production. And for this purpose, lands are being acquired and gazetted, slowly but consistently. All this indicates that pastoral projects of the kind being projected by the Nigerian Government need to be assessed in terms of their long-term effect on existing Fulani pastoral instititions, in terms of their specific production objectives vis-a-vis the government production objectives, and in terms of the supportive social services which grazing reserves demand. These are the areas that would finally determine the future rangeland scheme in Runka and elsewhere in Nigeria.

33. In any case, like all other previous forms of pastoral development (eg. the relocation of the National Herds after the 1970s drought), the establishment of reserves implies and demands management. Not only in terms of range, animal and veterinary management; there should also be some reliable assurance of adequate opportunities for Fulani pastoralists to assume some form of management responsibility, not connected with capital development in the reserve. In other words, the perspectives of reserve development should be slanted heavily towards Fulani herdsmen as a necessary step in building up their confidence and integrating their objectives with those

of the national objectives and aspirations. The establishment of grazing reserves in the ten northern states where nomadic pastoral Fulani are mostly found, represents a first stage. Whatever part grazing reserves play in influencing and encouraging the attitude of the pastoral Fulani towards animal production, problems of management, particularly of motivating the interest and support of Nigeria's animal husbandry practitioners on a permanent basis, will ultimately become a crucial issue for determining their success.

34. Whichever way development progresses in Runka, the following set of interventions are suggested as suitable for supporting the policy objectives of the Government, and for confidence-building measures to sustain continuous Fulani interest in rangeland development:

1) attempts should be directed towards reversing range deterioration trends by establishing more areas of improved pastures, and an efficient system of controlled land use management, with veterinary and physical infrastructure, and extension inputs, aimed at improving the livestock economy.

2) Simple handling facilities (dipping, castration and innoculation centres) must be increased, commensurate with the establishment of improved methods of management. Users in the reserve should be taught how to make use of these facilities effectively. That means herdsmen must become involved in all the livestock handling and they should be encouraged to provide the bulk of the labour at handling centres.

3) It is necessary at an early stage of development to start thinking in terms of maintaining long-term productivity. The present prohibition against farming inside the reserve must continue. Since most of the pastoralists using the area already maintain a permanent home base, their involvement in crop cultivation should be encouraged. The Fulani should be given formal land rights on the land they occupy. This will encourage closer links with the government and the development agencies. Also they should be encouraged to use mineral fertilizers in addition to animal manure. This will enable them to get a better output of crop residues on which the sustenance of animals depends during the dry season.

4) The structure of the local grazing committee needs reappraisal and reorganisation along these lines: representatives from the State and Dutsin-ma Local Government, senior management officials of the reserve and Fulani representatives. Consultation and not enforcement should be the basic rule of the committee. This will help in rebuilding lost confidence in the committee and thereby discard the top-down approach which has been the order during discussions relating to policy issues and the management of the reserve.

5) The exclusion of the Fulani on important committees in the field of agriculture and natural resources has alienated them in the decision-making processes. It is therefore essential that Fulani be co-opted as members. A Fulani should represent each district of the Dutsin-ma Local Council; this would mobilise them on matters affecting their welfare and economic interest. In fact, it will help in the division of responsibility between the management and the pastoralists, which hitherto has not been explored.

6) There is the need to reappraise the multi-functional activities of the extension agents. Their role in these activities forces them into a conflict situation which in the end poses a threat to the objectives for which the reserve was established. As an interim measure, the strength of the management staff should be increased for each range; and each range official should take responsibility over the organisation and supervision of daily operations in the reserve.

7) Apart from the local grazing committee, a monitoring committee should be formed to serve as liaison with the central management authority and local government authority. Members should include a Fulani representative from each of the ten ranges; a range officer representing each range; and senior veterinary officials. The committee's responsibility should cover the following areas: animal health, fire and water points control, pasture development, adjudication of conflicts between reserve officials and herdsmen, problems associated with the allocation of grazing spaces, the maintenance of essential facilities, and general improvements of the reserve.

* * * * * *

NOTES

1. In 1965 the then government of Northern Nigeria enacted the first grazing reserves law to protect the traditional livestock industry by setting aside traditional grazing lands as grazing reserves. Ruma-Kukar-Jangarai, formerly known as Katsina Native Authority Reserves no. 11 and 12, fell under this arrangement. With the effect of the 1974 drought on the national herds, further grazing reservation proposals were made. During the Third National Plan (1975-80), a target figure of 22 million hectares was put forward by the ten northern states. In 1978 guidelines on grazing reserves development were approved by the National Council on Agriculture and Water Resources. By the end of 1980, only 2,020,612 hectares, or 9.2% of the targeted figure, had been acquired by state governments.

2. This paper does not intend to go into detailed discussion of this aspect of inquiry at this stage. I am in the process of putting up a proposal to carry out a comprehensive study on this, using more reserves as case studies, especially now that right of occupancy is being proposed for some Fulani herdsmen utilising Jangarai as part of the settlement project.

3. Stocking rates in the Sahel and Sudan zones of Nigeria are 8 and 4 hectares per animal unit respectively, while in the northern guinea and southern guinea savannah zones it is 2 and 1.5 hectares per animal unit respectively.

4. Traditionally, grazing and location of camps are based on two types of groupings: the extended family group, and friendship associations. In the first, camping is carried out on a related kinsmen basis; in the second it is based on long friendship and mutual understanding. This type of association is fragile in that individuals reserve the right to terminate their membership if they feel that it is not in their interest to continue.

5. Conservative estimates reveal that 50% of Fulani herdsmen are settled, 38% semi-settled and combining arable farming with animal husbandry; while about 12% are still following the age-long nomadic herding practices (ILCA, 1979).

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APPENDIX 1

Regression Analysis: Contribution of Inputs to Fulani Animal Production

Variable	Value of F	Significance	Mult.R	R.Sq.	R.Sq.cha
Crop residues	14.71035	.000	.59649	.35581	.35581
Fencing	0.19432	.661	.59654	.35586	.00005
Supp.feed on concentrates	6.57599	.013	.62326	.38845	.03134
Ropes	0.08357	.774	.59759	.35712	.00036
Water troughs	0.00473	.945	.79405	.63052	.00716
Feed mineral troughs	1.71655	.196	.59726	.35675	.00089
Herdboys wages	33.19546	.000	.78953	.62337	.23491
Vet. services	0.01249	.911	.79607	.63373	.00321
Cattle medicine	0.92600	.340	.80009	.64014	.00641

Note: Variable value of F significance multiple R.
The expenses on supplementary feeding on concentrates, veterinary services and medication ought to have been higher, but for the heavy subsidies on them from the Federal Government of Nigeria.

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TRADITIONAL CONCEPTS OF ANIMAL DISEASE AND TREATMENT AMONG FULANI HERDSMEN IN KADUNA STATE OF NIGERIA

by

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These observations were made partially during a study of the Fulani traditional anthelmintic remedies, funded by the International Livestock Centre for Africa (ILCA), Addis Ababa, Ethiopia. The bulk of the study was conducted among herdsmen co-operating with ILCA's sub-humid programme, Kaduna, Nigeria.

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1. There are no "professional" traditional veterinarians in Nigeria.[1] Perhaps because of this, traditional veterinary practice has not drawn as much attention as traditional human medicine in Nigeria. However, some degree of specialisation exists. In general, traditional knowledge of cattle diseases and remedies is to be found only among Fulani herdsmen; knowledge of poultry and small ruminant remedies is concentrated among the women and men of the settled farmers, respectively; canine remedies are known by hunters; and horse remedies are the speciality of those in service of the ruling families of the north. It is curious that although the Fulani herdsmen keep dogs, they offer no traditional medical care for them, and will rarely complain to the veterinarian about them.

2. The concepts of animal disease and treatment traditionally held by the herdsmen are often startlingly close to the orthodox. Cattle diseases are caused by infectious agents, trauma, etc. Thus goli is a disease of cattle, more significant in calves, characterised by constipation or diarrhoea and poor growth and caused by worms; the term goli is freely translated by field vets as helminthiasis.

3. In some instances the herdsmen appear to know the route of infection. The condition called madara by the Fulani is suggestive of neoascariasis. The herdsmen describe this condition as "a disease of the young calf, characterised by bloody diarrhoea and poor growth and transmitted to the calf through the milk (madara) of the dam".

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1. N.Nwude and M.A. Ibrahim, 1980. Plants used in traditional Veterinary medical practice in Nigeria. J. Vet. Pharmacol. Therap. 3:261-273).

4. The herdsmen have some knowledge of vectors and the animal diseases they transmit. Sammore seems to have become accepted to mean trypanosomiasis of cattle.[1] Sammore is described by the Fulani as a disease of cattle, characterised by weakness, emaciation and inappetence and 'caused' by tse-tse fly bites.

5. The people also have a grasp of other concepts essential for disease control. For instance, they recognise helminthiasis to be a herd problem and of more significance in calves of less than a year old. Accordingly, more than half of the Fulani anthelmintic herbal remedies are specifically for use in calves, and 'deworming' commences within one week of birth: often it continues at intervals for several weeks, at times throughout the first year of age, as a routine, depending on the particular herb.

6. Traditional management of insect-borne diseases is often directed against both the vector and the parasite. Animal houses and camps are regularly fumigated with herbs to kill insect parasites. The water extracts of the leaves of certain plants, Sesbania aculeata for example, are used as a wash for cattle before traversing a tse-tse belt as a preventive and not a cure of the bite.[2]

7. The herdsmen also employ prophylactic measures in the herbal management of cattle diseases. Often the same herb is used both to protect and to cure. In such instances, the dose and the frequency of administration are varied. Sometimes different herbs are used for cure and prophylaxis.

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1. See R C Abraham's (1961) Dictionary of the Hausa Language. Hodder & Stoughton, London. 992 pages.

2. Dalziel, J.M. (1937). The useful plants of west tropical Africa. Crown Agents, London.

8. Combination therapies abound in traditional veterinary medicines of the Fulani. Up to four or five different plants may be incorporated in one preparation. Sometimes individual herbs are used to treat the same condition. Occasionally people claim that combinations are more potent than the individual herbs, but usually the rationale can no longer be remembered.

9. The flower, fruit, seed, leaf, bark, stem and root part of plants are all used by the herdsmen, but the leaf and the bark are the most commonly used. For the treatment of a particular disease, usually a part of a plant, the bark for example, is specifically mentioned as the remedy. Asked why other parts of the same plant may not be used, most herdsmen are unable to give a reason other than tradition.

10. The plant part may be simply given to the animal to eat, or it may be extracted, usually in water, sometimes in milk, occasionally in butter. Often, dried or powdered preparations are mixed with potash or bran. In such instances the potash and bran, so the Fulani state, serve simply to disguise the medicament, which otherwise may not be palatable to the animal. The herdsmen also ensure administration of non-palatable extracts by forced drenching, but only in cases where it is desired to treat several animals.

11. Drugs employed by the Fulani may be administered orally, rectally, topically, vaginally or by inhalation. Drug administration by injection is virtually unknown to the herdsmen. Indeed, injections (especially by the intravenous route) by a veterinarian are either held with admiration or with apprehension, or, where the treatment given is ineffective, are blamed entirely for any worsening state of the patient. Situations where herds-

men change camps for fear of injections are not uncommon. Where animal health is restored rapidly after intravenous injection, the herdsmen may insist that all subsequent treatments be given by the intravenous route only.

12. The frequency of drug administration differs with the type of herb, the disease to be treated and the purpose of the treatment (curation or prevention). The concept of 'dose' is perhaps the most poorly developed in traditional veterinary medicine, indeed in traditional medicine. The herdsmen are usually unable to state how much of a plant part is to be used to prepare the medicament, and how much of the preparation is to be given. The only way to determine the dose and concentration of a particular preparation is to request the informant to prepare the medicine and to administer the preparation to preselected animals of varying but known weights and ages in the presence of the observer.

13. The herdsmen have a knowledge of plants which are toxic to their livestock, especially those plants which are acutely toxic. Most of the herbal preparations used as drugs by the herdsmen are claimed by them to be non-toxic; occasionally it is stated that a preparation may be used "even in pregnant animals". However, chronic toxicity is much more difficult to notice, even in orthodox practice. A study of the long term toxic effects of preparations is of great importance in any systematic study of traditional veterinary medicines..

14. To make the collation of information easier, the information collected more accurate, and to enable effective scientific investigations into traditional veterinary medicine, free translations of disease terms (from the vernacular to the scientific) must be discouraged. Unfortunately, there

are no dictionaries or glossaries to enable reliable translations. Even for apparently accepted translations, like sammore = trypanosomiasis, the descriptions given by the herdsmen are vague, and some clinicians claim that the term sammore applies to any chronic disease. Indeed, a number of sammore remedies are also hanta remedies. Hanta is freely translated as fascioliasis. In the case of goli if no worms are seen in the faeces, the herdsmen are unable to distinguish it from simple constipation or diarrhoea resulting from, say, a change in diet. In order to ensure accuracy, translations should be prepared by teams of investigators, including clinicians, research scientists, experts in the Fulani language, and informants.

15. Until we have such accurate translations, investigators must state fully the traditional description of the disease condition, rather than the freely translated terms; for without it, no valid conclusions can be reached as to the efficacy of a medicament against the disease for which it is traditionally used.

16. Clearly, endeavours like those mentioned above require teaming up of interested investigators from many disciplines as well as adequate funding.

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PRINCIPLES OF SELECTED CREDIT SYSTEMS FOR LIVESTOCK PRODUCTION AND DEVELOPMENT

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Introduction

1. Lending by international as well as national organisations and governments, bilateral and non-governmental donors, and several kinds of credit institutions for development in the agricultural sector, have increased considerably in the past years and decades. Lending to the livestock sector accounts for approximately 20 per cent of the total lending for agricultural purposes. Many of the early livestock loans were directed to beef cattle development in Latin America where extensive grasslands and large management units provided relatively simple conditions for further livestock development and production plans.

2. In recent years several countries started pushing cattle improvement plans for smaller production units and for groups of individual producers. Some livestock development projects have been directed to complex situations where small-scale mixed farming is practised. Recent projects increasingly involve mixed agricultural and livestock production, together with dairy, pig and poultry farming, often in smallholder development schemes. In several developing countries large areas remain to be developed for more intensive pastoral purposes; in other areas, where livestock production is more a by-product of peasant agriculture, livestock can often be developed as one component alongside farmers' other agricultural activities. Group activities and cooperative efforts in the form of ranches have been financed where traditional social structures or newly established forms of organisation indicated that these were desirable or acceptable forms of livestock operations and the most efficient means of utilising credit.[1]

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1. P J Brumby: International lending for livestock development. World Animal Review 1973, pp.6-7

3. Credit is the supply of money, inputs (goods) and/or services (labour) at a certain point in time against repayment of the same or other goods and services and/or money at a later date, often in a bigger quantity or with a certain percentage of interest added. Repayment of the loan is essential: if repayment will not be possible or is not or cannot be expected, no credit or loan should be granted. It should be replaced by a grant-in-aid, a gift, a subsidy or some kind of social welfare assistance. With credit or a loan the lender forgoes the use of money or its equivalent currency by making the loan available or extending the credit to the borrower, who promises to repay on the terms specified in the loan agreement. In this way the borrower obtains resources to use for current production (or consumption) purposes before doing the saving that would be required to obtain the goods if credit were not available.

4. The loan can be unsecured, when it is based solely on the good reputation and financial position of the borrower. Often institutional credit is conditional upon security in the form of a personal guarantee by other individuals or by the group of borrowers, mortgages on land or permanent buildings, or a lien on the livestock of the borrower. In some cases the repayment of the loan may be guaranteed by the government or a government institution. In other circumstances the repayment of the cattle loan may be secured out of the marketing returns of agricultural production, mainly cash crops.

5. Repayment should be made on a regular basis, with scheduled repayment instalments. The repayment period will often be based on the amount of credit and not on the expected returns from eg. dairy farming. That means repayment terms are based purely on financial aspects. The repayment period for cattle loans often will not exceed three or five years. The risk of death of the animals nearly always will be passed

to the borrower with issue of the animals. Therefore, it is recommendable to insure the animals - if such insurance possibilities are available - as long as there is any money outstanding under the credit agreement.[1]

Credit requirements for animal husbandry

6. Credit needs for activities of animal husbandry can be broadly classified as under:

- medium-term finance for the purchase of livestock; for replacement, strengthening, improvement or addition to herds of cattle (or goats, sheep, pigs); or for changing the herd structure;

- medium-term finance for fodder production in order to ensure a continuous supply of fodder; eg for lucerne grown under irrigation on consolidated blocks. After the lucerne field has been established, repayment is required after each harvest;

- medium-term finance for the purchase of equipment, the cost of which may not justify long term loans, or for establishing sheds as fences, waterpoints, etc.;

- short-term loans for meeting working capital requirements, connected with the purchase of feed, the running costs of the feedlot, payment of wages, marketing expenses, or disease control. The seasonal credit for the feedlot will be required for the first couple of years of operation. After this period the feedlot should have generated enough income to operate without credit;

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1. W.M. Prohl: Technical Report on Agricultural Credit in Lesotho, Part IV: Summary and recommendations for a National Agricultural Credit Scheme. Mohale's Hoek, Lesotho 1978, pp.19-20.

- long-term finance for investments on buildings, for establishing processing units (dairy industry), pasteurization plants, etc. The investments needed will not be effected on an individual basis but will often be organised under a project run by a co-operative, a regional or project authority or by government. The bulk of these credit requirements will often be met by the government too, or by international or bilateral donor assistance.

Loan terms for pig and poultry breeding are usually shorter than for beef and dairy cattle. In the pig and poultry sectors the time lapse between investment and returns is comparatively short, and their relatively high output per unit of capital used reduces the length of the terms of the loans.

7. It is difficult to generalise about the credit requirements of animal husbandry as needs may differ both in their nature and in their dimension from one type of activity to another and from one type of organisation to another. Where operations are carried out by individuals on their own and on a limited scale, credit may not be specifically needed for meeting the expenses of feeding them, partly because the expenses are low and partly because outlays and returns may be more or less continuous. The current costs can probably be met from current incomes leaving little need for credit. Also for replacement of stock on a limited scale a short-term loan may often suffice except for those who want to enter such business for the first time. In that case the credit can be disbursed in the form of a package deal. The package may consist of one or two dairy cows and feed stuff for 6 months, and even of an additional amount for a shelter for the animals. Repayment should be in 2, 4 or 6 instalments per year and the repayment period should depend on circumstances, but not exceed 3 or 5 years.

8. Where no individual loans are extended or where livestock production is not carried out individually but organised under a project run by a group or a co-operative society, initial investment will be more substantial, both on account of the number of animals required and the total amount of the group loan needed, but also on account of the common facilities which have to be built up. It is because of such considerations that assistance by way of loans features in various animal husbandry and livestock development schemes as for example institutional or government loans to small farmers for purchase of milch cattle and to participants in the scheme for forming clusters of specialised dairy farms and under various programmes for the development of poultry, piggery or sheep breeding.[1] Lending for such livestock and poultry development projects usually takes the form of a supervised credit scheme with intensive technical assistance in the preparation of the individual farm and livestock production plans, in the budgeting of expected costs, returns and repayment capacity, and for improvements in management and production.

Group lending instead of individual loans

9. In order to avoid high administrative and supervisory costs for large numbers of small loans to individual farmers or cattle breeders, lending to groups of farmers, rather than to individuals, has been advocated and practised in quite a number of countries. For a long time lending to small-scale producers was considered a dangerous and complex affair. As a consequence many credit institutions hesitated to provide small loans: the cost of making and supervising individual loans to small peasant farmers was higher than the expected returns on these loans.
Furthermore, conventional project appraisal procedures were not applicable to these small loans. However, group lending, by encouraging a number of small farmers or cattle breeders

1. Reserve Bank of India: Report of the All-India Rural Credit Review Committee, Bombay 1969, pp.865-866.

to form a group and take out one large loan instead of a number of small ones, may reduce the cost of extending loans.

10. Moreover, a much larger number of borrowers can be served, not only with credit but also with services such as extension and technical assistance, the supply of inputs or a package of short-term and medium-term credit. Another advantage, especially for the lending institutions, is the collective responsiblity of the borrowers for the repayment of the group loan. Because of the social control of the group, chances of default are lower: members of the group can put pressure on other members reluctant to repay; for if a participant defaults, the entire group would be denied further credit or the other members would have to repay the defaulter's share of the loan.

11. Of course, for a successful system of group lending a few basic considerations and conditions must be fulfilled, such as a degree of social cohesion, a manageable size of group in order to facilitate social control, and equal or nearly equal economic situation of the borrowing group members, similar credit requirements and a general acceptance of group responsibility for repayment of the loan.

12. The group loan may be on-loaned to the individual members of the group: credit co-operatives take loans from agricultural or co-operative banks in such ways for on-lending to their members. The group loan may also be utilised in some common group enterprise, for instance for group ranching, but also in collective systems of dairy farming or producer co-operatives.

13. Where the lending institutions provide 'supervised credit', it should be combined with a completely comprehensive assistance to the borrower, including:

- the compilation of detailed production plans, either for each dairy farmer/cattle rearer separately or for groups of farmers producing under similar circumstances, setting out the crops or fodder to be grown, rotation systems and inputs to be applied, and the required loan amount;

- the provision of the larger part of the loan in kind, in the form of appropriate investments and inputs;

- intensive assistance by an extension or management service, together with supervision of the application of the inputs.

14. If, instead of the labour intensive and rather expensive individual approach, one is to be able to reach groups of small producers, it is desirable to apply either an "area approach" or a "group approach" to a supervised credit system. These sometimes go together and a co-operative form of organisation can be a good solution for such an approach, especially in the context of a settlement or area development project. These co-operatives, often multi-purpose or 'integrated co-operatives' can play an important role in the modernisation and intensification of dairy farming and beef cattle breeding and in the processing and marketing of dairy products or the sale of slaughter animals.[1]

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1. The development of market facilities, organised stock routes, transport and fattening centres close to slaughter points are still too often neglected. The rewards for providing markets for the older female and young male animals can be substantial because more productive animals can then graze the pastures that are available and overall productivity can be raised substantially (Brumby, o.c., p.8).

15. Under the area or group approach all cattle owners are producing under the same conditions and circumstances. Every loan for the purchase of animals, the establishment and maintenance of a feedlot, for inputs, fodder and other expenses can be calculated, provided, supervised and followed in a similar way. Even fixed loan amounts and equal terms for repayment can be considered. Co-operatives organised at village level have a greater opportunity than agricultural banks or other credit institutions to reach the farmer at his own level and to guide and supervise all their members alike.

16. An example of such an area and group approach by multi-purpose service co-operatives was found in the Medjerda Development Project in Tunisia. The most important objective of the agrarian reforms in the late fifties in Medjerda area has been to make possible a considerable expansion of agrarian employment by means of intensification and diversification of land operation on small individual farms (about 8 hectares each). On all the newly established units the settlers had to practise mixed farming: a combination of horticulture and fodder production in a crop rotation system, together with six imported milk cows which required stable feeding. The new settlers, the beneficiaries of this land reform project, were organised into multi-purpose co-operatives as soon as the plots of land had been allotted to them. Membership was compulsory, indeed it was a condition for receiving a plot of land in the project; members had to follow the instructions of the co-operative and extension officers concerning the proper execution of the cultivation plans and the prescribed crop rotation system.

17. The co-operative societies were the intermediaries for the Tunisian National Agricultural Bank as far as extension and recovery of members' loans were concerned. For the purchase of the milk cows - by the project authority - a medium term loan was given to every settler. The co-operatives

supplied the cows to their members. The refund of the loans had to be effected in ten six-monthly terms, to be charged on the proceeds of the harvests of the seasonal horticultural crops, and on the proceeds of the milk production and the sale of calves and/or slaughter cattle.

18. Short-term loans were given for crop seasons of six to nine months and had to be repaid within one year. This credit served to finance the purchase of fertilizer and seeds (all supplied in kind), the use of irrigation water, wages to be paid and, in the early stages of the project, advances towards the cost of living. In principle it should have been possible to repay the seasonal loans out of the proceeds of the crops cultivated during that season.

19. In practice, a number of difficulties arose, especially with the repayment of loans. One of the reasons for the difficulties was an inadequate selection of the settlers who received plots on this irrigation project; another, the administrative deficiencies of the co-operatives.[1] To make matters worse members started, right from the beginning, to sell a considerable part of their harvests through

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1. For the organisation of the farms, the operation of the service co-operatives and the problems encountered, see P J van Dooren, 'State-controlled changes in Tunisia's agrarian structure' Tropical Man, Vol.I, 1968, pp.88-94 ; and P J van Dooren, 'The co-operative approach in implementing Land Reform Programmes, with special reference to Tunisia and Egypt' in M Konopnicki and G Vandewalle, Eds. Co-operation as an Instrument for Rural Development, Ghent 1978, pp.21-261 . The present author was in 1964-'65 adviser for agricultural credit and co-operatives' organisation in the Medjerda Valley Authority.

private channels instead of through their co-operative society. The proceeds of these illegal sales were mainly used for private consumption, in this way avoiding deductions for recovery of the loans. In 1965 the scheme was reorganised, with the aim of preventing the clandestine sales and stimulating the productivity of the members of the co-operatives. The advances for the cost of living of the families were discontinued. Recovery of the half-yearly instalments of the medium-term loans for the milk cows had to be effected from the returns of the horticultural production and from sales of calves and slaughter cattle. The daily proceeds from milk production were to be used for living expenses.

Revolving loan funds for livestock and poultry production

20. In an increasing number of development projects revolving funds have been established in order to supply loans to small producers. Loans from these funds, once repaid, become available again in the same project, for the same or similar target groups of beneficiaries/participants and for identical production purposes. The revolving fund, once established, should be used as a kind of perpetuum mobile to stimulate development by continually supplying loans to new groups of small producers (or to the same group, eg for reinvestments).

21. In the appendices two examples of the operation of revolving funds are given: Appendix I gives the principles of a fully paid up fund for loans to small producers. Appendix II gives the example of a proposal for Dutch bilateral aid to a poultry development project in Lesotho (1978). This aid was partly to be given in the form of a revolving fund gradually to establish numbers of egg-producing, broiler breeding and specialist rearing units in the Lesotho Poultry Project. This revolving fund was to be established by donor disbursement in instalments, keeping pace with the establishment of the poultry production units (with interest - free loans to the poultry producers).

Under normal conditions, the administration and management expenses of a revolving fund should be met out of the interest paid on the loans outstanding. In many development projects, however, the expenses for management, administration and operation of the fund have been considered as expenses of the development project or as development support. Sometimes, therefore, the project authority, the national government or a donor organisation (international or bilateral) will meet these expenses. In these cases, the revolving funds need not charge interest, especially not for loans to poor target groups.

A revolving fund for livestock loans in kind on the basis of share-contracts

22. In Indonesia, particularly in the former Dutch New Guinea (and, later on, as an element in Dutch bilateral assistance to Jamaica) loans on a share-contract basis for livestock production were given on such terms as to make the system have the effect of a revolving fund. Three variants occur:

Small individual contracts: the revolving fund provides 3 cows and 1 bull for example, to the small farmer. After 4 years, 3 cows from the offspring are selected by the fund to serve as repayment and interest; the following year a further three cows are selected. In other words, 50% interest in kind is retrieved after 4½ years.

Major individual contracts: the revolving fund provides 9 cows and one bull. After 4 to 5 years 15 animals (again 50% interest in kind) have to be "repaid" to the fund. Here again the fund may select the young animals from the offspring. These young animals in their turn can be given as a loan in kind to other farmers/cattle rearers.

Co-operative contracts: in this case individual loans (ie an even number of cows) are given to cattle/rearers, but the bulls are retained by the co-operative society or by

the production scheme (settlement project, etc). After 4 to 5 years the loans have to be repaid on the basis of 50% interest (150% of the number of cows originally received on loan). As the individual producers make use of the bulls which they do not own and do not feed, the expenses involved have to be paid by the co-operative society; or alternatively, the cattle rearers have to pay for the services of the bull.

23.. These types of "revolving loan funds in kind" must not be organised by financial institutions such as banks; the latter's role should be confined to financing them. The operation of the revolving scheme with share-contracts, especially for livestock production, should be the sole responsibility of project authorities, livestock departments and extension services. An additional advantage of these loans in kind is that the loan fund is not subject to inflation. It is advisable to attach an insurance scheme to such a loan scheme with share-contracts, as it provides a guarantee for repayment in case of illness or accidental death.

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APPENDIX I

Example of a revolving fund for the provision of credit

The example is that of a fund established with capital of 100 000 Dutch guilders. At the beginning of the year, loans are granted of 5 000 guilders at an annual interest rate of 5 per cent of the outstanding sum and an annual repayment of 1 000 guilders on each loan (both payable at the end of each year).

Year	Loans Granted	Total amount Outstanding	Repayment	Interest Payment	New Loans	Unused balance
1	20	100 000	20 000	5 000	6	-
2	20+5	105 000	25 000	5 250	6	250
3	20+5+6	110 000	31 000	5 500	7	1 750
4	20+5+6+7	114 000	38 000	5 700	9	450
5	20+5+6+7+9	121 000	47 000	6 050	10	3 500
6	5+6+7+9+10	124 000	37 000	6 200	9	1 700
7	6+7+9+10+9	132 000	41 000	6 600	9	4 300
8	7+9+10+9+9	139 000	44 000	6 800	11	100
9	9+10+9+9+11	147 000	48 000	7 350	11	450
10	10+9+9+11+11	154 000	50 000	7 700	11	3 150
11	9+9+11+11+11	159 000	51 000	7 950	12	2 100
12	9+11+11+11+12	etc				

Source: P J van Dooren, Co-operatives for Developing Countries; Objectives, Policies and Practices. Oxford 1982.

Explanation of the table:

(a) Fresh loans are made from the repayment of existing loans plus the interest earned on the latter. We are of course presuming here that this interest can be added to the fund and is not being consumed in meeting the costs of administering it. Any balance is put into a reserve fund and added to the interest and repayments of a subsequent year.

(b)The total sum outstanding at the start of a given year is to be found by subtracting from the sum for the preceding year the redemptions at the end of that year, then adding to the resultant figure the amount of new loans (made out of interest and repayments plus any balance remaining over from an earlier year).

(c)Advances made in any given year are completely repaid by the end of the fifth year thereafter and so do not any longer appear in the accounts for the sixth year.

(d) Where interest payments are not made, or are not added to the fund, new loans can never amount to more than that of the redemptions: in other words, the total amount outstanding can never be greater than the initial capital. The total number of concurrent loans (which have already been partly redeemed) will increase rapidly at first and thereafter continue to fluctuate between 30 and 35.

(e) Additions to the fund from external sources can increase possibilities of credit. Frequently the fund cannot be built up to the required level in a single year, but only over a number of years.

(f) Where there is "seepage", either through delays in loan-redemption, through the costs of administration and management where these are higher than the interest payments received, or through inflation making larger the amount of each loan, the number of new loans will diminish. As a result, the revolving fund will after some time become exhausted, both nominally and in real terms.

APPENDIX II

Abstract from "Summary of the Report of the Dutch mission - Lesotho Poultry Project, February 1978" by Dr P J van Dooren and E H Ketelaars.

Financial and Organisational Aspects

To calculate the needs and the cashflow of the revolving loan fund the mission examined the credit needs of the poultry units to be established, and came to the following conclusions:

- the loan amounts for establishing or expanding small poultry-producing units should consist of an amount for capital investment and an amount for running costs for the first production cycle;

- this total loan, to be given in kind (building, equipment, young birds, chicken food, etc.) should be repaid in ten half yearly instalments. The loans will be interest free;

- repayments into the revolving fund will be used to provide new loans to other poultry farmers;

- the farmer himself should be able to invest at least 10% of the total capital costs in his poultry unit. The loan amount for investments will therefore be limited to 90% of these costs.

In concert with the project proposers (the Director of Veterinary Services in the Lesotho Ministry of Agriculture and the Poultry Extension Division), numbers and sizes of the production units and subsequent loan amounts were decided as follows (units to be established in Phase One of the project, ie in three years):

Units	Number	Size	Loan amounts	Own investment
Egg production	200	500 birds	R 3 200	R 300
Broiler production	288	500 "	R 2 400	R 200
Specialist rearers	32	2000 "	R10 400	R 800

The average income in ten years, after deducting the repayment instalments, will be: for the egg-producing units, R 1 066; for the broiler producers R 984; and for the specialist rearers, R 1 092 per annum. (The input of own labour is less in the broiler units). The total amount of loans needed for 520 production units will amount to R 1 664 000 (within 3 years). The necessary investment in the revolving loan fund, after deducting the repayments, will therefore amount to R 1 240 320. As a result of continuing inflation, assessed at an average of 10% per year, an additional injection of R 147 680 in the revolving fund will probably be necessary in this period.

Criteria for the selection of prospective borrowers for small commercial poultry production units are as follows:

- degree of reliability, sense of responsibility, ability and education;
- ability to invest a minimum of 10% of the needed capital out of own funds;
- generation of employment and income-earning capacity for the largest possible number of small producers;
- viability and economic prospects for small but commercial units;
- social and economic circumstances which influence the need for credit, employment and income-earning possibilities for the prospective borrowers (eg preferences for widows with children who have to earn a living for their family);

- distribution of the producing units according to transport, marketing and processing facilities, spreading the units over the whole western part of the country;

- the siting of the units should not be in remote areas, but preferably in densely populated villages, because of employment creation and contribution to the diet of the inhabitants. What we have in mind is a few units per village, the actual number depending on the size of its population; besides, a certain concentration of units is desirable in areas with a higher density of population (centres of consumption) or around the processing plant (slaughter-house for the broilers).

The first producers to be selected will be those who have already some experience with poultry production, preferably with flocks of less than 100 birds, and who have shown their ability to manage a unit of 500 birds with a good chance of success.

This poultry project is especially suited to improving the social and economic living conditions of women, especially given the frequent and long periods of absence of their husbands, working as migrant labourers in South African mines.

After two years' operation of the revolving fund, a small Dutch evaluation mission is to be sent, not only to evaluate the results of the project over these years, but also to discuss whether the programme should be changed, expanded or adapted to new circumstances or proven needs. It is important, however, to uphold the main intention of the project, namely that the revolving fund should benefit small and poorer producers and should contribute to employment creation, improvement of nutrition and increased earning capacity for as many people as possible.

Loan and repayment procedures

After selection of the prospective borrowers, loan agreements must be concluded stipulating the following conditions:

- the loan will be given as "supervised credit", ie under the guidance and control of the poultry extension service, whose instructions have to be followed by the borrowers;

- the borrowers are obliged to keep simple records of production and expenditure in their units, using forms which will be provided by the poultry extension service;

- there is an obligation, for the egg-laying units, to sell a minimum number of eggs through the egg circles; and, for the broiler units, to sell their birds to the slaughter-houses of the poultry project;

- the housing and equipment of the poultry units shall remain the property of the Poultry Industry Control Board as long as the loan is not fully repaid;

- regulations about the system of repayment and the minimum amounts of the half-yearly instalments shall be respected; penalties will be imposed in case of default in repayment.

A standard loan agreement for the poultry project will be prepared by the financial controller in co-operation with the poultry extension service.

Repayment of the half-yearly minimum instalments should be linked to payments to the producers for deliveries of eggs at the egg circles, and of broilers at the slaughter-houses; and for newly established production units, to disbursement to

the rearers when delivering their chickens to the poultry division. At the time of writing the egg producers are already delivering their eggs to the egg circles. Once a month they receive the money due for these deliveries. The borrowers for egg-producing units have to deliver most of their eggs to the egg circles, only a minor part of the production being sold at the farm-gate. With the system of monthly payments for the eggs, one sixth of the half-yearly instalment can easily be deducted for loan repayment.

For the broiler producers, a similar system can easily be organised. With 5 or 5.2 production cycles per year (each cycle covering 10 weeks) and regular purchases of the broilers by the slaughter-houses, one-fifth of the yearly repayment (or 40% of the half-yearly instalment) should be deducted from the proceeds. The specialist rearers (2.6 production cycles per year) should repay 40% of the yearly repayment after each production cycle has been completed. With such systems, repayment takes place at the time the producer receives his money. For him, deduction of the repayment from the proceeds is the easiest way, and for the project it provides a guarantee that repayment will take place at the proper time.

After completing the repayment scheme (that is, after 5 years, under normal circumstances) the borrowers should be encouraged to make voluntary savings, instead of repayments, as a reserve fund for maintenance, repair and renewal of equipment and buildings.

1.1 Loans to Egg producers

Date	Number of Loans New	Number of Loans Total	Credit Amounts New	Credit Amounts Total	Repayments 10% p. 6 months	Total Disbursement
Sept. '78	25	25	R 80.000	R 80.000	-	R 80.000
March '79	25	50	R 80.000	R 160.000	R 8.000	R 152.000
Sept. '79	35	85	R 112.000	R 272.000	R 16.000	R 248.000
March '80	35	120	R 112.000	R 384.000	R 27.200	R 332.800
Sept. '80	40	160	R 128.000	R 512.000	R 38.400	R 422.400
March '81	40	200	R 128.000	R 640.000	R 51.200	R 499.200

Loans to egg producers: R 3.200 (own capital R 300)
Repayments are 10% per 6 months over total credit amount of previous half year.

1.2 Loans to broiler-units

Date	Number of Loans New	Number of Loans Total	Credit Amounts New	Credit Amounts Total	Repayments 10% per 6 months	Total Disbursement
Sept. '78	35	35	R 84.000	R 84.000	-	R 84.000
March '79	35	70	R 84.000	R 168.000	R 8.400	R 159.600
Sept. '79	50	120	R 120.000	R 288.000	R 16.800	R 262.800
March '80	50	170	R 120.000	R 408.000	R.28.800	R 354.000
Sept. '80	59	229	R 141.600	R 549.600	R 40.800	R 454.800
March '81	59	288	R 141.600	R 691.200	R 54.960	R 541.440

Loans to broiler producers: R 2.400 (own capital R 200).

1.3 Loans to specialist rearers

Date	Number of Loans New	Number of Loans Total	Credit Amounts New	Credit Amounts Total	Repayments 10% per 6 months	Total Disbursement
Sept. '78	20	20	R 208.000	R 208.000	-	R 208.000
March '79	-	20	-	R 208.000	R 20.800	R 187.200
Sept. '79	8	28	R 83.200	R 291.200	R 20.800	R 249.600
March '80	-	28	-	R 291.200	R 29.120	R 220.480
Sept. '80	4	32	R 41.600	R 332.800	R 29.120	R 232.960
March '81	-	32	-	R 332.800	R 33.280	R 199.680

Loans to specialist-rearers: R 10.400 (own capital R 800)
If they can provide R 1000 own capital, the loans can be R 10.200.

1.4 Total of Loans and Disbursements through Revolving Fund

Date	Number of Loans New	Number of Loans Total	Credit Amounts New	Credit Amounts Total	Repayments 10% per 6 months	Total Disbursement
Sept. '78	80	80	R 372.000	R 372.000	-	R 372.000
March '79	60	140	R 164.000	R 536.000	R 37.200	R 498.800
Sept. '79	93	233	R 315.200	R 851.200	R 53.600	R 760.400
March '80	85	318	R 232.000	R 1.083.200	R 85.120	R 907.280
Sept. '80	103	421	R 311.200	R 1.394.400	R 108.320	R 1.110.160
March '81	99	520	R 269.600	R 1.664.000	R 139.440	R 1.240.320

1.5 Disbursements from the Netherlands, needed to feed the Revolving Fund:

in 1978	R 372.000
in 1979	R 388.400
in 1980	R 349.760
in 1981	R 130.160

1.6 Backflow into Revolving Loan Fund

Date	Number of Outstanding Loans	Total amounts of Original Loans	Repayments
Sept. '81	520	R 1.664.000	R 166.400
March '82	520	R 1.664.000	R 166.400
Sept. '82	520	R 1.664.000	R 166.400
March '83	520	R 1.664.000	R 166.400
Sept. '83	440	R 1.292.000	R 166.400
March '84	380	R 1.128.000	R 129.200
Sept. '84	287	R 812.800	R 112.800
March '85	202	R 580.800	R 81.280
Sept. '85	99	R 296.600	R 58.080
March '86	-	-	R 26.960
	Total of Repayments in 10 half-years :		R1.240.320

If repayments after March 1981 are re-allocated to new loans, the amounts of repayments will be higher in following years.

odi

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PASTORAL DEVELOPMENT NETWORK

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Paper 17a
February 1984

NEWSLETTER

Contents

1. Together with this Newsletter we are sending you three papers and a register of Network Members.

   17b by Addis Anteneh compares the sources and methods of financing animal health services in 13 countries of west and central Africa and Madagascar

   17c by Zeremariam Fre looks at the special problems of agricultural planning for refugees in eastern Sudan, in this case Eritrean refugees with a tradition of pastoralism

   17d by Katherine Homewood and W A Rodgers presents detailed research data on range, herd composition and milk production in Ngorongoro, northern Tanzania, and argues that a pastoralist economy is compatible with conservation plans for the area.

   Finally, we enclose the Register of Members of the Pastoral Development Network. This register includes information about those members who had responded, by the end of January 1984, by filling in and returning the forms which had been sent out to all members. You are encouraged to use the information in the register to make contact with other members who have similar interests and experience. If the information contained in your entry is not accurate, please send us the appropriate details; likewise if your name has not been included in this Register but you would like it to appear in future ones.

2. Activities of the Network

   A new series of lunchtime meetings on aspects of Pastoral Development has begun: on the 15 February, Jeremy Swift (Institute of Development Studies, University of Sussex) and Angelo Maliki (University of Paris) talked about their experience in setting up herders' associations in Niger in the context of the USAID Niger Range and Livestock Project. On 14 March, Cindy White will talk about the allocation of credit to Wodaabe pastoralists in the context of the same project. Also planned are talks by Camilla Toulmin and Paul Devitt.

   Clare Oxby is about to begin a piece of research into the social organisation of herd management in Africa. She will focus on recent changes, such as the increasing use of paid labour and

the increasingly common occurrence of absentee herd ownership, and the implication of these changes for livestock sector planning.

3. Request for written comments on papers issued

One of the distinguishing characteristics of a 'network' is that information passes in both directions along the lines of contact. It is hoped that members will be encouraged to enliven the network by responding to papers concerning their areas of interest, in the form of written comments. Some of these may then be published in the next issue. Also, suggestions as to possible authors/topics for future papers are welcome.

4. Forthcoming conferences

25-28 April 1984 Annual Meeting of the Association for Arid Lands Studies, to be held in San Diego, California, USA. Further information from Robert H Schmidt, Jr, AALS Program Chairman, Department of Geological Sciences. University of Texas at El Paso, El Paso, Texas 79968, (915) 747-5559/5501.

13-18 May 1984 Second International Rangeland Congress, to be held in Adelaide, Australia. Further information from The Secretary, 2nd International Rangeland Congress, c/o CSIRO, Private Bag, Deniliquin, NSW 2710, Australia.

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Clare Oxby

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PASTORAL DEVELOPMENT NETWORK

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Paper 17b

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FINANCING ANIMAL HEALTH SERVICES IN SOME AFRICAN COUNTRIES

by

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This paper is a summarized version of a paper presented at the AAU Workshop on Financing the Recurrent Costs of Agricultural Services in Developing Countries, held at Cumberland Lodge, Windsor, UK, 3-8 July 1983; Workshop Paper No 3.

1. Summary and Conclusions

This paper is mainly descriptive and reviews the situation in 13 countries of west and central Africa and Madagascar. The period covered is primarily the 1970s. The size and composition of the animal health budget and the sources and methods of financing are discussed. The evolution of the animal health budget over the last 13–14 year period to 1978/79, the share of livestock expenditure in total national expenditure and livestock's role in the economies of the 14 countries are reviewed and compared. The role of external financing in livestock services as well as methods and channels of financing are discussed and preliminary comparisions are made between actual and budgeted expenditure and potential receipts from livestock related taxes, levies and charges. Finally the paper tries to evaluate the adequacy of existing animal health services by using selected measures and comparing the existing situation to that of standards of optimum effectiveness developed by expert investigations.

1.2 Although it is difficult to generalize too far from the evidence reviewed, the following preliminary conclusions are drawn:

- animal health services have generally not been funded by national operating budgets to an adequate level, especially considering the important role that livestock plays in the economies of several of these countries;

- there are indications that more finance could be made available, if government policy were more favourable toward allocating to the livestock services a higher portion of the revenues already being tapped from the livestock sector;

- the composition of the recurrent budget of animal health services should give cause for concern -- staff costs continue to take a disproportionately large portion and this situation, if it continues, will at some stage make field operations almost totally ineffective;

- there was and probably is a high degree of dependence on external financing, particularly for investment expenditure;

- the quantity and quality of services provided in many of these countries have still a considerable way to go before attaining adequate standards of controlling animal diseases of economic importance.

- there is need for further studies -- e.g. to extend the coverage to other geographical areas and to other livestock services in Africa; in-depth investigations into equity issues and resource allocation efficiency; alternative organization and management mechanisms of channelling finance and of cost recovery.

- apart from financial and manpower constraints to carry out such studies, access to data already available in government files and the reservations of many African decision-makers about the usefulness of

such studies pose important obstacles which can only be resolved by the cooperation of our African colleagues.

2. Introduction

Past livestock development projects in sub-Saharan Africa have emphasized principally, the transfer of technology which has proved successful in commercial ranching operations in the developed market economies and the provision of credit as well as technical assistance to facilitate such a transfer. It has now become increasingly obvious that an adequate understanding and analysis of the economic and social policy issues involved in the livestock sector are as important as technological inputs or credit. The International Livestock Centre for Africa (ILCA) recently established a Livestock Policy Unit, at its headquarters in Addis Ababa, to look into some of the policy issues considered important in sub-Saharan Africa. One of these is the financing of livestock services.

ILCA's Livestock Policy Unit intends to study the financing of such services as animal health, animal husbandry involving extension and training, marketing, management and research services. The general purpose of the study is to examine how such livestock services are financed and the effect that the method of financing has on: the adequacy of the service provided; the government's net budgetary burden; the extent to which different classes of livestock owners/-producers use livestock services; equity issues in the delivery and use of these services; and the economic efficiency of resource allocation.

The systematic study of the financing of agricultural services is a topic which has largely been neglected in the past, both by African governments and external donors. In the livestock field, the few exceptions have been studies concerning animal health services carried out for some West African countries under French and West German technical cooperation. Partly as a result of the historical importance of veterinary services in livestock development in Africa, information from the existing literature is more readily available for animal health services. Hence the choice of a study reviewing the situation regarding animal health services as a starting point.

This paper draws extensively on the studies carried out by IEMVT (1980), GTZ and SEDES (1975, 1976 and 1977). The present paper is essentially descriptive mainly due to lack of complete data. The analysis toward the end of the paper is preliminary and is further restricted, in several instances, to some 6 or 7 of the 14 countries. (Benin, Cameroon, Central African Republic, Chad, Gambia, Ivory Coast, Mali, Mauritania, Niger, Senegal, Sierra Leone, Togo, Upper Volta and Madagascar).

The paper concentrates on the recurrent budgetary expenditure allocated by central government.

3. The Size and Composition of the Animal Health Serivces Operating Budget

3.1 The Evolution of the Animal Health Budget

Table A in the annex to this paper summarizes the evolution of the animal health budget over 14 years for the 14 countries.

It can be seen from the table that funds allocated by most countries to livestock services have generally been increasing in absolute (but current value) terms during the 12-14 years up to 1978/79.

The share of animal health services in total national budgets for all sectors shows a consistent decline in most cases. Of the countries for which data are continuously available over a reasonably long period, only Mali, Senegal and Benin seem to have maintained the share of their budgetary allocations to livestock at more or less the same and relatively high level over the years.

Table A includes information on the share of livestock services in government budgetary expenditure for agriculture as distinct from total budgetary expenditure for all sectors.

Although absolute allocations to livestock services have continuously increased in all the countries (except Sierra Leone in 1978/79) over the different years for which percentage share calculations could be made, no general pattern of relationship can be established between these allocations and their relative share in total agricultural expenditure.

Although the data base may be admittedly weak, the information given by the figures in Table A indicates the inherent inconsistencies in the budget allocation process which can adversely affect the financing of livestock services in many countries in sub-Saharan Africa.

3.2 Expenditure for Animal Health Services and Livestock's Role in the Economy

Table B in the annex shows the relationship between the contribution the livestock sub-sector makes to agricultural GDP and the central government expenditures allocated to the sub-sector. The share of livestock in agricultural GDP ranges from 2% (Ivory Coast) to 39% (Chad) respectively less than 7 and more than 2.5 times the overall average (15%) for the 14 countries. For the six Sahelian important livestock countries (Chad, Mali, Mauritania, Niger, Senegal, Upper Volta), the average share is about 30% or twice the overall average. However, the percentage shown by the livestock services budget in livestock GDP does not necessarily reflect livestock's importance to the economy. In 1976/77, Chad spent only about 0.6% of its livestock GDP on animal health services and is at the bottom of the range of these values. Ivory Coast spent about 17% of its livestock GDP on animal health services and has the highest value in the range.

Unfortunately the figures shown could only be calculated from data available for 1979 so that any trend which may have emerged in relation to earlier years could not be identified. Nevertheless, it is clear that in many cases the livestock sector is not getting an allocaltion proportionate to its contribution to the agricultural sector and the economy as a whole. A simple measure to test this was used for the countries for which all relevant data were available. The measure -- the ratio of the percentage share of government agricultural expenditure in agricultural GDP to the percentage share of livestock expenditure in livestock GDP -- was calculated to be the following:

Upper Volta	1.57
Mauritania	2.84
Niger	3.80
Gambia	4.00
Ivory Coast	0.28
Cameroon	0.74
Sierra Leone	1.29
Togo	4.77

A ratio of one signifies that the level of central government expenditure for livestock services is proportionate to the contribution of livestock to agricultural GDP. A ratio of more than 1 signifies that proportionately less is being allocated to livestock than its contribution to agricultural GDP. It can be seen that except for Sierra Leone and Upper Volta which are the nearest to unity, four of the eight countries for which data are available spend a much lower proportion of agricultural expenditure on livestock than the contribution of livestock to agricultural GDP warrants. Ivory Coast presents an extreme opposite case, perhaps a reflection of the government's effort to reduce the country's great dependence on foreign supplies of livestock and livestock products.

3.3 Composition of the Animal Health Budget

In many cases staff and non-staff costs can be distinguished in the overall budget for livestock services. Table C shows the breakdown of staff and non-staff costs for the 14 countries and the years for which data are available. It is clear from the table that in most of the countries the share of non-staff costs in the total operating expenditure indicates a declining trend. Although non-staff budgetary allocations have in the majority of cases shown an increase in absolute terms during the 13 or 14-year period it is the higher rate of increase of staff budgets that has given rise to this situation. Average figures calculated for 10 countries for which data are continuously available over a reasonably long period can illustrate the situation. In these ten countries (Chad, Mali, Upper Volta, Mauritania, Niger, Gambia, Senegal, Ivory Coast, Sierra Leone and Togo), the average share of staff expenditure in the total expenditure for animal health services increased from 67% in 1970/71 to 74% in 1975/76. The values ranged from 47% to 91% in 1970/71 and from 36% to 97% in 1975/76.

Staff budgets have risen mainly for two reasons. Firstly, the number of national animal health staff of all categories has considerably increased without a proportionate increase in the materials and facilities made available to the staff.

Secondly, salary increases for animal health staff have further contributed to staff cost increases, which could not be adjusted easily once staff are already in post.

The implications of the decline of the share of non-staff expenditure in terms of the quality of services provided is rather evident apart from the wastage of expensively trained but underutilized manpower.

Information on the composition of the animal health budget, as between operational (current) and investment (capital or development) expenditure, is very difficult to obtain. Data are available only for the six Francophone Sahelian countries as shown in Table D. Lack of separate operational and investment expenditure data in most countries, do not allow a comparison of these two categories of government expenditure with that in the rest of the agricultural sector or in the economy as a whole. However, indications are that the percentage shares of operating and investment expenditure by livestock services in total national operating and investment expenditure are extremely low. The following figures for three countries illustrate the point.

Mali	$\frac{OE\ Livestock\ (L)}{OE\ Total\ (T)}$	= 0.4%	$\frac{CE\ L}{CE\ T}$	= 0.1%
Upper Volta	$\frac{OE\ L}{OE\ T}$	= 1.6%	$\frac{CE\ L}{CE\ T}$	= 0.6%
Senegal	$\frac{OE\ L}{OE\ T}$	= 0.8%	$\frac{CE\ L}{CE\ T}$	= 0.1%

OE = Operating Expenditure CE = Capital Expendiure

Source: Calculated from Table D and IMF (1982) data.

4. Sources and Methods of Financing

4.1 The Role of External Financing

Again there is information only for the six Francophone Sahelian countries and only for four or five years up to 1975. As can be seen from Table 1 below, the share of external financing in total expenditure, and surprisingly also in operating expenditure, is quite high in many of these countries. The situation in Chad is of special interest in illustrating the point.

Table 1 Share of External Aid in Total Operating and Investment Expenditure (1971-1975)

Country	Share of External Aid in:- Total Expenditure	Operating	Investment
Chad	67	64	100
Mali	48	47	100
Upper Volta	28	27	100
Mauritania	35	27	93
Niger	18	17	25
Senegal	7	8	0

Source: Calculated from Table D in annex

Apart from personnel costs, much of the operating expenditure in animal health services consists of the purchase and distribution costs of vaccines, drugs and acaricides and the running and maintenance costs of vehicles, veterinary equipment and fixed capital items such as buildings. Chad not only produces vaccines required for many of the contagious animal diseases but also exports to neighbouring countries (IEMVT 1980). Veterinary drugs and chemicals as well as fuel and maintenance items for vehicles normally have to be imported. Assuming that external financing is directly related to the requirement of foreign currency to purchase these items, then the share of external financing in the operating expenditure of animal health services ought to bear some relationship to the required expenditure on these items. In the case of Chad, let us further assume that vaccines need not be imported and paid for in foreign currency; that all drugs and chemicals are imported, and that operating costs for transportation, storage and distribution have a 75% foreign exchange component. On this basis, the share of external financing in total operating expenditure should be only 51% instead of 64%.

The assumption that external funds are provided to finance only foreign exchange needs in animal health services may appear rather unrealistic. However, historically external aid for development had most often been directly related to meeting foreign currency shortages faced by recipient countries. This said, could this situation be an indication of the inadequacy of Chad's "domestic effort" in financing the recurrent expenditure portion of livestock services?

Judging from the evidence on the expenditure side as a whole, indications are that the financing of animal health services in most countries has not reached a level appropriate to the need of adequate protection of the livestock population from the most important economic diseases. Several factors could explain this situation. One important factor could be the way in which countries raise and utilize financial resources from domestic sources.

4.2 Livestock Related Revenue

In many African countries taxes on cattle used to be the major source of revenue collected from pastoral herders. Cattle head taxes have now been suspended or abolished in several countries in Africa either because of practical administrative difficulties and irregularities in their collection or because they became counterproductive in the governments' efforts to census the animal resource. In many cases these taxes were in existence from precolonial times although they were legalized during the colonial period.

In more recent times a wide variety of duties, taxes, fees and charges have been applied in most countries possibly in part as a response to the increased livestock services being provided by veterinary or animal production departments. Table E shows the type of duties, taxes, fees and charges applicable to livestock and livestock products in the 13 West African countries and Madagascar in the 1970s. The purpose of Table E is to give a qualitative indication of what means are available and used by governments to raise funds for financing livestock services. User charges directly related to animal health services (vaccination, treatment, meat inspection, veterinary certificate charges and fees) are obviously the least popular methods judging by the number of countries applying them. This could be because of the administrative and even political difficulties which arise from levying and collecting these charges, or due to the cost of doing so.

The most popular appear to be trade taxes and charges as well as slaughtering fees perhaps because they are easier to administer and less politically sensitive (because they do not directly confront livestock owners). It is perhaps because of this indirect relationship to the final beneficiaries of livestock services that trade taxes and slaughter fees have very little chance of being recirculated to finance livestock services but normally enter general purpose central treasury or municipal accounts. Where this is the case, claims that user charges should be earmarked and recirculated to livestock services seem to have a stronger basis.

Although the revenue figures that could be potentially raised were not calculated from duty, tax and charge rates available, there are some indications of how much revenue some of the countries considered here raise from livestock and livestock products. The figures in Table 2 below are reported in the IMF (1982) yearbook for 5 of the 14 countries.

It is interesting to note that in Mali livestock head tax receipts alone are many times the operating budget allocated to livestock services.

From the figure for 1975 in Table 2 below and Table A in the annex it can be shown that the livestock head tax revenue was over five times the livestock services budget allocation in Mali. From figures available in SEDES (1975) a sum of CFA 1,400 million could have been collected theoretically in 1972 while the livestock services budget was only 11% of this figure. Using SEDES figures again, one can calculate that the livestock budget in the Gambia was equivalent to only 1.2% of the potential receipts from livestock head taxes (1970); in Chad the 1974 livestock services budget accounted for 20%; and in Mauritania 25% (1973).

Table 2 Livestock Related Revenue (Actual)

	1972	1973	1974	1975	1976	1977	1978	1979
1. Chad (million CFA)								
Meat control tax	18	9	95	14	4	NA1	NA	NA
livestock sales	135	38	37	63	1	NA	NA	NA
Total	153	47	132	77	5			
2. Mali (million CFA)								
livestock head tax	NA	NA	NA	929	961	987	964	1060
slaughter fee				6	5	6	8	7
tax on nomads	NA	NA	NA	1	2	1	6	3
Total				936	968	994	978	1070
3. Upper Volta (million CFA)								
livestock head tax	NA	44	40	51	55	50	44	47
transit tax	NA	16	13	4	NA	NA	NA	2
Total		60	53	55	55	50	44	49
4. Gambia (000 Dalasi)								
livestock head tax2	10	10	10	10	NA	53	89	NA
Total	10	10	10	10	NA	53	89	NA
5. Senegal (million CFA)								
livestock head tax	NA	167	NA	3	NA	NA	NA	NA
tax on edible fats	NA	134	NA	124	126	191	208	224
Total		301	NA	127	126	191	208	224
6. Cameroon (million CFA)								
livestock head tax	NA	NA	NA	100	10	NA	NA	NA
tax on meat transport	NA	NA	NA	NA	10	NA	NA	NA
vet.health inspection tax	NA	NA	NA	60	250	60	170	80
Total	NA	NA	NA	160	270	60	170	80

Source: IMF (1982)

1 NA = Not available

2 Only central government's share of total receipts; percentage share not stated.

All receipts from livestock related duties, taxes and charges should not necessarily be chanelled to financing livestock services including animal health, nor is it suggested that 100% collection is feasible on the basis of the rates established. What the above discussion suggests is that governments have possibilities for raising larger amounts to help operate improved livestock services, especially in those countries where the sector plays an important role in the economy. In the first instance, this of course implies that such countries undertake to accord adequate priority to livestock development.

4.3 Methods and Channels of Financing

In many African countries, mass vaccinations against the principal contagious diseases such as rinderpest and CBPP are provided free of charge. Anti-parasitic treatments are usually charged (not necessarily at full cost) to livestock owners after an initial phase of demonstration campaigns. The practice in the 13 African countries considered here (no information for Madagascar) gives the following picture. In six countries (Benin, Cameroon, Gambia, Ivory Coast, Mauritania and Togo) all vaccinations and treatments were provided free of charge at least as at 1976 (Nissen 1982). In Cameroon and Ivory Coast free services are specified only for the traditional livestock production sector (GTZ/SEDES 1976). In the Central African Republic, Chad, Mali, Niger and Sierra Leone all vaccinations are free of charge while treatments are paid for; in Senegal all vaccinations and treatments are paid for except for vaccinations against rinderpest and CBPP, whereas in Upper Volta all animal health interventions are paid for (Nissen 1982).

The provision of animal health services is normally the monopoly of government agriculture or livestock departments. There is no indication in the literature that private veterinary practice is wide spread. Private services, where they exist, are usually only in the procurement, sale and/or distribution of veterinary medicine.

We have some information on how finance for livestock services is channelled in some countries (GTZ/SEDES 1976 and IEMVT 1980).

In Mali, Upper Volta, Niger, Senegal and Gambia, in addition to central government budgets, finance is channelled through regional administrations which raise funds through different local taxes and levies including those on livestock. In Chad and Mauritania, it seems that the budget for livestock services is wholly channelled through the central treasury. In Upper Volta, Mauritania and Sierra Leone revolving funds have been established for the purchase of biological products by the animal health services.

Livestock head taxes have been cancelled or suspended in the Sahelian countries particularly during and following the big drought.

Cancellations or suspensions of livestock head taxes, apparently have not adversely affected the size of the animal health or the livestock services budget in absolute terms (at current prices). On the other hand, they seem to have affected negatively the share of the livestock budget in the national budget probably because, as indicated earlier, the livestock services budgets are in an even weaker position to have claims on funds raised from charges on activities such as cattle trade and slaughtering not directly carried out by livestock producers. There is an indication that the decline of the share of livestock services in the total budget is sharper for the years after 1973 at least in the case of Mali, Niger and Senegal, although it is uncertain that this is an effect of the change in fiscal policy.

5. Some Indicators of the Adequacy of Animal Health Services

The adequacy of services could be measured by several means. Here we used the

following as indicators:

- the number of technical staff of different categories available to animal health services in different years.
- the number of animals (cattle only for simplicity's sake) served per staff category.
- the recurrent budget allocation/expenditure per head of cattle population.

- the ratio of expenditure on personnel and non-personnel costs to measure the coefficient of effectiveness.

Obviously we need some standard or norm against which to measure the adequacy of the services provided. The following standards developed by the GTZ/SEDES group have been used.

a) As far as staff is concerned the relationships between high (HL), medium (ML) and low level(LL) staff should be

   $\frac{ML}{HL} = 3$; $\frac{LL}{HL} = 15$; $\frac{LL}{ML} = 5$.

b) financial norms were established taking (a) above into account and further assuming that 100% of the animals are vaccinated against rinderpest and CBPP and that treatments are paid for and administered by livestock owners/producers.

5.1 Table F in the annex shows the situation as regards the different categories of staff members existing in 1970, 1975 and 1979 and the ratios of low level (LL) to middle level staff. It can be seen that the total number of staff increased in 7 of the 11 countries shown. The number of high level staff increased in 9 countries including the 7 referred to above while the number of middle level staff increased in all countries.

The general picture one draws from this is that the majority of the countries concerned have concentrated on increasing the number of middle level staff mainly at the cost of increasing the number of low level field staff. As a result only very few countries could favourably measure against the standard LL:ML ratio (5:1) in 1979 while the ML:HL ratio in many of them was closer to the standard ratio of 3:1. This indicates that the staffing of animal health services in most of these countries has increasingly become top heavy and has probably affected the quantity of services provided.

5.2 Table G shows the size of the cattle population which was actually served and should, according to the norm, be covered by different categories of staff and veterinary centres respectively. The information in the table, while not exactly comparable, shows that the staffing composition is top heavy (compared to the GTZ/SEDES norm) in the majority of cases and that middle and low level staff should be increased in number relative to the other categories.

5.3 Table H shows the recurrent budget allocation or expenditure per head of

cattle population. According to similar norms used by GTZ/SEDES (1977) and Nissen (1982) the six Sahelian countries should spend an average of US$ 0.75 - US$ 0.90 per head of cattle based on 1976 data and at 1976 prices. It can be seen from Table H that only Mauritania and Senegal which spent respectively US$0.86 and US$1.22 in 1975 reach that level of financing. Although the current dollar expenditures per head have increased for all six countries between 1970 and 1979, the remaining four countries spent much below US$0.75 per head. In all cases, the increased expenditure per head is only partly caused by the decline in the cattle population as a result of the 1972-73 drought, since the overall rate of increase in expenditure per head is much higher than that of the decrease in cattle population, particularly between 1970 and 1975.

5.4 Table J shows the changes in the coefficient of effectiveness (CE) over a 9-10 year period.

The CE ratio is calculated by dividing the non-staff expenditure by the staff expenditure in order to determine the degree to which animal health staff are supplied with vaccines or drugs, means of transportation and veterinary field equipment to facilitate their operation in the field. Both GTZ/SEDES and IEMVT consider a ratio of 1 or very close to 1 as a measure of an efficient operation.

The CEs differ greatly for the different countries ranging from 0.10 to 0.69 in 1977 and 0.11 to 1.03 in 1970.

Although not a totally adequate expression of comparative efficiency (e.g. services in Mauritania may appear to look more effective than, say, Mali or Niger because of a much small number of staff given the area and the livestock population), it is important to note that except in Sierra Leone, there has been a constant decline for all the countries listed. This deterioration should be of serious concern to governments.

Staff and non-staff cost estimates have been calculated (GTZ/SEDES 1977) using the standards and assumptions mentioned earlier in this section. According to the results arrived at from these calculations, the average CE for the six Sahelian countries (Chad, Mali, Mauritania, Niger, Senegal and Upper Volta) is at around 1.1 with a range from 0.7 to 3.5. A comparison of these figures with those depicting the situation in the 1970s (Table J) makes it clear that the CE were far below this level in almost all the countries listed. There will therefore be a lot of effort required on the part of these countries in the first instance to reverse the deteriorating situation of non-staff expenditure.

It is also important not only that increasing funds are made available to animal health services but also that a policy of keeping an appropriate balance between personnel and non-personnel expenditure is maintained subsequently.

The adequacy of animal health services is not only a function of the availability of adequate manpower and funds. It is also a function of several factors including the management of the resources made available. Things like organizational structure, staff motivation procedures, disease reporting systems and the control of livestock movements are important elements which have to be looked into.

TABLE A ANIMAL HEALTH OPERATING BUDGETS (AHOB)[1/]

(National Currencies in Current Prices and Percent of NOB and AB[1/])

in million FCFA, unless otherwise indicated

COUNTRY \ YEAR	65/66	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76/	76/77	77/78/	78/79	Growth rate p.a (%) 65/66-78/79
1. CHAD AHOB	153.6	160.9	155.4	160.1	163.5	120.9	121.3	134.4	181.1	195.7	195.0	NA[2/]	NA	2.6
% NOB	1.94	1.4	1.3	1.2	1.1	0.8	0.7	0.9	1.2	1.2	NA	NA	NA	=-[3/]
% AB	NA	NA	NA	NA	NA	4.7	3.6	2.9	3.2	4.0	NA	NA	NA	-
2. MALI AHOB	56.8	NA	NA	NA	136.9	154.1	148.4	141.9	173.8	NA	NA	NA	NA	6.1
% NOB	1.08	NA	NA	NA	1.26	1.38	1.30	1.08	1.18	NA	NA	NA	NA	-
% AB	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
3. U. VOLTA AHOB	127.8	127.8	137.1	134.4	128.6	125.5	131.5	137.2	157.7	187.3	229.0	249.9	253.7	5.9
% NOB	1.43	NA	NA	1.29	1.22	1.19	1.21	1.08	1.08	0.89	0.99	0.81	NA	-
% AB	NA	NA	NA	NA	NA	NA	15.0	NA	17.8	18.3	NA	19.2	16.2	-
4. MAURITANIA AHOB	86.5	93.1	140.2	163.1	174.0	157.4	134.5	177.5	NA	220.0	244.0	229.0	270.0	4.6
% NOB	1.99	1.52	1.98	1.97	NA	1.57	1.18	1.24	NA	1.08	0.61	0.44	0.50	
% AB	INFORMATION NOT AVAILABLE								INFORMATION NOT AVAILABLE				8.5	
5. NIGER AHOB	190.5	207.2	233.6	245.9	261.9	269.8	280.6	301.6	328.0	366.5	398.6	458.6	494.6	7.3
% NOB	2.98	2.15	2.35	2.27	2.40	2.2	2.0	1.98	1.86	1.50	1.2	1.1	0.8	-
% AB	INFORMATION NOT AVAILABLE									16.0	11.9	10.9	7.9	-
6. GAMBIA AHOB (1000 Dalasi)	INFORMATION			85.8	86.1	133.0	149.7	162.9	213.2	239.7	627.3	928.1	1118.7	6.39
% NOB	NOT			0.25	0.24	0.30	0.32	0.34	0.29	0.36	0.33	0.23	0.43	-
% AB	AVAILABLE						11.6	3.5	5.8	3.7	4.7	3.2	-	-
7. SENEGAL AHOB	365.3	NA	469.1	430.1	448.7	534.6	524.0	486.0	555.1	653.5	701.8	729.6	NA	6.6
% NOB	0.80	NA	1.0	0.87	1.06	1.31	1.16	0.99	1.01	0.92	NA	NA	NA	-
% AB	INFORMATION NOT AVAILABLE													
8. IVORY COAST AHOB	242.0	305.9	380.3	513.5	570.8	592.7	621.9	NA	849.3	957.3	1234.1	1465.8	1667.1	15.4
% NOB	0.48	0.48	0.56	0.75	NA	NA	NA	NA	0.66	0.62	1.12	0.57	0.60	-
% AB	INFORMATION NOT AVAILABLE													
9. BENIN AHOB	89.6	108.7	103.3	105.4	113.4	128.7	121.2	144.3	143.3	129.6	130.1	165.0	NA	6.3
% NOB	1.08	1.32	1.24	1.07	NA	1.09	1.06	NA	NA	NA	NA	NA	NA	-
% AB	INFORMATION NOT AVAILABLE													
10. SIERRA LEONE AHOB ('000 Leone)	INFORMATION		79.8	84.2	110.6	121.5	148.9	157.7	291.8	341.8	475.4	541.2	530.9	22.8
% NOB	NOT		0.19	0.15	0.20	NA	NA	NA	NA	NA	NA	NA	NA	-
%AB	AVAILABLE		INFORMATION NOT AVAILABLE					2.7	2.7	3.1	3.6	5.7	4.9	-

1/ AHOB = Animal Health Operating Budget; NOB = National Operating Budget; AB = Agricultural Budget.

2/ NA = Information not available; "--" = Not applicable

TABLE A (Contd.)

COUNTRY	YEAR	65/66	67/68	68/69	69/70	70/71	71/72	72/73	73/74	74/75	75/76	76/77	77/78	78/79	Growth rate p.a. 65/66-78/79
11. CAMEROON	AHOB	204.9	289.0	294.4	310.8	I N F O R M A T I O N				631.3	799.6	873.7	912.9	1118.4	9.3
	NOB	0.62	0.71	0.70	0.67	N O T				NA	NA	NA	NA	NA	-
	AB	NA	NA	NA	NA	A V A I L A B L E				NA	9.4	9.1	13.2	13.7	-
12. MADAGASCAR	AHOB	341	451	501	533	580	593								12.3
	NOB	1.33	1.05	1.10	1.23	1.33	1.12	I N F O R M A T I O N		N O T	A V A	I L A	B L E		-
ZAgricultural Budget	AB	NA	NA	NA	NA	NA	6.2								-
13. TOGO	AHOB	30.5	44.7	47.7	54.3	57.4	59.7	72.1	78.5	91.1	76.5	76.5	96.0	127.2	11.3
	NOB	0.61	0.71	0.73	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
	AB	I N F O R M A T I O N				N O T	A V A I L A			B L E		2.1	1.8	2.1	-
14. CENTRAL AFRICAN REPUBLIC	AHOB	90.5	113.1	104.2	93	39.3	76.3	69.0	69.6	54.2	56.5	48.5	48.5	48.0	0.9
ZNational Budget	NOB	1.06	1.08	0.91	0.76	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
ZAgricultural Budget	AB		I N F	O R	M A T	I O N	N	O T	A V	A I	L A B	L E			

2/ For Cameroon the 1965/66 to 1968/69 budget was common for both livestock and fisheries. After 1969/70 - Livestock only; figures from 1974/75 include both operating and investment budgets.

3/ No explanation given for the sudden and sharp decline of AHOB starting in 1970/71.

Sources: SEDES (1975) GTZ/SEDES (1976) IEMVT (1980), IMF (1982)

TABLE B LIVESTOCK GDP AND THE ANIMAL HEALTH SERVICES BUDGET (1979) IN MILLIONS OF CURRENT US DOLLARS AND PERCENTAGES

Country	Total GDP	Share of Agri. in Total GDP	Value of Agri.GDP	Share of Livestock in Agri.GDP	Value of Livestock GDP	Budgetary Agricultural Expenditure (BAE)	BAE as% of Agri.GDP	Animal Health Budgetary Expenditure(AHBE)	AHBE of Livestock GDP
	US$m.	%	US$m.	%	US$m.	US$m.	%	US$m.	%
Chad	570	70	399	39	156	NA	NA	0.92	0.59[1/]
Mali	1220	42	512	36	184	NA	NA	NA	NA
Upper Volta	860	38	327	27	88	7.3	2.2	1.19	1.4
Mauritania	470	27	127	26	33	13.7	10.8	1.25	3.8
Niger	1710	44	752	30	226	29.5	3.9	2.33	1.0
Gambia	132	46	61	16	10	14.4	23.6[2/]	0.59	5.9
Senegal	2480	29	719	21	151	NA	NA	3.43	2.3[2/]
Ivory Coast	8130	26	2374	2	47	108.8	4.6[3/]	7.80	16.6
Benin	850	43	365	12	44	NA	NA	0.77	1.8[2/]
Cameroon	5330	32	1706	10	171	38.3	2.3	5.77	3.1
Sierra Leone	790	36	284	6	17	10.9	3.8	0.50	2.9
Madagascar	2810	34	955	21	200	NA	NA	NA	NA
Togo	1000	25	250	10	25	28.5	11.4	0.60	2.4
CAR	640	37	237	8	19	NA	NA	0.23	1.2
Total/Average[4/]	27992	32	9068	15	1371			24.86	2.5

1/ 1976-77
2/ 1977-78
3/ 1980
4/ Unweighed

Sources: World Bank (1981) for total GDP and share of agricultural in total GDP; Jahnkee (1982) for share of livestock in agricultural GDP; Table A for animal health services budget.

TABLE C COMPOSITION OF THE ANIMAL HEALTH SERVICES BUDGET

Staff and Non-Staff Expenditure - in 1000 Dalasi(Gambia); 1000 Leone(Sierra Leone); Million FCFA for the Rest & Percentage[1/]

COUNTRY \ YEAR	1965/66		1967/68		1968/69		1969/70		1970/71		1971/72		1972/73		1973/74		1974/75		1975/76		1976/77		1977/78		1978/79	
		%		%		%		%		%		%		%		%		%		%		%		%		%
1. CHAD																										
i. Staff Budget(SB)	102.8	67	102.8	67	109.0	70	111.0	69	115.0	70	97.3	80	94.7	79	112.9	84	144.0	85	146.0	81	NA	NA	NA	NA	NA	NA
ii. Non-Staff "(NSB)	50.8	33	58.6	33	46.4	30	49.1	31	48.5	30	23.6	20	25.6	21	21.5	16	24.5	15	35.0	19	NA	NA	NA	NA	NA	NA
2. MALI																										
i. SB	38.7	68	NA	NA	NA	NA	NA	NA	65.1	48	70.2	46	64.8	44	94.6	67	118.4	68	NA	NA	NA	NA	KA	NA	NA	NA
ii. NSB	18.1	32							71.8	52	83.9	54	83.6	56	47.3	33	55.4	32								
3. U.VOLTA																										
i. SB	103.0	81	110.0	86	118.3	86	115.3	86	114.1	89	107.3	86	113.3	86	118.1	86	138.2	89	166.3	89	207.9	91	228.3	91	231.7	91
ii. NSB	24.8	19	17.8	14	18.8	14	19.1	14	14.5	11	18.2	14	19.1	14	19.5	11	21.0	11	21.1	11	21.1	9	21.6	9	22.0	9
4. MAURITANIA																										
i. SB	58.4	68	71.7	77	74.9	54	80.3	49	81.2	47	85.2	54	96.0	71	101.5	57	NA	NA	147.5	67	169.0	69	165.5	72	169.5	63
ii. NSB	28.1	32	21.4	23	65.3	46	82.8	51	92.2	53	72.3	46	38.5	29	76.0	43			72.5	33	75.0	31	63.5	28	100.5	37
5. NIGER																										
i. SB	119.6	63	123.6	60	132.3	57	136.8	56	143.6	55	145.9	54	156.5	56	163.6	54	197.2	60	252.0	69	235.5	59	287.2	63	301.1	61
ii. NSB	70.9	37	83.6	40	103.3	43	109.1	44	118.3	45	123.9	46	124.1	44	138.0	46	130.8	40	114.5	31	163.1	41	171.4	37	193.5	39
6. GAMBIA(100 Dalasi)																										
i. SB	NA	NA	NA	NA	NA	NA	68.6	80	69.5	81	102.2	77	113.8	76	121.3	75	165.2	78	175.7	73	470.4	75	656.9	82	829.2	70
ii. NSB							17.2	20	16.6	19	30.8	23	35.9	24	41.6	25	48.0	22	64.0	27	156.9	25	171.2	18	355.5	30
7. SENEGAL																										
i. SB	252.3	69	NA	NA	304.8	65	330.7	77	335.2	75	371.7	70	389.0	74	386.2	80	459.4	83	545.5	84	593.9	85	620.7	85	NA	NA
ii. NSB	113.0	31			164.3	35	99.4	23	113.5	25	162.9	30	135.0	26	99.8	20	95.7	17	108.0	16	107.9	15	108.9	15		

1/ Percentage share of staff and non-staff budget in total budget

NA = Data not available

TABLE C (Contd.)

YEAR / COUNTRY	1965/66		1967/68		1968/69		1969/70		1970/71		1971/72		1972/73		1973/74		1974/75		1975/76		1976/77		1977/78		1978/79	
		%		%		%		%		%		%		%		%		%		%		%		%		%
8. I.COAST																										
i. SB	115.0	48	188.0	62	228.2	60	329.4	64	411.2	72	419.4	71	433.9	70	NA	NA	631.4	74	729.4	76	876.4	69	1012.0	71	1137.2	74
ii. NSB	127.0	52	117.9	38	152.1	40	184.1	36	159.6	28	173.3	29	188.2	30			217.9	26	227.9	24	357.7	31	433.8	29	427.9	26
9. BENIN																										
i. SB	68.5	77	84.9	78	84.6	82	85.8	82	90.7	80	102.0	79	93.4	78	116.3	81	115.3	81	DATA NOT AVAILABLE							
ii. NSB	21.1	23	23.8	22	18.7	18	19.6	18	22.7	20	26.7	21	27.2	22	28.0	19	28.0	19								
10. CAMEROON																										
i. SB	130.9	64	146.1	51	175.2	60	194.2	63	BREAKDOWN NOT AVAILABLE																	
ii. NSB	74.0	36	142.9	49	119.2	40	116.6	37																		
11. S.LEONE (000 LEONE)																										
i. SB	NA	NA	NA	NA	38.2	46	46.4	55	51.4	47	53.0	44	64.3	43	71.6	46	69.2	24	121.9	36	136.1	29	151.1	28	151.8	29
ii. NSB					41.6	52	37.8	45	59.2	53	68.5	56	84.6	57	86.1	54	222.6	76	219.9	64	339.3	71	390.1	72	379.1	71
12. MADAGASCAR																										
i. SB	183.0	54	211.0	47	269.0	54	301.0	57	314.0	54	341.0	58	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
ii. NSB	158.0	46	240.0	53	232.0	46	232.0	43	266.0	46	252.0	42														
13. TOGO																										
i. SB	28.9	89	40.0	90	42.6	89	48.8	90	52.3	91	55.3	93	66.8	93	73.3	94	85.5	94	74.5	97	67.3	88	87.2	91	116.9	92
ii. NSB	3.6	11	4.7	10	5.1	11	5.5	10	5.1	9	4.4	7	5.3	7	5.2	6	5.6	6	2.0	3	9.2	12	8.8	9	10.3	8
14. CAR																										
i. SB	48.7	54	52.0	46	60.7	58	58.2	63	NA	NA	47.7	63	48.5	70	41.7	60	33.6	62	31.3	55	32.5	67	40.5	84	48.5	95
ii. NSB	41.8	46	61.1	54	43.5	42	34.8	37			28.6	37	20.5	30	27.9	40	20.6	38	25.2	45	16.0	33	8.0	16	2.5	5

Sources: IEMVT (1980); GTZ/SEDES (1977), GTZ/SEDES (1976); SEDES (1975)

NA = Not available

TABLE D COMPOSITION AND SOURCE OF FINANCING OF THE ANIMAL HEALTH SERVICES BUDGET

(Million FCFA)

Country	Period	Total Expenditure			Operating Expenditure			Investment Expenditure		
		TA[1]	EA[2]	NB[3]	TA[1]	EA[2]	NB[3]	TA[1]	EA[2]	NB[3]
Chad	1972-75	1580.7	1066.5	514.2	1422.2	907.9	514.3	158.5	158.5	-[4]
Mali	1971-75	1120.5	536.2	584.3	1094.5	510.2	584.3	26.0	26.0	-
Upper Volta	1971-75	985.2	275.0	710.2	975.2	265.0	710.2	10.0	10.0	-
Mauritania	1972-75	1582.7	553.0	1029.7	1404.7	387.5	1017.2	178.0	165.5	12.5
Niger	1971-75	1777.7	319.7	1458.0	1619.6	280.6	1339.0	158.1	39.1	119.0
Senegal	1971-75	2980.0	217.4	2762.6	2730.0	217.4	2512.6	250.0	-	250.0

1/ TA = Total for each category

2/ EA = External aid

3/ NB = National budget

4/ "-" = NIL

Source: GTZ/SEDES (1976)

TABLE E TAXES, DUTIES AND CHARGES APPLICABLE TO LIVESTOCK & LIVESTOCK PRODUCTION (1975)

Type of Levy	Chad	Mali	Upper Volta	Mauri-tania	Niger	Gambia	Senegal	Ivory Coast	Benin	Cameroon	Sierra Leone	Togo	CAR	Mada-gascar
1. Import/export duties & taxes on live animals, meat, edible offals	X	X	X	X	X	X[1]	X[8]	X[11]	X	X	X[13]	X	X	X[16]
2. Trade licence fees on butchers & merchants	X	X	X	X	X	–	X[9]	X	X[12]	X	X[14]	–	X	–
3. Livestock head tax	X	X	X[2]	X[3]	X[5]	X	X	–	–	X	–	–	–	X[17]
4. Meat Inspection taxes, charges	X	–	–	–	–	–	–	X	–	–	–	–	–	–
5. Vaccination charges	–	–	X	–	–	–	X[10]	–	–	–	–	–	–	–
6. Treatment charges	X	X	X	–	X	–	X	–	–	–	X	–	X[15]	–
7. Slaughtering fees	X	X	X	X	X[6]	X	X	X	X	X	X	X	X	X
8. Market fees	–	–	–	X	–	–	X	X	–	–	X	–	–	–
9. Holding ground fees	–	–	X	–	–	–	–	–	X	–	–	–	–	–
10. Transit fees	–	–	X	–	–	–	–	–	–	–	–	–	–	–
11. Sanitary taxes and vet. certificates	–	X	–	–	–	X	X	X	–	–	X	–	–	–
12. Other charges	–	X[1]	–	X[4]	–	–	–	–	–	–	–	–	–	–

1/ an additional development tax in one region.

2/ excluding camels, sheep and goats.

3/ suspended for 5 years from mid-1972 because of the drought.

4/ "taxes sur la circulation des viandes".

5/ gradually being abolished.

6/ abolished in 1973.

7/ only on imports of meat, import of live animals banned; exports are free of duties and taxes.

8/ export taxes & duties were suspended for three years from June 1972.

NOTE: "X" denotes that duties, taxes are (positively) levied on livestock and livestock products: "--" not levied.

Sources: SEDES (1975); GTZ/SEDES (1976); Nissen (1982)

9/ plus local taxes and development tax varying with locality.

10/ except for Rinderpest and CBPP.

11/ import duties and taxes only on pigs, export duties and taxes only on cattle.

12/ higher licence fees for merchants operating in the transhumant zone.

13/ only meat and other animal products; live animals imported duty and tax free; no export duty.

14/ no licence fee for butchers-merchants pay a fixed sum per head per year irrespective of species type.

15/ a very interesting feature is the "carte d'abonnement" to Bororo cattle owners. The "carte" is valid for one year and enables 80 heads of cattle to have all veterinary services for a fee of CFA 1200.

16/ only one exports

17/ abolished in 1972

TABLE F ANIMAL HEALTH TECHNICAL STAFF

(number by category and ratios)

COUNTRY	STAFF CATEGORY				RATIOS		
	High level	Middle level	Low level	Total	ML/HL	LL/ML	LL/HL
1. Chad							
1970	9	46	166	221	5.1	3.6	18.4
1975	23	60	216	299	2.6	3.6	9.4
1979	24	152	163	339	6.3	1.1	6.8
2. Mali							
1970	45	64	248	357	1.4	3.9	5.5
1975	50	66	250	366	1.3	3.8	4.9
1979	75	156	335	566	2.1	2.1	4.4
3. Upper Volta							
1975	30	33	166	229	1.1	5.0	5.5
1978	12	34	149	195	2.8	4.4	12.4
4. Mauritania							
1970	10	19	79	108	1.9	4.2	7.9
1975	11	23	78	112	2.1	3.4	7.1
1979	9	78	59	101	8.6	0.8	6.7
5. Niger							
1970	3	28	178	209	9.3	6.3	58.6
1975	13	53	196	262	4.1	3.7	15.1
1979	33	124	291	448	3.7	2.3	8.8
6. Senegal							
1972-73	79	135	480	694	1.7	3.6	6.1
1974-75	108	172	258	538	1.6	1.5	2.4
1978-79	148	256	222	626	1.7	0.9	1.5
7. Ivory Coast							
1975	59	172	222	454	2.9	1.3	3.8
1979	63[1/]	235[1/]	335	633	3.7	1.4	5.3
8. Benin							
1970	9	24	55	88	2.7	2.3	6.1
1975	16	33	81	130	2.1	2.5	5.1
1979	20	50	112	162	2.5	2.2	5.6
9. Cameroon							
1975	42	86	596	724	2.0	6.9	14.2
1979	48	191	266	505	3.9	1.4	5.5
10. Togo							
1970	10	43	31	84	4.3	0.7	3.1
1975	22	61	33	116	2.8	0.5	1.5
1979	36	72	21	129	2.0	0.3	0.6
11. CAR							
1970	1	18[2/]	89[2/]	108	18.0	4.9	89.0
1975	11	NA	144	155	-	-	13.1
1979	17	39	274	330	2.3	7.0	16.1

1/ 1978

2/ 1969

Sources: GTZ/SEDES (1976); IEMVT (1980) and Nissen (1982)

High Level = Veterinary doctors and other graduate

Middle Level = Assistant veterinarians.

Low Level = Field-level technical assistants.

TABLE G HEADS OF CATTLE PER CATEGORY OF STAFF

(1000 head)

	Actual 1975			Calculated on basis of norms (1976 data) 1/		
	HL	HL	LL	HL	ML	LL
Chad	157	60	17	155	50	11
Mali	77	59	16	192	60	13
Upper Volta	57	52	10	161	59	13
Mauritania	109	52	15	123	38	8
Niger	193	47	13	179	54	11
Senegal	21	13	9	178	62	13

1/ Norm prescribes

240,000 Livestock Units per high level staff
60,000 " " " " middle "
17-20,000 " " " " low "

Sources: Actual data (1975) calculated from information obtained from GTZ/SEDES (1976); data based on norm calculated from information available in GTZ/SEDES (1977).

TABLE H CATTLE POPULATION AND HEALTH EXPENDITURE PER HEAD
1970, 1975 and 1979

	Cattle Population ('000 head)	AHOB 1/ per Head (current US$)
Chad		
1970	4500	0.12
1975	3600	0.24
1979	3716	0.25
Mali		
1970	5400	0.09
1975	3886	0.21
1979	4765	NA 3/
Upper Volta		
1970	2550	0.18
1975	1700	0.47
1979	2706	0.44
Mauritania		
1970	2003	0.30
1975	1200	0.86
1979	1186	1.07
Niger		
1970	4077	0.22
1975	2508	0.65
1979	3112	0.75
Gambia		
1970	247	0.17
1975	300	0.44
1979	312	1.90
Senegal		
1970	2557	0.62
/1975 2/	2318	1.22
1979 2/	2440	1.38
Ivory Coast		
1970	408	4.78
1975	545	7.74
1979	650	12.00
Benin		
1970	549	0.72
1975 2/	700	0.91
1979 2/	756	0.92
Cameroon		
1970	2308	0.48
1975	2600	1.28
1979	3100	1.69

.../2

TABLE H (Contd.)

	Cattle Population ('000 head)	AHOB 1/ per Head (current US$)
Sierra Leone		
1970	296	0.39
1975	290	1.21
1979	338	1.48
Madagascar		
1970	8519	0.23
1975	9700	NA
1979	10150	NA
Togo		
1970	187	1.07
1975	226	1.73
1979	221	2.70
CAR		
1970	677	0.35
1975	600	0.43
1979	1200	0.19

1/ AHOB = Animal Health Operating Budget

2/ 1977 data

3/ NA = Not available

Sources: FAO Production Yearbook (1977) for the 1975 and (1981) for the 1970 and 1979 cattle population data; livestock budgets/expenditure figures based on figures in Table A of text.

TABLE J CHANGES IN THE EFFICIENCY COEFFICIENT

YEAR / COUNTRY	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
Mauritania	0.87	1.03	1.13	1.34	0.40	0.75	0.49	0.24	0.44	0.38	0.59
Senegal	0.29	0.33	0.43	0.34	0.61	0.49	0.20	0.18	0.17	NA	NA
Gambia	NA	0.25	0.24	0.25	0.32	0.33	0.27	0.36	0.33	0.22	0.42
Mali	NA	NA	1.10	1.20	1.29	0.50	0.47	NA	0.43	0.37	0.35
Upper Volta	NA	0.16	0.12	0.17	0.16	0.14	0.16	0.12	0.10	0.09	0.09
Niger	NA	0.70	0.79	0.79	0.78	0.81	0.65	0.73	0.69	0.59	0.64
Chad	NA	0.44	0.42	0.24	0.27	0.19	0.24	0.04	0.03	NA	NA
Cameroon 1/											
Sierra Leone	NA	0.82	1.29	1.31	1.20	3.21	1.80	2.49	2.58	3.38	NA
CAR	0.72	0.59	NA	0.59	0.43	0.67	0.61	0.82	0.59	0.19	0.05
Benin	0.22	0.22	0.25	0.26	0.28	0.23	0.23	NA	NA	NA	NA
Togo	0.12	0.11	0.10	0.08	0.08	0.08	0.06	0.03	0.14	0.10	0.09
Ivory Coast	0.67	0.56	0.39	0.41	0.43	NA	0.35	0.35	0.45	0.41	0.35
Madagascar	0.85	0.75	0.85	0.72	NA	NA	NA	NA	NA	NA	NA

1/ Data for Cameroon are only available for 1965/66 to 1969/70 but they are given below for comparative purposes.

1965/1966: 0.56
1966/1967: NA
1967/1968: 0.96
1968/1969: 0.67
1969/1970: 0.59

NA: Data not available

Sources: GTZ/SEDES (1976), SEDES (1975), IEMVT (1980)

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THE INTEGRATION OF PASTORALISM AND SEMI-MECHANISED FARMING: THE EXAMPLE OF AN ERITREAN EXPERIENCE IN EASTERN SUDAN

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Introduction

1. The Eritrean refugee problem in the Sudan, which dates back to 1967 and has been growing since,* has recently started to attract world attention. The International Conference on Refugees held in Khartoum in June 1980, organised by the United Nations High Commission for Refugees (UNHCR), the Sudanese Government and certain non-governmental organisations (NGOs), recognised the humanitarian dimension of the refugee problem and the urgent need to help refugees make a living in the Sudan. Various international organisations attending the Conference committed themselves to assisting the refugees in various ways in their struggle for self-sufficiency. One of these was Euro Action-ACORD (EAA), a consortium of non-governmental organisations. In conjunction with the Office of the Commission for Refugees (COR) and Kassala local government, EAA is implementing an agricultural production programme, in Kassala Province, eastern Sudan (see map on p2), called the Qala-en-Nahal Refugee Resettlement. The programme is divided into two parts: first the setting up of a tractor hire service which includes provision both for ploughing and for crop haulage from field to farm; and second, the building and operation of a general workshop and seven village workshops in the Scheme area.

2. This article considers the achievements and complexities of working with Eritrean refugees, including both pastoralists and agropastoralists, in Eastern Sudan. The importance, both past and present, of pastoralism and livestock to the refugee community is discussed. The successes of the Scheme, notably the increase in food crop production for most small farmers, are recognised. But the author underlines the importance of the livestock sector to the refugee community and the need for its integration into such programmes, especially when considering the future needs of the refugees when they eventually return home.

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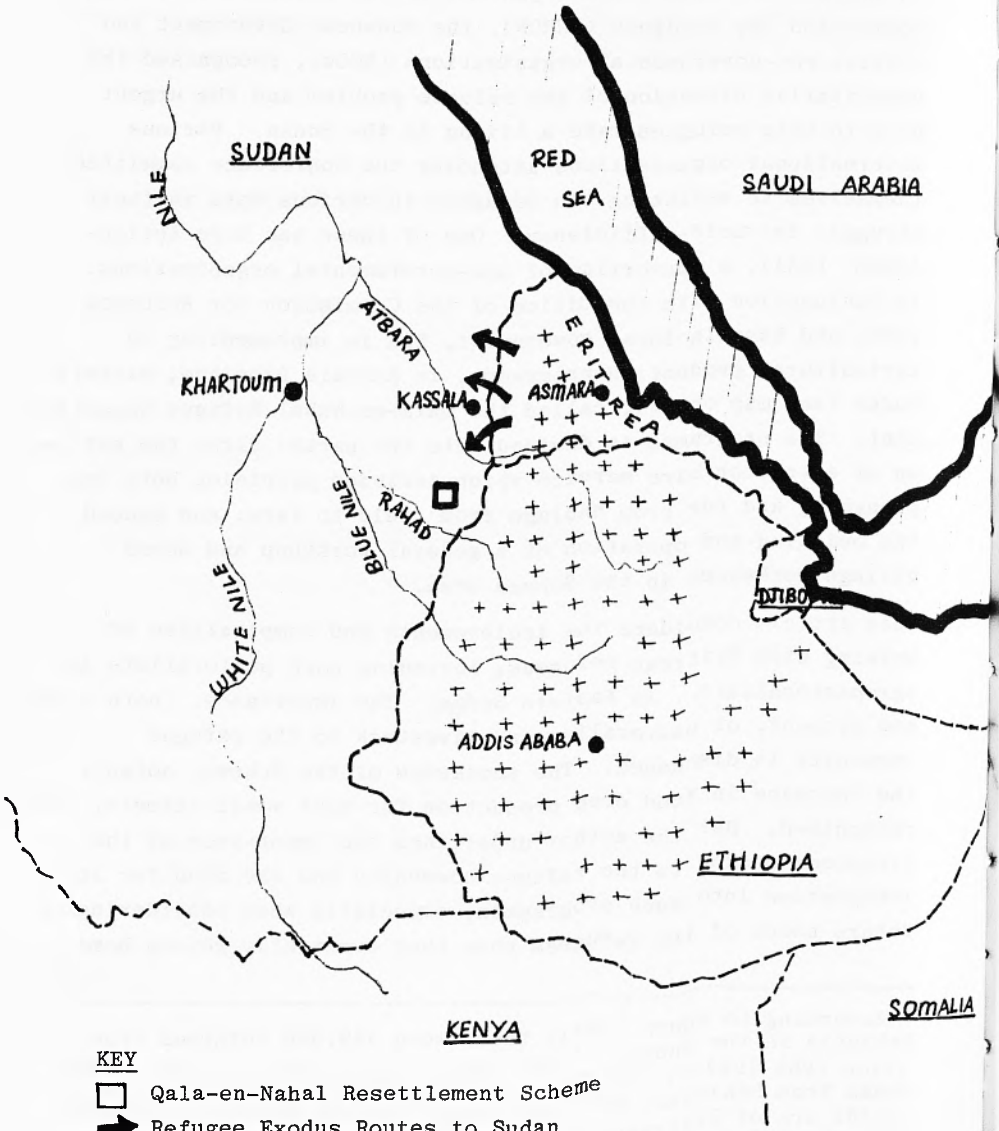
* According to UNHCR (1981) there were 439,000 refugees from Ethiopia in the Sudan. According to the Eritrean Relief Association (ERA 1983:2) 'of the estimated 525,000 refugees in the Sudan from Ethiopia, Eritrea, Zaire, Uganda, Chad etc, 400,000 or 76% are of Eritrean origin'. The Eritrean refugees are concentrated in eastern Sudan.

Map 1 : Location of Qala-en-Nahal Resettlement Scheme showing refugee exodus routes



3. The author spent two months on the Scheme in 1981, towards the end of the first cultivation season. The present account is based partly on his own discussions with farmers there, and partly on documents kindly make available by Euro-Action-Accord. The views expressed in this article and any interpretation of data, however, are the responsibility of the author alone.

The Euro Action-ACORD Refugee Resettlement Scheme (Qala-en-Nahal, eastern Sudan)

4. The Scheme covers some 48,000 ha, of which about 31,000 are cultivatable. It is located in the eastern region of the Sudan in a 600 mm annual rainfall zone. The main rainy season is from June until September, followed by eight months of warm to hot dry weather. Generally speaking, the soils are deep cracking clays similar to those found in the central clay plains of the Sudan, while the vegetation is a low rainfall woodland savannah type. Agriculturally the area is suited to the rainfed field production of sorghum, (dura) and sesame (sim sim), which are the main crops. Tomatoes, maize, and okra are also produced by some families in their compounds. Irrigated crops are limited to very small plots which have developed spontaneously near the domestic water supply tanks in about 5 Eritrean villages. These utilize waste water and a wide range of vegetables are grown in the dry season.

5. In 1982, there were some 25,000 families on the Scheme, of which about 20,000 were Eritreans and 5,000 Sudanese. This paper focusses on the Eritrean majority of Scheme members. The refugee community originates from widely different climates, locations, occupations, and ethnic groups in both highland and lowland areas of Eritrea: Muslims and Christians; pastoralists and agropastoralists; rural and urban dwellers; skilled and semiskilled workers; the educated and the illiterate; landless peasants and landed classes.

6. June to September 1981 was the first cultivation season of the EAA Scheme, though technical and socio-economic surveys had been previously conducted by EAA. The programme objectives, as

set out in a 1981 letter of intent signed by EAA and the Sudanese Commission for Refugees, were as follows:

a) to design a system of tractor and land management in Qala-en-Nahal which will serve to ensure a viable and efficient tractor service giving maximum potential benefit to all refugee farmers
b) to facilitate the procurement of the additional machinery requested by the Sudan Government utilising funds committed by the British Overseas Development Administration at the June 1980 conference in Khartoum, taking account of those existing tractors which are either non-functional or which are reaching the end of their working life. To ensure uniformity of equipment and to provide a generous reserve tractor capacity
c) to develop an effective agricultural management structure to implement objective a)
d) to organise a tractor operational training programme for locally recruited agricultural staff
e) to make appropriate arrangements to ensure the effective overhaul and routine maintenance of Qala-en-Nahal's tractor fleet during the EAA project period
f) i. to develop the present mechanical workshop to provide comprehensive engineering services to the area
ii. to develop the workshop as a training institute subject to approval of the Sudanese Government.

In 1982 it was clarified that the tractor hire service would offer equal access to both Sudanese and refugee smallholders within 'refugee-affected areas' of the Scheme; the refugees would no longer take priority.

7. According to EAA, the achievements of the Scheme at the end of the 1982 agricultural season were as follows: the tractor hire programme was very successful: some 37,273 feddans or 15,530 hectares of land has been cultivated (8,280 feddans or 3,450 hectares of which were subsequently recultivated after initial germination failures). Much of the recultivation involved two passes of the disc ploughs; the gross area cultivated was there-

fore approximately 50,000 feddans or 21,000 hectares. Compared to 1981 there was an increase in land cultivated of 6 per cent. The number of farmers who hired tractors rose by 757 farmers from 4,879 in 1981 to 5,636 in 1982, representing an increase of 15.5 per cent. It is difficult to assess accurately the numbers of refugees receiving assistance with cultivation, because no differentiation was made within a particular village unit between refugees and Sudanese. Some guide may be given however: the 6 refugee village units, which include mainly refugee farmers plus a small minority of Sudanese, cultivated the plots of 4,863 farmers; and the single Sudanese unit, which includes only Sudanese, cultivated the plots of 773 farmers.

8. The success of the programme is not just to be measured in land area ploughed. More importantly, by ensuring equal access to big and small land holders alike, it reached the majority of the farmers. A further achievement in 1982 was the concentration of the entire cultivation period into 10 weeks, as opposed to the 14 week period in 1981. This increase in efficiency meant substantial cost savings to the Scheme. The number of work-days during the cultivation period fell from 56.24 in 1981 to 47.73 in 1982. The number of farmers receiving free cultivation in 1982 declined as a result of the termination of the concession of free cultivation to new settlers. Only those who were regarded as hardship cases were entitled to free cultivation. This was estimated at about 10 per cent of the total number of farmers receiving cultivation.

9. Finally, cooperation with farmers at grass roots level is considerable:

> Considering that over five thousand farmers used the service there were surprisingly few complaints. A spontaneous innovation in Salmin (project village) saw the development of an ad-hoc village committee... The committee dealt with any problems and individual complaints although of course recourse remained open to senior EAA staff... The number of farmers per day receiving cultivation was 173 over a six week period. This represents a vast amount of organisation, the majority of which was undertaken by the refugees. (EAA progress report, May 1983)

Stock-keeping on the scheme in the context of stock-keeping in Eritrea

10. For all ethnic groups in Eritrea, livestock is a basic form of wealth and plays a vital role in the creation and maintenance of social relations: bridewealth, funeral sacrifice, feasts, kinship and social obligations, and so on. Pastoralism is referred to as Gusnet Trit (in Tigrigna) or Reyet Nway (in Tigre), which literally means *tending livestock*. According to Chambers (1968), 78 per cent of the total land area in Eritrea is suitable for grazing. Because of aridity and stony soils, agricultural land is limited. Pastoralism therefore is a major occupation and one of the main sources of livelihood in rural areas.

11. In Eritrea, we can identify two major livestock production systems. Firstly, the traditional pastoralism of the agriculturally marginal areas; and secondly the agropastoralism (or mixed farming) of the less arid areas. The majority of Eritreans adhere to the latter. There are fundamental differences between the two systems of livestock production. For example, for traditional pastoralists the management of breeding herds and the continuity of milk production is the core of their profession.

12. For agropastoralists, on the other hand, it is the management of draught oxen which comes first: herds may be composed of up to 50 per cent males (oxen) in the peak cultivation season. Oxen hiring is also a major feature of this system. In fact the majority of peasant farming both in highland and lowland areas is oxen-based, there is a widespread use of animal manure as fertilizer (and also for fuel); and animal labour is used for cereal threshing. It is therefore important not to underestimate the importance of stock-keeping among agropastoralists (see Brandström et al 1979:8).

13. As refugees, the Eritreans have lost most of their material wealth (land, livestock, houses etc) back home but brought with them their traditional pastoralist skills and agropastoralist practices. They have also brought a limited number of animals. People as well as livestock found it difficult to acclimatise to the new

eastern Sudan environment and many of the early settlers, together with much of their livestock, succumbed during 1968-71. As the settlement has established itself some Eritrean pastoralists have started buying animal replacements: mainly small ruminants (sheep and goats) but also some cattle.

14. A comprehensive survey of animal husbandry on the Scheme is unfortunately non-existant. As in many parts of the pastoralist world, livestock owners are reluctant to provide real livestock figures in order to avoid government taxes. There are, however, partial accounts which enable us to get a general picture. In 1982, the Sudan Agricultural Bank (Gedaref) conducted a general survey of the area (see table 1) and gave the following data on livestock:

> More than half of the farmers (58 per cent) reported holding livestock. While the total numbers of animals held is generally small, most households do own donkeys, goats and chickens. Cattle are owned by 23 per cent of them.

Table 1 : Percentage of households on Qala-en-Nahal Scheme keeping livestock and average number of stock per household by type of animal

Type of livestock	Percent of households	Average number per household
Any stock	58	-
Cattle	23	3
Sheep	6	3
Goats	53	2.3
Donkeys	55	1
Camels	4	1
Chickens	25	26.3

Source: Sudan Agricultural Bank 1982 (Gedaref Branch)

15. According to the Scheme, these figures are an underestimate, since non-milking cattle are moved outside the project area so as to reduce overgrazing and damage to crops. Donkeys are used for transport and also for carrying water; goats are kept for milk and meat. A few households own camels but no one reported horses.

The Agricultural Bank survey, though clearly an underestimation of livestock ownership among refugees, certainly underlines the importance of livestock to households on the Scheme and the consequent need to integrate more closely the livestock and crop farming activities of the programme. Some of the livestock-keeping households on the Scheme are Sudanese, but on the whole the latter are more crop-oriented and less stock-oriented than the refugees.

16. The tradition of communal herding continues among Eritreans on the Scheme during the busy wet season, milking and in-calf cows belonging to different families are grouped and herded together in a rota system. This allows the pastoralist to have more time to cultivate, weed and harvest. Cattle are managed together in herds of from 100-150 head of cattle. According to the Sudan Agricultural Bank Survey, the majority of the households(67 per cent) herd their own stock by themselves while 33 per cent have theirs herded by a paid labourer. The latter are the wealthier pastoralists, who pay a boy or an adult to look after the herd.

17. Most of the dry herds are kept away from the Scheme villages by Sudanese government restrictions which are enforced by the local Sudanese Administration. Seasonal herd movements are carried out particularly in the River Rahad region (see map 1); they are characterised by three major considerations, vital to cattle survival: water, forage and escaping from fly ravages. In the wet season (July - September), cattle have to be moved northwards to higher ground where insect attack is less devastating. From October onwards, sorghum residues and fodder are abundant in the crop-farming areas and cattle start moving southwards to these areas where the Scheme is situated. After February, forage and water shortages become serious limiting factors to animal production. Survival until the next rainy season becomes the critical issue. One Eritrean pastoralist on the Scheme lost 30 per cent of his cattle in a particularly bad year.

18. There are two main calving seasons: one in the wet season and the other during the crop harvesting period. The best bulls are selected for breeding and are left to run with the main herd all

the time. This has been a long husbandry tradition. According to Spooner (1981), calves are born with the milking herd and isolated with their dam within the compound, where cut grass is fed to the mother. The calves are kept on ad-lib suckling for the first two weeks when colostrum is being produced and then half is milked off by hand for feeding the young children of the household. Water and fodder shortages obviously limit milk production and the lactation period may be drastically reduced. Pastoralists recognise the need for supplementary feeding as a consequence of the particular problems of survival under the present harsh conditions. Preserved bundles of sorghum stalks or sesame seed cake, if available, are fed to animals during the austere period (March - June). Among cattle diseases the most important ones are anthrax, rinderpest, foot and mouth disease and bovine pleuro-pneumonia. Mange and caprine pleuropneumonia are prevalent among goats. The Sudanese Government Veterinary Department offers very limited services to pastoralists in the area. There are plans however for expanding the Department's services which are recognised to be inadequate.

19. Livestock taxes and water charges are payable by pastoralists and agropastoralists on the scheme (see table 2). They are collected by the local Sudanese administrators for the Kassala Local Government under whose auspices EAA operates the Scheme. The local Sudanese administration is responsible for the overall administration of the Eritrean refugee settlement, including education, health and security.

Table 2 : Livestock taxes and water charges

Item	Tax (in LS* per item per annum)	Water charge
Head of Cattle	0.60	0.05 per day
Sheep/goat	0.25	0.02 per day
Donkey	0.25	no charge
Camel	na	0.02
Camel-drawn sesame oil press	120.00	na
Water seller's donkey	4.00	na

Source: Spooner 1981

* LS: Sudanese pound, 162.5 LS equalled £1 in November 1983

Conclusion

20. This article has indicated the complex nature of working with people living in a country other than their own. Three major parties are involved in such a development exercise: Eritrean Refugees, the host country Sudan and the development agency (EAA). Many pastoralists and farmers, particularly small farmers, have expressed their satisfaction with the EAA Scheme and have clearly benefitted from it. Cooperation with farmers at grass roots level is considerable, but could be improved even further. Success of the EAA Scheme in Qala-en-Nahal should not be taken for granted. The combination of factors which made this success possible are commendable: Sudanese compassion towards refugees, EAA resources, good management, refugee dedication and cooperation, and good consecutive rainy seasons. The immediate food shortage problem, critical in refugee situations, has been resolved; small businesses are booming in scheme villages; and some technically oriented young Eritreans are improving their skills through an in-service apprenticeship training programme, started in 1982. These skills and new experiences can be a useful asset for reconstructing the refugees' home country in the future.

21. It has to be stressed however, that EAA and the refugee community have gained 3 years of valuable experience (1981-83) and this may be the time to make major adjustments. In particular, the article emphasizes the need from now on to integrate livestock into crop production systems as well as to non-farming projects in the scheme, if real self-sufficiency is to be achieved in the near future. Given the livestock orientation of many farmers and pastoralists in the scheme, livestock will remain an important component of their subsistence economy. Although at present livestock numbers per household are low, their overall distribution is widespread. Moreover it is likely, judging from experience in Eritrea, that as pastoralists and farmers become wealthier as a result of higher incomes from crop farming proceeds, they will buy in more livestock. Eritrean traditional pastoralists

confirm this trend:

> We will sell (cull) unproductive cattle then save the money, not to buy a car or build a house, but to buy in more cattle when the time is right;... for cattle owners, cattle mean everything... anything good for our cattle, for example veterinary services, fodder, water, is good for us...
> (A refugee on the Scheme, 1981)

22. Because more and more land is being cultivated on the Scheme since the 1981 EAA involvement, there will be more crop fodder for livestock. With some improvement in feeding technology (chopping sorghu, stalks, haymaking and so on) it may be possible to use the available crop residues more efficiently as fodder. Pastoralists appreciate the problem of lack of appropriate technology:

> The sorghum stalks here are useless anyway. They are too thick to be chewed and don't contain much sugar. The cows thus walk over the stalks...
> (Another refugee, 1981)

23. Apart from the fodder shortage and some inefficiencies in using available feed resources, water shortages during the dry season (Nov-June) and inadequacy of veterinary services in the area remain the crucial limiting factors to livestock production. As we have said earlier, research is needed to assess and identify areas of intervention for the development of the livestock sector. The Sudanese administration may have plans for improving the situation; EAA also can respond to such a need. Given their previous experience as pastoralists and agropastoralists, and their high motivation, the refugee community would respond favourably to such an incentive.

24. We have said enough about the technical and economic development aspects. But what about the aspirations of the Eritrean refugees for their future? An Eritrean pastoralist in the Scheme summed it all up by saying:

> We like our soil, our land and our people. We'd prefer to be poor in Eritrea than rich in the Sudan.

This is a pastoralist who has lived in the refugee settlement for more than 15 years. Whether the development activity is

pastoral, semi-mechanized farming, poultry or of a small income-generating nature, a crucial policy question is being asked: should one strive towards 'refugee assistance' in a host country, like Sudan in this case; or towards 'refugee prevention', in other words encouraging and assisting potential refugees to remain in or return to their own country? It is this question which makes long-term planning difficult if not impossible in the Sudan. The Eritreans, through their indigenous relief agency, the Eritrean Relief Agency, emphasise the importance of 'refugee prevention':

> To assist displaced persons inside Eritrea it will help to check the flow of refugees into the Sudan, a country that already hosts 525,000 refugees and is beset with economic problems itself... a sound refugee policy should be the checking of the flow of refugees and the encouragement of their eventual return to their homelands.
> (ERA 1983a:12)

The present author encourages the consideration of the above view as a future long-term policy.

25. Inside Eritrea the crucial basis for development, popular participation and self motivation, is already well established. This can be summed up by an observation made by a refugee relief and development worker:

> ...the long suffering of the people caused by drought and war, has produced a will to create the very structures required for the construction of a better economy and an improved society. This, in turn, will demand from aid agencies a measure of understanding and flexibility to which many of them are not accustomed. (Kirsty Wright 1983)

26. In view of the eventual return of Eritrean refugees to their homeland it seems particularly important to recognise and develop their pastoralist activities: for they will be particularly motivated to invest their energies in a resource which, one day, they may take back home with them. Meanwhile, the host country in addition to the livestock owners, may benefit from the supply of milk and other animal products.

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PASTORAL DEVELOPMENT NETWORK

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PASTORALIST ECOLOGY IN NGORONGORO CONSERVATION AREA, TANZANIA

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Introduction

1. This study has its origins in the preparation of a revised management plan for the 8000sq.km Ngorongoro Conservation Area (NCA) in Northern Tanzania. Ngorongoro is not only of importance as a wildlife conservation area but is home to an estimated 18,000 Maasai pastoralists and their livestock. The original planning for NCA saw the development of natural, archaeological (Olduvai), human and livestock resources in a mutually compatible framework (Fosbrooke 1962, 1967), and this is embodied in the 1979 acceptance of NCA as a UNESCO World Heritage Site. However there has been considerable friction between conservationists and pastoralists aggravated by recent political and economic changes . The Maasai have been prevented from cultivation since 1975 denying them an alternative or subsidiary mode of production important to most if not all pastoralists of Sub-Saharan Africa. Antagonism between Maasai and the conservation-oriented NCA Authority reached a point where a previous administration decided to press for the exclusion of all pastoralists; the new management plan, funded by UNESCO, was expected to justify such a decision.

2. Initial surveys suggested an increasing inability to maintain a pastoralist economy in NCA (Arhem 1981). Maasai from different areas of NCA gave different reasons for their deteriorating economic status - disease, overgrazing, lack of water. The aim of this study therefore was to investigate these problems by quantifying different aspects of animal production and the

utilisation of those products. This was carried out for three areas of differing environmental conditions allowing comparative analysis and isolation of major controlling factors, as well as pinpointing the major shortfalls in production.

3. The environment of NCA is characterised by great diversity in land form, habitat and community and has been described in general terms by Fosbrooke (1967). Kurji (1981) gives a full bibliography. Altitudes range from 1500m to 4000m, rainfall from 400mm to 1500mm and the vegetation from short arid grassland to dense montane forest. There is evidence that pastoralists have been present for over 2000 years and the Maasai themselves have been resident for at least 200 years. Much that is characteristic of the present landscape has been caused by the activities, grazing and fires of pastoralist occupation. Despite the importance of the pastoralists in the NCA they have never been studied in detail - it is the wildlife resource that has drawn the attention of resource manager, biologist and public. Arhem, Homewood and Rodgers (1981) present a summary of the Maasai population and their livestock.

4. Three study sites were selected (fig.1) each in a different ecological zone and belonging to a different "village" political unit with different perceived problems:
   - Ndureta in the Gol mountains:a hot, arid area at 1800-2200m with <500mm annual rainfall. This area borders the short grass Serengeti plains and suffers annual incursions of over a million wildebeest. Wildebeest induced disease and lack of

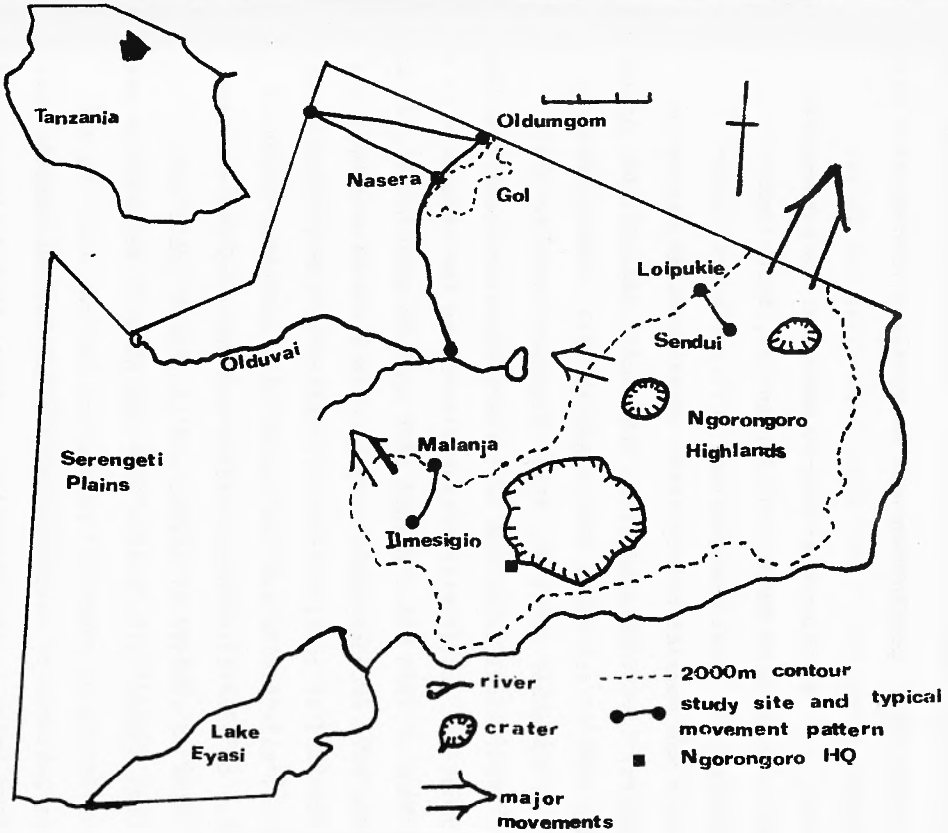

Fig. 1 Ngorongoro Conservation Area, showing main physical features and study sites

water are major problems.

- Sendui on the Ngorongoro Highlands: a high altitude, very cold area at 2800m with annual rainfall >1000mm. This area has very dense livestock populations and overgrazing is seen as a major problem.
- Ilmesigio on the slopes of Magrut Mountain: an intermediate area at 2500m with 900mm annual rainfall, high disease incidence and local overgrazing.

5. The study was carried out by three workers looking at range parameters, livestock production and social aspects. An initial study period of six weeks (July- August 1981) was followed by visits in December 1981, May 1982, December 1982 and July-August 1983. Local range and veterinary research staff assisted throughout the study. Field methods involved the selection of a study boma at each site. Within each boma as many households as possible were encouraged to cooperate in a count of people and livestock and in contributing information on cattle population dynamics, milk yields and the use of milk and other foods. A register of identified named cattle was built up and the fate and yields of individual cattle and household herds were monitored sporadically over a two-year period. Information was also collected on rangeland parameters and the activity and ranging patterns of cattle during all-day follows. Methods are described below in the individual sections that follow on herd size and composition, livestock densities, cattle population dynamics, activity , ranging patterns and milk yield.

Rangeland

6. Preliminary rangeland data analysis suggests a difference in forage availability between sites. Table 1 gives dry season forage volumes derived from estimates of grass ground cover values and grass leaf table height (eg. 50% cover of 10cm. high grass gives a volume of 0.05cu.m/ sq m. or 500 cu.m./ ha.). Crude protein content of the forage is given as a guide to nutritive values. The low forage volumes of the short grass plains is immediately obvious and explains why cattle rarely use this habitat. At Nasera (Gol) the smaller area of hillslope is more heavily used (60% feeding records in 18% area) and browse, with a high nutritive value , forms a major dry season dietary item. Sendui upland tussock habitat is extensively used but browse here is not accessible. Ilmesigio dry season grazing takes place on the upper pastures and wooded valleys where browse is available. The grazing values of these pastures is reflected in the dietary inputs of cattle which can be estimated from analyses of faecal nitrogen (Arman et al 1975) also given in table 1. Sendui was found to have consistently lower nutritive values in the diet (very marked in the dry season). The absence of browse items may be significant here.

Cattle herd size and composition

7. Our figures for herd sizes are derived from several different sources: repeated gate counts, cross- checked by several different observers as herds entered or left the boma each day;

independent accounts of individual herds by different members of the households associated with each boma; opportunistic counts of herds encountered during the day; and NCA ground census (1980) gate counts reported by name for all NCA bomas. Many bomas contain several stockades or corrals corresponding to different co-resident herdowners. Individual corral herds within each boma were of similar size in all three study areas (157-176; see table 2) while the total boma herd sizes varied more (157-331). The 1980 NCA count gave similar results for Sendui and Ndureta. The Ilmesigio herd was substantially smaller in 1980 as one herdowner was absent during our study. Mean NCA counts of all corral herds in the three areas in our study show the study herds are representative.

8. Corral herd composition is strikingly similar in Ndureta and Ilmesigio with around 40% adult cows, 15% heifers, 5% bulls, 10-15% steers and 25-30% calves under one year (table 3). The Sendui herd had slightly fewer adult cows made up for by an excess of heifers. The age structure of the female herd is similar for all three areas.

9. Pastoralists are generally thought of as reluctant to allow outside attempts to estimate stock numbers and composition. There was no doubt as to the accuracy of our counts and age/sex breakdowns for the cattle present at the time of the study and we are confident that they represent a true picture of the subsistence herds available at the time of the study. The relation of the size and composition of these herds to the

longer term situation is examined in the section on population dynamics.

Cattle densities

10. Livestock densities for the NCA as a whole and for village areas were calculated from the NCA census (Arhem 1981). Density and biomass density estimates for the areas surrounding study bomas were derived from our data as follows. Densities were calculated for an 8 km radius grazing circle around each boma (201 sq km) minus non-utilisable land, eg. ravine and forest. For each village area the mean boma cattle and small stock population sizes (table 1) and mean weights (180 kg, 15 kg respectively) were used. Other bomas within 16km were plotted and the extent of their grazing circle overlap calculated to give an overall density figure. In some areas dense settlement patterns (eg. close to a school or in planned villages) leads to very much higher than average figures. Arhem (1981) gives overall 1980 figures of 17700 pastoralist people, 126589 cattle and 135501 small stock, which for the 6300sq km usable rangeland in NCA (excluding 1700sq km restricted craters, forest reserves and archaeological sites) gives per sq km densities of 2.81 people, 20.1 cattle and 21.5 small stock. Individual village cattle densities per sq km are 12.3 for Ndureta (Olbalbal-Odoinyo Gol), 60.4 for Ilmesigio (Oloirobi) and 60.8 for Sendui (Melenda-Nairobi- Kapenjiro); small stock densities are 12.9, 46.8 and 76.0 respectively. Arhem (1981) documents considerable annual variation in numbers of people (6000- 19000) and livestock

(75000- 175000 cattle) in NCA during the period 1960-1980, apparently in response to rainfall and hence water and grazing availability.

11. Grazing circle biomass densities are detailed in table 4 along with theoretical values estimated from rainfall data as per Coe et al (1976). All three study areas have biomass densities in excess of theoretical figures, especially the Oldomgom site in Ndureta and Sendui where values are 50-100% higher. This explains the need of herdowners to move to Nasera pastures despite the problems of water, wildebeest and limited hill slope grazing. Sendui is overgrazed (stressed by residents), especially as the high altitude almost certainly reduces forage productivity, and the extent of unpalatable Eleusine jaegeri will reduce the theoretical stocking figure even further.

Cattle population analysis.

12. An understanding of herd productivity depends on a knowledge of population dynamics. Births and deaths for all offspring of each individually identified cow were plotted on a time axis for the two - year period August 1981 - August 1983 and used to calculate calving rates, calf and cow mortalities. Additional data on deaths, sales, gifts and exchanges for all cattle age/sex classes allowed the estimation of the rate of increase (or decrease)"r" for each herd (Caughley 1977). There is little difference between sites for most parameters (table 5). All sites show a decline in herd size during the study period. With

the great variability in the NCA environment, two-year means do not necessarily reflect long term patterns or indeed consistent differences between sites. Cow mortality is lower in Ilmesigio than elsewhere but calf mortality is similar. The lower frequency of site visit in Ilmesigio may have led to an artificially low value for calving rate (0.53 per annum cf 0.61 and 0.69 for Gol and Sendui respectively). Offtake rates are consistent at around 8% per annum, giving rates of population decrease "r" equivalent to population halving in 9 years for Gol, 11 for Ilmesigio and 12 for Sendui.

13. Age at death for calves is of interest with calves less than 3 months old showing a high mortality in Ilmesigio, compared to intermediate and low values in Sendui and Gol. Gol calf mortality peaks around the age of weaning whereas for Ilmesigio it is linked to high disease incidence. Births are concentrated in the rains, over half being born in the period January to March, with fewer than 3% born in the dry July - September period. Sex ratio at birth is not significantly different from unity and there was no differential calf mortality with sex.

Disease

14. Disease incidence as a major cause of mortality was investigated in some detail in the August 1983 mid dry season. In general heifers and male animals were in better condition than adult females with a lactation/ pregnancy burden. Such animals were anaemic and frequently presented signs of stress and disease -

lung murmurs, jugular pulse, swollen lymph nodes etc. Calves were in very poor condition showing strong anaemia and dehydration. Gol had less overt sign of cattle disease and blood parasites were not seen. Anaplasma and Theileria were seen in both Sendui and Ilmesigio, and trypanosomes at Ilmesigio. Intestinal parasites were not frequent in cattle. Pneumonia and respiratory infections were common in small stock and hydatid cysts seen in all animals examined. Cattle dipping to reduce tick burdens (and hence tickborne disease, especially ECF and Theileriosis) was commonly practiced in Oloirobi vaillage (including Ilmesigio) but recent acaricide shortages have led to infrequent dipping and a great increase in cattle deaths. The importance of cattle disease in Ilmesigio was emphasised by the amount of energy and effort herdowners put into traditional medicine in this area.

Cattle activity and ranging patterns

15. Cattle are grazed and watered on alternate days under dry conditions but this pattern becomes less rigid in wetter seasons and areas. The maximum radius normally covered by pastoralist cattle in their daily trek is around 8km. Systematic activity sampling methods were used (Lewis 1977) based on a scan sample of ten individuals chosen at random at 15-minute intervals throughout the day. The activities within the boma were mainly resting, ruminating or social interaction; during the day walking, grazing, browsing, chewing and standing were the dominant activities. Only the "active day" records of the period

outside the boma are analysed here, comprising some 400 individual observations each for a representative grazing day and a watering day in each area. Follow-up activity and ranging data were taken on subsequent visits.

16. Results of activity samples are summarised in table 6. The length of the active day for an adult herd ranges from 9.25 hrs to 11 hrs or more, with time spent walking being as little as 1.74 hrs (14.3% of the active day - Ndureta December 1982, wet season) or as much as 7.8 hrs (64.5% of the active day - Ndureta, August 1983, dry season). On grazing days the time spent walking is more consistent whatever the area or season averaging 2.5hrs. Calves and sick cows have a consistently shorter active day and typically walk for a shorter time to closer reserved grazing and water. In terms of distances covered, Ilmesigio herds had the shortest trek to both grazing and water while Ndureta and Sendui herds had generally greater distances to travel in both wet and dry seasons, with even calf herds having to move 12-13 km to water in dry conditions (<4km for Ilmesigio calf herds).

17. The main factors affecting the length of the active day and the times spent walking and feeding are the availability of water and grazing. In particular the time spent walking to water constrains time available for feeding which must then be made up on grazing days. In August 1981 the Ndureta herd had little time to feed on their watering day although they were forced to spend a considerable time inactive owing to the difficulties of

watering in a narrow rocky gorge. Olmakutian cattle in Ilmesigio had to walk for an even longer time with less feeding or inactive time; Sendui cattle had to walk a long distance to water but were able to feed along the way. These herds showed a very different grazing day activity pattern with 60-70% time spent feeding and an appreciable time spent ruminating. By contrast the Olelekando herd in Ilmesigio showed little difference between grazing and water days. Ilmesigio herdowners stated that when the pastures have burnt at the end of the dry season cattle have to walk very much further to graze. Some samples greatly exceed the normally observed maximum day's trek of 16km (see table 6; cf Dahl and Hjort 1976) though similar distances are occasionally recorded by other authors (20km for Amboseli cattle; Western and Dunne 1979). Cattle on watering days were rarely able to rest, lying or standing, during the heat of the day: this became a dominant activity between 1 and 3 pm on less active days.

18. The implications of daily travel are made very much clearer by a calculation of energy expenditure (see table 6 and Western and Dunne (1979) for method). The 15-minute interval location plots on topographic 1:50,000 maps gave minimum estimates for horizontal distance and vertical displacement. Energetic expenditure on locomotion can then be expressed as a proportion of fasting metabolism (FM) to give an idea of the extra demands of daily travel. These minimum estimates range from 17% FM to over 50% with a mean of 22.4% on grazing days and 37.4% on water days. By comparison Western and Dunne (1979) describe a typical

maximum energy expenditure of 35%FM for daily travel. Ndureta herds have consistently high mean travel expenditure (around 33%FM) while the Olelekando herds in Ilmesigio had the lowest (around 22%FM). This could be expected to have a major impact on both survivorship and production figures.

19. Over the course of a year or several years a herdowner may move his herd to a series of sites over a wide area: the general pattern of long term movements in NCA is described in detail in Arhem (1981). In general each herdowner has a permanent boma where he is based during part of the year: this may be a dry season base (as Ilmesigio for Olelekando or Sendui for Olesenguyan)or a wet season base (as Ndureta for Lesian) depending on the environmental characteristics. The herdowner spends a few months at his permanent boma but will then move to one or a series of temporary bomas with an access herd of varying composition - he may deploy different subsets of the animals under his management to different temporary camps under the care of his brother or a relative. Figure 1 shows the positions of different study herdowners and their access herds at different times during study visits 1981-1983 and a summary scheme of long-term movements over a period of years described by Arhem (1981) on the basis of village interviews.

Milk production

20. The milk production values discussed in this paper do not represent total output but only that part which is taken by the

Maasai. Several attempts were made to get full milk yields for comparison but this was undesirable from the standpoint of owner, calf and cow, and only four possibly full milk yields were obtained.

21. Table 7 summarises the results of over 1000 individual milk yields from over 100 different cattle for a representative range of study herds, areas and seasons. The lowest mean yields were in Ndureta (227g - August 1983; 300g - August 1981) and Sendui (243g - November 1981) and the highest in Ilmesigio (596g - August 1981) and a temporary intermediate altitude boma near Sendui (656g - May 1982). The August 1981 values for Ilmesigio are significantly greater than those for Ndureta and Sendui ($F=59.05$, $p<0.001$). December 1981 figures are low for Ndureta and significantly lower still for Sendui ($t=2.176$, $df=32$, $p<0.05$). May 1982 yields were better for Sendui (511g in the permanent boma; 656g in the orpurkel or temporary boma; these are significantly different, $t=2.313$, $df=20$, $p<0.05$) but Ndureta was still dry with average yields signifcantly lower than even the lower Sendui yield ($t=3.671$, $df=32$, $p<0.001$). In December 1982 however the Ndureta cattle averaged a non-significantly higher mean yield than the Sendui herd now based at a different temporary lowland boma.

22. The four full yield figures do not differ significantly from mean yields for a sample of cattle with the same calf age distribution for the same area and season. This probably indicates more about the difficulty of getting full yields than

about relative amounts of milk produced by the cow, taken by the calf or taken by the Maasai. Typically high yields come from cows with dead calves: these are not full yields in the strict sense nor can they be taken as representative of cows with healthy calves. Yields recorded from the exotic x Zebu cattle kept by the NCAA and herded on the Ngorongoro Crater rim are not directly comparable as they represent full yields (calves are bucket fed). Nevertheless it is clear that these cattle produce an order of magnitude more milk than pastoralist cattle in NCA. This is likely to be due to breed, veterinary care, and ready access to water and feed, as supplements appear to have little effect (table 7).

23. Milk production is directly affected by the energy demands of travel ($r= -0.698$, $n= 11$, $p<0.05$ using mean expenditure values) and shows a significant inverse correlation with time spent walking ($r= -0.736$, $n= 11$, $p<0.05$ using grazing day values where mean grazing+water day values are not available). Conversely there is a significant correlation between mean time spent feeding and mean yield ($r= 0.582$, $n=11$, $p<0.05$). These relations account for the significant differences between areas and seasons presented in the previous section, with high yields where good grazing and water are freely available (only Ilmesigio in August 1981; all three areas in December 1982).

24. Milk production could be affected by factors other than season, travel costs and feeding time; for example , morning versus evening milking; grazing versus watering days; age and sex of

calf; maternal age and parity. Any of these could affect both total milk production and/or amounts taken by the Maasai - our data cannot distinguish between the two. Despite the differing energy costs and feeding times there is no obvious pattern of grazing versus watering day yields nor are the observed differences statistically significant. Similarly there is no obvious pattern of morning versus evening yields. A breakdown of yield by calf age shows no obvious pattern in individual areas although the pooled data shows an artificial overall decline. There is no clear pattern of yield with parity. The few animals which were pregnant, lactating and still being milked showed a fall-off in yield with advancing pregnancy as expected. Our results indicate that a consistently though not significantly larger amount of milk is taken from cows with male calves. This has been found in other pastoralist groups (Dahl and Hjort 1976) but our Maasai informants in all areas strongly denied that it is recognised policy.

25. Variation in milk availability was estimated from our data on average milk yields and numbers of cows in milk (table 8). The seasonality of calving and high calf mortality means that more young calves and hence lactating cows will be present at the end than at the beginning of the rains. Thus both December samples had 55% cows in milk and May- August almost 65%. A long intercalf interval (18 - 23 months) and seasonality in calving mean that different numbers of calves come into milk each year. This difference is most pronounced for Gol (41, 39, and 17 cows giving birth in September 1980- August 1981, September 1981 -

August 1982, and Septmber 1982 - August 1983 respectively). Figures for Ilmesigio and Sendui were 20,13,21 and 33,22,21 for the same periods respectively. A large proportion of Gol cows were reported pregnant during the August 1983 sample so they would have a higher proportion of milking cows in the following year.

26. Table 8 incorporates data on numbers of adult equivalents (Arhem et al 1981) and estimates availability of milk per person during each period on this basis. A detailed analysis of human nutritional needs versus inputs made during the August 1981 sample (Arhem et al 1981) showed the energy (though not protein) shortfall and the importance both of sharing among households and of grain bought from outside NCA. Table 8 shows how milk availability varied in subsequent samples, falling drastically low eg. in August 1983 and necessitating sale of stock for grain purchase. Sendui has the most severe shortfall in milk availability with an average of only 0.54 kg/AE/day compared to 1.08 kg/AE/day in Gol. Our figures for Ilmesigio may be artificially low as there was no rainy season sample.

Discussion and conclusions

27. This work was undertaken in response to the claim by NCA pastoralists that they are unable to survive on a purely pastoralist economy. The results bear out their claim over this two year study period. Low milk availability is due to low productivity and low milk yields. Herd productivity is affected by high mortality of both calves and adults, in part a result of disease and in part through poor nutrition and high energy demands. The resulting lowered condition also affects the calving rate, which at 0.5 - 0.6 is low for zebu. Low calving rate means a lack of milk which in turn means a higher offtake from the herd for sale to buy grain. The average 8% offtake is high for pastoral economies and as it includes adult cows and heifers, herd performance is also affected. Excessive energy expenditures due to the long distances moved to water also affect milk yields as does poor grazing.

28. A low proportion of cows in milk at any one time (55% in the early rains) and a low milk yield (averaging 0.42 kg/day) means little milk is available per person per day. This averaged 0.79 kg/AE/day for the whole study period supplying some 81% of protein but only 27% energy requirements. Not surprisingly grain purchased from outside NCA is vitally important. Despite striking environmental variation in climate, topography and vegetation, and differing degrees of importance attributed to

disease, water and grazing factors in limiting production, the overall economic pictures that emerge are similar for all three. Pastoralists in the three areas resort to different strategies to make the most of local resources, from altitudinal transhumance in Sendui to semi-nomadic migration in Gol - a close parallel to wild ungulate populations in NCA (eg wildebeest). All three groups however have an increasing dependence on grain which must be purchased. This grain dependence comes at a time of sociological and economic change in Tanzania when private shops, mobile entrepreneurs, credit facilities and livestock markets are increasingly rare. Grain itself can be a commodity difficult to purchase (Arhem 1981, IRA 1983) further exacerbating a perilous economic situation.

29. The NCAA is charged with the development and management of the pastoral communities in Ngorongoro and their current management plan drafts give greater attention to pastoral problems than earlier documents (IRA 1983). Many long term problems which hinge on a continued growth of pastoral populations within a finite area and consequent overstocking and overgrazing are beyond the scope of this paper. The long term management of pastoralist resources cannot be separated from the management of the natural resources of the area. Over the past few years concern had grown that pastoralism would become incompatible with conservation and that erosion, species loss and lowered wildlife densities would result from increased pastoralist presence. This study, and preparatory surveys for the 1983 management plan, suggest this need not be the case. Ecosystems

Ltd (1980) in a survey of Arusha Region as a whole showed erosion to be associated with agricultural and agropastoral rather than pastoralist settlement. In Ngorongoro itself the problem of wildlife transmitted disease (eg Malignant Catarrhal Fever from wildebeest) means that the wildlife dictate how cattle use the area not vice versa. It is one of the tenets of the revised management plan that conservation and pastoralism can be compatible.

30. Shorter term problems affecting the immediate economy of the pastoralists can be more easily alleviated. Disease problems, especially tickborne diseases, could be reduced by more effective veterinary care and the continued provision of acaricide and drugs. Livestock condition and hence milk yields can be improved by continued maintenance of water sources. This when managed properly can also deploy livestock resources to reduce heavy grazing. Lastly grain can be made more readily available by developing Maasai trading institutions (cooperatives etc) and maintaining transport routes within the area. Largely as a result of this study such development is under planning consideration at the moment with a major project by Oxfam improving road access to Sendui (greatest need for grain and greatest difficulty obtaining it), and proposals to supply acaricide and substitute windmills for broken diesel water pumps currently before the EEC.

Table 1: a. Range parameters

Area	Habitat	Season	Forage volume cu.m./ha	% Crude protein
Gol	slopes	wet	833	8.4
	plains	wet	313	8.9
	slopes	dry	592	6.0
	plains	dry	177	5.3
	browse	all	-	11.2-12.7
Ilmesigio	upland tussock	dry	340	6.5
	woodland turf	dry	228	8.1
	lowland tussock	dry	588	3.8
Sendui	Eleusine tussock	dry	980	4.7
	upland tussock	dry	795	6.8
	Embulbul plains	dry	87	6.5
	Loipukie tussock	wet	616	7.6

b. Diet nutritive values
(crude protein % estimated from faecal analysis)

	dry	wet
Gol	8.0	9.3
Ilmesigio	8.7	8.9
Sendui	5.5	8.2

Table 2: Herd Counts

boma	August 1981						1980 NCAA census					
	corral herd			boma herd			boma herd			village means		
	ad	calf	total	ad	calf	total	ad	calf	total	cattle	small stock	n
Nasera	126	42	168	178	76	254	109*	42*	151*	167	197	31
Ilmesigio	124	52	176	258	73	331	232	67	299	155	242	23
Sendui	92	65	157	92	65	157	93	66	159	225	450	21

* These figures are the pooled NCA counts of 1980 corral herds for the two major Ndureta herdowners using the temporary Nasera boma in our 1981 study.
ad = adult

Table 3: Herd Composition

Area	% Total Herd						% Female Herd		
	Cow	Heifer	Bull	Steer	Calf <1yr	Total	Cow	Heifer	Calf <1yr
Nasera	42.9	15.5	5.4	11.3	25.0	168	60.5	21.8	17.7
Ilmesigio	40.6	14.5	2.1	14.6	28.1	96*	60.0	21.5	18.5
	38.1	12.5	4.6	15.3	29.6	176**	58.6	19.3	21.9
Sendui	29.4	15.7 +11.1	4.6	7.8 +5.2	26.1	157	(42.5)	(38.7)	18.9
Dahl and Hjort (1976) theoretical composition							60.0	25.0	15.0

* Ngodoo ** Ngodoo + Olelekando

Table 4: Biomass densities

Area	Site	Rainfall mm (est.)	Biomass density Actual (kg/sq km)	Theoretical	A/T
Gol	Oldomgom	550	7274	3568	2.04
	*Nasera hillslope	500	4716	3134	1.50
	**Nasera plains	500	339	3134	0.11
Ilmesigio	Ngodoo boma	900	11000	9100	1.21
Sendui	Senguyan boma	1000	14071	10500	1.34

* Area used for 6-8 months of the year only
** Does not include seasonal high densities of wildlife

Table 5: Population parameters

	Gol	Ilmesigio	Sendui
No. adult cows monitored	70	38	45
Calving rate	0.61	0.53	0.69
Cow mortality	0.129	0.079	0.133
Calf mortality	0.231	0.279	0.276
r	-0.074	-0.065	-0.057
Time to halve (yrs)	9.3	10.7	12.2
Offtake	8.3%	8.8%	7.3%
% calves dying at <3 months	6	41	18
3-12 "	86	35	46
>12 "	8	24	36

Table 6: Daily activity and travel energy expenditure

Oldoinyo Gol

Date	Season	Day	Hours activity walk	feed	other	Distance covered (km) horizontal	vertical	Travel energy (kcal)	%FM
Aug 81	dry	w	5.3	3.6	1.9	14.5	1.10	2651	53
		g	2.8	5.8	1.0	7.5	0.20	920	18
Dec 81	dry	w	-	-	-	16.5	0.24	1779	36
		g	2.8	7.7	1.5	14.0	0.38	1725	35
May 82	dry	w	2.8	6.5	2.8	7.5	0.88	1752	35
		g	3.6	6.0	2.4	5.0	0.70	1306	26
Dec 82	rains	w*	1.7	7.9	2.3	7.5	0.20	920	18
Aug 83	dry	w1	-	-	-	20.6	0.20	2099	42
		w2	7.8	3.4	0.9	23.0	0.24	2364	47
		g	-	-	-	12.5	0.28	1468	29

* Abundant water: no dry days. 1=Osokunwa wells; 2=Olongoyo hill pools

Ilmesigio

Aug 81	dry	w1	6.9	3.1	0.9	14.0	0.74	2166	43
		w2	2.6	4.8	1.9	5.5	0.20	740	15
		g	2.7	4.9	2.2	6.5	0.20	830	17
Aug 83	dry	w	4.3	5.3	2.4	12.3	0.82	2111	42
		g	-	-	-	4.8	0.36	873	18

1=Olmakutian boma; 2=Olelekando (Ngodoo) boma

Sendui

Aug 81	dry	w	3.8	5.6	0.9	12.5	0.70	1982	40
		g	1.6	6.8	2.5	4.0	0.40	850	17
May 82	dry	g	2.2	9.1	0.7	4.5	0.35	833	17
Dec 82	rains*	w	2.6	8.3	1.1	9.5	0.86	1908	38
		g	2.1	7.8	2.2	7.5	0.62	1434	29
Aug 83	dry	w	4.5	5.1	1.4	12.5	0.70	1982	40
		g	1.9	6.4	2.3	4.6	0.40	904	18

* Data from Loipukie temporary camp

Table 7: Milk production

Date	Area	Boma	mean milk yield (g)	s.d.	no. cows	no. yields
Aug 81	Gol	Nasera	300	97	38	155
	Ilmesigio	Ngodoo	597	148	24	186
	Sendui	Senguyan	340	113	33	180
Dec 81	Gol	Olduvai	352	151	21	51
	Sendui	Senguyan	243	136	13	47
May 82	Gol	Ndureta	339	122	25	91
	Sendui	Senguyan	511	120	9	29
	Sendui	Lera	656	174	13	31
Dec 82	Gol	Ndureta	547	169	21	90
	Sendui	Loipukie	487	145	14	57
Aug 83	Gol	Nasera	227	102	18	61
	Ilmesigio	Ngodoo	424	247	11	36
	Sendui	Senguyan	379	187	13	44

NCAA herd total yields average 4.7 litres/ day (8 cows x 8 weeks; s.d.=0.51)
NCAA cows fed supplement " 5.3 litres/ day (8 cows x 10 weeks;s.d.=0.62)

Table 8: Variation in milk availability

Area	Date	Mean milk yield/cow (g/day)	No. milk cows	Total yield (kg/day)	Adult equivalents	Milk kg/A.E.	$\bar{X}$
Gol	7/81	600	38	22.8	20.3	1.12	
	12/81	704	29	20.4	20.3	1.00	
	5/82	678	41	27.8	20.3	1.36	
	12/82	1094	27	29.6	19.5	1.52	
	8/83	454	17	7.8	19.8	0.40	1.08
Ilmesigio	8/81	1194	23	27.4	21.1	1.30	
	8/83	848	19	16.2	22.9	0.70	1.00
Sendui	8/81	680	34	23.2	29.6	0.78	
	11/81	486	21	10.2	29.6	0.34	
	5/82	1022	23	23.6	30.8	0.76	
	12/82	974	16	15.6	28.8	0.54	
	8/83	758	20	15.2	30.0	0.50	0.58

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Contents

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Contents

1. Papers issued

Together with this Newsletter I am sending you three papers:

18b brings together some comments on Addis Anteneh's paper on Financing Animal Health Services (Network Paper 17b). The main item is a note by Richard Morgan in which he compares Botswana's experience with the countries included in Anteneh's survey, which were in west and central Africa, and Madagascar.

18c and 18d both result from work carried out under the Niger Range and Livestock Project: J Swift and A Maliki's paper (18c), after describing the broad aims of the project, focuses on their experience with setting up herders' associations. C White's paper (18d) makes the case for establishing a pastoral credit system and is based on detailed surveys of Wodaabe production systems which show up trends of increasing poverty. In the next issue of the Network (19), it is planned to include a third paper on the Niger Range and Livestock Project: this will refer to its animal health programme.

2. Lunch-time talks at ODI

On 21 June, Camilla Toulmin (Oxford University) talked about 'The allocation of resources to livestock research in Africa'.

3. Forthcoming conferences/training courses

26 March - 28 September 1984: six month nondegree training course on International Range Management and Extension to be held at Utah State University, USA. Further information from Suzanne Blakely, Conference and Institute Division (UMC 50A), Eccles Conference Center, Utah State University, Logan, Utah 84322, USA.

24-27 April 1985: Annual Meeting of the Association for Arid Lands Studies, to be held in Fort Worth, Texas, USA. Papers on all topics related to arid lands studies welcome. Further information from Otis W Templer, AALS Program Chairman, Department of Geography, Texas Tech University, Lubbock, TX 79409, USA.

4. Recent acquisitions to the library

If you would like any of your recent drafts/publications to be listed here and to be available in the ODI library, please send copies of the documents to Fiona Harris.

ANDREOTTI, Y : 'Herdsmen in Helicopters: a report from the Nenets Autonomous Area' in Soviet Union No 2 (395) 1983, pp 37-41.

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5. Format of Network Papers

Some time ago readers were asked whether they were happy with the present format or whether they would perfer to see all papers in one issue bound together. Of 165 replies, 138 said they would like to see papers bound together. However the 27 who said they preferred the current format had convincing arguments (papers were easier to file separately by country or subject; they were also easier to loan and to copy). Also, the AAU has to bear in mind coordination of administration with the two other current networks, Irrigation Management and Agricultural Administration. For these reasons, a final decision has yet to be made, and the format remains unchanged for the time being.

6. Subject matter of Network Papers

Please fill in and return the enclosed questionnaire as soon as possible to help me plan for future issues. A large proportion of papers have been concerned with Africa (though of these, few with francophone Africa); does this correspond with your expectations? Also, there have been few papers recently on range, or veterinary services. Please let me know what you would like to see, and what you can offer.

The effective date of this Newsletter is 7 September 1984.

Clare Oxby

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PASTORAL DEVELOPMENT NETWORK

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COMMENTS ON PASTORAL NETWORK PAPER 17b

(Financing Animal Health Services in some African Countries)

by

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Richard Morgan writes:

FINANCING ANIMAL HEALTH SERVICES IN AFRICA: A NOTE ON BOTSWANA'S CASE.

1. The purpose of this note is to compare the case of Botswana with the picture regarding the financing of animal health services presented in Addis Anteneh's survey of 14 African countries (ODI) Pastoral Development Network paper 17b, January 1984). An attempt is also made to take the discussion slightly beyond the descriptive by introducing some consideration of the factors causing the exception that Botswana appears to represent.

Anteneh's preliminary conclusions were, in summary, that funding of animal health services in the countries surveyed has not been adequate, particularly as a proportion of national operating budgets; that recurrent costs have been disproportionately dominated by staff expenses; that animal diseases have not been adequately controlled; and that additional studies of equity issues, resources allocation efficiency and financing strategies for livestock services are needed.

Botswana's livestock sector as part of the national economy.

2. Whilst the overall average contribution of livestock to the agricultural GDP for the countries surveyed was 15%, the sector makes up at least 10% of total GDP in Botswana, and contributes around 15% of export revenues as well. This latter figure was until recently much higher, but has been dwarfed by the rapid expansion of mineral exports after Independence. Income from cattle is extremely important in the rural sector, to which some 83% of households still nominally belong, and cattle holdings are closely correlated with income distribution as a whole. The country has a high livestock to people ratio: almost 3:1 if cattle are taken alone, and 3.8:1 if smallstock (goats and sheep) are also

included. In the formal sector, abbatoir and meat processing industries, based on the Botswana Meat Commission's export oriented plant at Lobatse with an annual throughput capacity of around 220,000 head, contribute some 40% of national value added in manufacturing. The period from the late 1960's to the early 1980's saw a rapid growth in the national herd, as a result of relatively good rainfall combined with favourable prices in export markets, predominant among which is the EEC, arrangements with which give Botswana an import levy rebate of 90% on a substantial annual quota. Thus by 1981, export volume was up 79%, and average prices per beast paid to producers up 212% on the 1968-71 period.

Funding of the livestock sector

3. Expenditure on livestock-related projects, many of which were aimed at improving animal health services, financing commercial ranch investments, and expanding marketing infrastructure, is roughly estimated at P2.4+ per animal annually over the period 1979-1982, or P7.5 per citizen. In terms of the measure proposed by Anteneh to indicate the adequacy of livestock sector allocations (ratio of percentage share of government agricultural expenditure in agricultural GDP to share of livestock expenditure of livestock GDP), Botswana is close to unity, and in this sense to an adequate recognition of the sector's economic contribution. A further measure, perhaps of higher relevance to a commercial beef-exporting country, is that of the government's net subsidy to the sector (which is significantly often referred to as a livestock industry). The following calculations are the average of annual figures for the years 1977/78 to 1980/81 (Presidential Commission on Economic Opportunities, 1982).

+ Current exchange rate Pula 1 = £ sterling 0.59.

	Pula million
Net input subsidies (relevant Ministry of Agriculture expenditure less revenues	5.6
Capital expenditure on livestock development	5.4
EEC export levy rebate (passed on to producers via Botswana Meat Commission payments)	10.8
	21.8
LESS	
Taxes on Botswana Meat Commission turnover	5.2
Tax on farming companies	0.3
Tax on individual farmers	0.9
	6.4

4. Thus a net subsidy of P15.4 million per annum, or P270 per livestock-owning household (estimated at 45% of all rural households although this measure has definitional problems), or about 2.2% of GDP, is passed by government to the sector. This net subsidy has risen considerably since the above period as animal health service spending was expanded as a response to the temporary loss of access to the EEC market following an outbreak of foot-and-mouth disease in 1978, and due to measures such as the largely grant-assisted increase of export abbatoir capacity and the importation of stockfeed and vaccine for free or subsidised distribution to farmers, taken in response to the current 3-year drought period.

5. It is also worth noting that Botswana has recently developed an industrial vaccine production sector to meet local and regional needs; this is presently limited to foot-and-mouth strains but is likely to encompass rabies and rinderpest within a few years, and to take on the role of regional animal vaccine bank and research centre. Whilst a considerable subsidy to Botswana producers is involved, success in

exporting to neighbouring countries has enabled the Vaccine Institute to operate in surplus and to service its initial loans.

6. A general pattern, therefore, of profitable export markets permitting net subsidies to the internal sector is apparent; export earnings (and donor aid) have helped the country to provide assistance to beef producers, only a small proportion of which is recouped through internal savings. It is arguable, however, that the commercial livestock sector should finance its own expansion to a much greater extent, and contribute more to government revenue than the 4-5% it presently does through taxation (Hudson, 1981).

The animal health budget.

7. As implied earlier, the livestock sector accounts for a significantly higher share of government operating budgets (about 4%) and of total capital expenditure (6.3%) than in the countries surveyed by Anteneh for which data were available. Interestingly, staff costs as a percentage of total operating costs have been around 50-52% in Botswana, although this, and the fact that such costs have been covered almost wholly from domestic finance, disguises a considerable but diminishing contribution of externally-funded technical assistance. Capital expenditure has recently been met about 60% from external aid (a sizeable part of this in the form of World Bank loans), so that for both parts of the budget internal funding has been much more significant than in most of the countries surveyed.

Livestock-related revenue.

8. The survey found that potential tax receipts were often small in comparison to the livestock budget, leading by implication to an under-financing of the sector, with both undercollection and a lack of priority to its development being causal factors. By contrast, Botswana's relative freedom from financial constraints arising from a favourable

foreign exchange and budgetary position, in addition to generous foreign aid allocations, may have induced a financing policy towards livestock which has overemphasised expansion at the expense of a more broad-based economic development. This possibility is illustrated by the incentives to private investment in livestock offered by a very narrow taxation system: apart from the minor flat rate local government tax on livestock holdings, which in practice is virtually unadministered, only about 6% of cattle-owning households are taxable, and of these less than 15% actually pay tax (i.e. less than 1% of cattle-owners).

9. Whilst this taxation system has not let to underfinancing, particularly as taxes collected and revenue from government sale of livestock accessories (usually subsidised) are paid into general accounts, and whilst it can be defended on the grounds of increasing rural incomes and, indirectly, encouraging foreign exchange earnings, it can be questioned on the following grounds:

- it helps to perpetuate inequalities between cattle-owning household and others, as well as within the sector, through a high producer price/low taxation regime;
- it encourages investment in an activity which is generally not employment-intensive, and does not contribute to economic diversification away from a production system vulnerable to drought and to loss of a single main export market;
- it creates conditions favouring household accumulation to the extent that long term degradation of the grazing resource occurs as a result of short term "pasture mining".

It should be noted that the sector has not achieved any significant shift to a high-input production system, and that expansion of farmer incomes has occurred largely on

the basis of traditional open grazing on communal land, access to which is increasingly determined by the ownership of water sources.

10. Consideration of possibilities for reform of the livestock taxation system has focussed mainly on the introduction of an ad valorem slaughter tax at the two export abbatoirs to replace to some extent taxation of incomes. This has not so far been adopted, on the grounds that it would reduce the incentives for offtake; and the same reasoning could apply to other options such as increasing trekroute watering fees and quarantine camp charges. Some vaccines, notably foot-and-mouth, are both free and compulsory, in view of the potentially huge cost to the country of a few defaulters, and thus the scope for revenue-raising through sales is limited mainly to livestock accessories, useage of which it is intended to encourage anyway. As in many countries, the context is one of government monopoly in provision of livestock services, arguably by default, and of a highly centralised animal health service administration. The lobbying capacity of larger livestock owners provides a counterbalance to this centralisation.

Effectiveness of animal health services.

11. These services in Botswana have been generally effective in maintaining a highly profitable export trade with Europe, and have done so by creating an elaborate network of vaccination campaigns, cordon fences for livestock movement control, quarantine camps, trekroute infrastructure and abbatoir facilities. In terms of the specific indicators used by Anteneh, Botswana's Department of Animal Health has a combined ratio of high and middle-level staff to cattle numbers of less than 5000 to one, which is far lower than the norms suggested in the survey, and also very low by comparison with all the countries surveyed. Once again, this disparity reflects the particularly prominent economic role of livestock raising as well as its consistent

profitability in post-Independence Botswana. Finally, as compared with an estimated norm for recurrent budget allocations per head of cattle of US$ 0.75-0.90 for Sahelian countries in 1976, Botswana allocated on average between 1977 and 1981 about US$ 2.1, rising to around US$ 4.8 in more recent years.

Conclusion

12. The exceptional treatment of animal health service financing described here suggests consideration of wider conditions. When taking further survey work beyond the descriptive level, a need is implied for attention to be given to the role of livestock sectors, in national and regional economic structures, to the extent that these sectors are integrated into world markets, and to the question of cattle farmers' access to influence over resource allocation decisions. This last area necessitates in effect a treatment of the relation that exists between farmers and the dominant or decision-making elite at the levels at which finances are controlled or raised (in Botswana's case, a relation of significant overlap), and the processes by which their interests are represented. Also suggested by this brief consideration of Botswana's case is that the limitations on support to animal health services in some countries may be partly explicable through an examination of the reliability and sources of overall national finances, as well as of the range of investment and market opportunities facing the country and the relative attractiveness of livestock among them.

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M.J. Iles writes:

13. I have a few general comments which might have benefitted the paper and which have implications for policy:

(i) I would have liked the tables summarising expenditure in constant prices.

(ii) It would have been beneficial to have judged expenditure against national priorities which are likely to vary from country to country, i.e. production, management, health or marketing.

(iii) Following on from (ii) it would have been very useful to have an expenditure breakdown for preventive and curative services since this represents an important policy choice (whether or not that choice was consciously made). I accept that this might prove an insurmountable data problem for a desk study.

(iv) It would also have been useful to know the relationship between the provision of services and the location of the national herd. Have any countries made an attempt to service the needs of nomadic herders?

(v) I would also have been interested to learn the sources by farm type (nomad, small commercial, large commercial) of sales and head taxes, where they still exist, as an indication of the level of commercial activity. Again, this may prove impossible because of lack of data.

James Dickey writes:

14. This is a very good assessment of the budgetary situation of the Animal Health Services of West Africa which command a very small and diminishing portion of the National Budgets and are top heavy on personnel. The needed increase

of the Animal Health Service budget, whether from the government allocations or private user fees, should be chanelled towards meeting the recurrent costs of operations. Donor funds might best be used to improve the diagnostic capacity, while the recurrent costs of these improvements should be covered with host country or private producer funds. The efforts initiated by ILCA to develop the economic efficiency of resource allocations could produce essential guidelines for both host countries and donors to utilize more effectively the limited financial resources available. The well organized tables supporting the article provide an excellent reference. Thanks.