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FOOD AND AGRICULTURE ORGANIZATION
OF THE UNITED NATIONS



UNITED NATIONS
ENVIRONMENT PROGRAMME

EMASAR PHASE II

Volume VIII

SUDAN

Proposals for grazing land development



ND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

ECOLOGICAL MANAGEMENT OF ARID AND SEMI-ARID RANGELANDS

IN AFRICA, AND THE NEAR AND MIDDLE EAST

(EMASAR - Phase II)

Volume VIII

SUDAN

Proposals for Grazing Land Development

By

G. Boudet
Chef de la Section d'Agropastoralisme
Institut d'Elevage et de Médecine Vétérinaire
Maisons-Alfort, France

P.G. Delpiano
Economiste agricole
ROC International
Paris, France

A. Abdallah
Range Ecologist
Provincial Administration
Egypt

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I FOREWORD

1. At the request of the Government of the Republic of Sudan and with the assistance of the EMASAR ^{1/}Phase II project, a grazing land consultation mission visited Sudan from 23 May to 26 June 1977. The mission was composed of three members:

- A. Abdallah, Rural Sociologist
- G. Boudet, Agropastoralist
- P.G. Delpiano, Agricultural Economist

2. The terms of reference of the mission were to :

- i) examine the studies made on selected perimeters and related preparatory papers and make proposals for the best use of these perimeters and their sustained production, taking into account the projected figures of meat/milk demand and the possibilities of implementing a grazing rights policy, and the integration of crop and livestock and possibly forestry productions;
- ii) synthesize the available information related to the grazing, feed and livestock resources, the present traditional land usages and marketing practices, the present action programmes in the livestock sector in selected areas;
- iii) establish a plan for the gradual implementation of grazing cooperatives and/or other related improved land use and production schemes, with guidelines for resources management and land registration, including the use of incentives to this effect.

3. The mission schedule and travel programme was arranged by the Range and Pasture Administration of the Ministry of Agriculture, Food and Natural Resources. The briefing was made by and the discussion of the mission's findings and recommendations took place with the R.P.A. Director General, Dr Hashim Mukhtar, the FAO Representative, Dr K.M. Abed, and the UNDP representative, Mr C.H. Lamunière.

^{1/} The Phase I of the EMASAR Programme (Ecological Management of Arid and Semi-Arid Grazing Lands in Africa, the Near and Middle East) consisted in an expert consultation (May 1974) and a Conference (February 1975). The present Phase II endeavoured to enlarge on three different subjects -

- the definition of grassland education, training and information strategies;
- the preparation of a forage plant breeding and improvement programme for arid and semi-arid zones;
- the assistance to countries in the formulation of grazing land development projects and guidelines.

As regards Education and Training, Volume II (Sahel countries) and Volume V (Eastern and Southern Africa) have been published and will be followed by similar publications regarding Near East and Middle East.

As regards Forage Plant Breeding and Improvement, Volume III (Dry Tropical Africa) and Volume IV (North Africa, the Near and Middle East) are being published.

As regards Grazing Land Development, Volume I has dealt with elements of development and extension strategies for the Sahel. The present volume is in the same project component.

4. During their stay in the Sudan, the mission members worked closely with the Range and Pasture Administration staff and with officers from other departments at regional and central levels, and had interchanges of information with local producers.

The Mission is much indebted to the responsible Government services for advice and guidance, to fellow UN personnel for their collaboration and to all concerned for their hospitality and assistance.

1 feddan	=	0,42 ha
1 ha	=	2,38 feddan
1 Sudanese pound	=	US\$ 0.3976
1 US \$	=	2.51 Sudanese pounds

II SUMMARY OF FINDINGS AND RECOMMENDATIONS

1. Sudan is a huge country and when it comes to attacking the difficult problems of grazing land use and management, dispersal of efforts in time, space or quantity, should be avoided.

2. The major tasks faced by the Range and Pasture Administration would be :
 - . the establishment of full-scale pilot projects on grazing land management and use;
 - . the combatting of bush fires;
 - . the investigation of grassland/fodder crop production techniques;
 - . the setting up of improved livestock production perimeters;
 - . the monitoring of economics of grazing land development;
 - . the dealing with relevant educational and training activities.

3. The general guidelines for action would be :
 - projects and trials should make the best use of the available staff and other inputs;
 - demonstrations should be carried out as much as possible with the collaboration of the local pastoralists and livestock owners; they should aim at grass-root training and use technologies easily understood and accepted;
 - demonstrations should aim at solving specific problems : the control of land degradation and fight against desertification (grazing resources management, soil and water conservation,...); the improvement of traditional livestock production systems (provision of alternative sources of feed and forage, improvement of livestock husbandry ..)
 - large scale projects should be monitored on the technical as well as economic side; the coordination of the different services involved (rural, water, forestry, animal health, etc..) should be effected from the start, particularly in the case of integrated projects, (Darfur, Kordofan...), the improvement of stock routes and town perimeters.

4. The following projects would seem to deserve a concentration of manpower and other inputs -
 - in the Gezira province
 - a) the establishment of a national forage seed production unit;
 - b) demonstration trials on the introduction of a fodder crop in an irrigated scheme;
 - in the Blue Nile province
 - a) the establishment of a permanent cooperative ranch at Abu Rumeila;
 - b) demonstration on the improvement of a seasonal cooperative ranch at Guezat;
 - in the Kordofan province
 - demonstration on the integrated use of a town perimeter around El Obeid.

III BASIC INFORMATION RELATED TO GRASSLAND DEVELOPMENT

1. Economic data ^{1/}

i) Sudan is the largest country in Africa, with an area of about 2,5 million Km.

Population and economic development are concentrated along the Nile, particularly in the Khartoum and Blue Nile Provinces. It is estimated that the population has grown from 10.3 million in 1955 to 14.1 million in 1973, with a growth rate of about 2% per year during the 18 year period. On the basis of this % of growth the population at the end of 1976 was estimated to reach 15 million people.

The economically productive population in 1973 was estimated at 6,6 million, predominantly rural.

ii) The economy experienced an estimated 7.8% growth p.a. from 1970 to 1972.

During the period 1962-1970, the national income per capita changed very little from LS 36 ^{2/} and when adjusted for prices increase, per capita income has in fact decreased. The Sudan economy is predominantly agricultural (including livestock, forestry and fishing) and agriculture plays a larger role than its 39% contribution to GDP would indicate.

Transport systems consist of 7,757 km of single track railways, 3,500 km of river services, and about 19,000 km of roads and tracks. Only about 330 km of the roads are paved, and about 5,000 km are built to gravel standard. The railways are operating below potential capacity at the moment and operations are not meeting current requirements. Port Sudan is the main door for Sudan trade; the port's actual capacity is almost saturated and needs to be increased.

2. Forage resources

i) The country's agricultural resources are under-utilized. Out of the country's land surface of 250 million hectares, 80 million hectares can be used for agricultural production, but only 31 million hectares are at the present being used; 7 million for cropping and 24 million for grazing. The area under cultivation is however, increasing at an average rate of 3,7% per year. The grazing areas are the basis of livestock production, which is supposed to employ wholly or partially about 25% of the total human population.

ii) Sudan covers a wide variety of ecological conditions, from true desert to tropical forest. Its territory recoups a range of isohyets from 0 mm per year to more than 1,200 mms of rain per year. ^{3/}

The vegetative cover reflects broadly speaking, the rainfall pattern and varies from desert scrub (100-200 mms rainfall per year) to high rainfall woodland. ^{3/}

Although official estimates of livestock losses due to recent droughts are not available, the general opinion seems to be that the total number of livestock has not been affected. In the northern part of the Sahelian zone however, (N. Darfur and N. Kordofan), cattle are gradually being replaced by sheep, goats and camels.

^{1/} See also Annex 1 for data on agricultural exports and imports (table 1) and details on GDP (table 2).

^{2/} about US\$ 97.00

^{3/} See Annex 2 and relevant map on environmental data (geomorphology, grassland types, carrying capacity estimates).

Comparison of vegetation surveys carried out in 1958 with reconnaissance flights in 1975 revealed that desertification has progressed southwards by about 90 to 100 kms during these 17 years. It would seem that this process is mostly man-made and due to over-grazing, cropping, cutting and uprooting shrubs for fuel and burning.

It is quite difficult to estimate accurately the carrying capacity of the different grassland types or major land forms of the Sudan. Annex 2 reproduces some estimates made by Hunting Technical Services in the framework of the FAO/UNDP Savanna Development Project (Phase II - Annex 3 - 1976) and by W.O. Shepherd (Report to the Government of Sudan on Range and Pasture Management - FAO, 1968).

It would appear that in the S. Kordofan/S. Darfur area the most serious overstocking takes place in July, October and November when long term transhumants pass through. Overstocking seems less severe at mid and late dry season, when only sedentary flocks and herds remain in the area.

Sudan's grasslands are frequently used by long range transhumants, short range transhumants and sedentary livestock owners, a situation which makes the national conservation and use of this resource difficult. The assessment of grassland productivity is furthermore made hazardous by the fact that grass and herbs which constitute the major diet of livestock are complemented by crop residues and browse species, which are frequently as rich in protein content or more.

There is certainly a great need to have stocking rate and grassland and crop residue management trials in order to better ascertain the productivity of the different forage and feed resources and the requirements of the different classes and categories of livestock.

3. Institutions

The Range and Pasture Administration is composed of 24 graduate staff, out of which two Ph.D., 10 M.Sc., 3 B.Sc., and 9 on study leave for Ph.D. and M.Sc. degrees in Range Management. This staff is assisted by 26 intermediate level technicians, who have generally been trained at the Animal Health Industry Training Institute at Kabete, Kenya. The administration is very short of professionals and technicians to carry out its widespread activities. Shortage of transportation facilities and budgetary limitations also hinder the work of this unit. ^{1/}

4. Social factors

- a) The process of range and pasture development in Sudan is faced by many acute problems which have to be tackled simultaneously within an integrated comprehensive approach simply because they are interacting with each other.
- b) From a sociological point of view pastoralists by their misuse of natural resources and by overstocking of animals, constitute the core of these problems. Some writers tend to sustain nomadism as an adequate way of utilizing natural resources but Allan states

^{1/} The above has been drawn from Volume VII "Near East - The present situation of grassland education, training and extension" by El Moursi, which should be consulted for additional details on grassland education and training. See also Annex III of the present volume for further details regarding the work of the Range and Pasture Administration.

that nomadic pastoralism is inherently self-destructive since systems of range management are based on the short-term objective of keeping as many animals as possible alive without regard to the long-term conservation of land resources. "The general picture is one of steadily increasing stock numbers and progressively deteriorating land. 1/ "

c) As regards deterioration of grazing lands; although there is no available data on hand on this subject, one can by mere observation, easily discover this widespread phenomenon all over the country, especially around water points, towns and cities. In some arid and semi-arid areas, retrogression has left the soil bare and denuded and hopelessly beyond any improvement. Fire further aggravated the situation and reduced grassland quality and quantity. 2/

d) On the other hand, destocking is usually rejected by pastoralists because cattle to them mean security, influence, power and prestige. It also constitutes a daily source of diet as well as a source of cash available at any time.

Furthermore, keeping big numbers of animals is considered as a defensive strategy against natural calamities and disaster. It is to the advantage of no one individual person to limit the number of his own animals unless his fellow members of the tribe can be persuaded to do likewise. 3/ The belief that those who have large herds are industrious, brave and puritanical is still prevailing. 4/

e) From a technical and economic point of view overgrazing as a common phenomenon in Sudan has gradually changed the grazing land cover from valuable indigenous perennial grasses to less valuable annuals. To reduce grazing pressure to be equivalent to the normal carrying capacity of the land is another big problem. If destocking is not accepted by nomadic pastoralists, therefore, another device should be injected, in order to conduct proper management over the traditional rights of communal land use for grazing to realize maximum utilization of pasture feeding capacity without deteriorating existing resources if not improving them. It is also the responsibility of the government to allocate the required funds for grazing land development in order to increase the carrying capacity of the pasture.

1/ Allan, W., The African Husbandry, London 1965, quoted from Lewis, I.M., Article on Nomadism, p.2

2/ Range and Pasture Administration, Strategies of Range Management in the Sudan, Ministry of Agriculture, Khartoum, p. 1

3/ Harrison, M.N., Report on a grazing survey of the Sudan Khartoum, Part III, p. 18

4/ There are many learned opinions nowadays which would put into doubt the classical shortcomings attributed to the traditional livestock production systems. The following is extracted from the FAO/UNDP study, subcontracted to Huntings Technical Services, "Agricultural Development in the Jebel Marra area" Annex III Livestock and Range Resources, p. 13. December 1977 :

"For many years the idea persisted that Southern Darfur was a land in which grazing was abundant, that cattle and other domestic livestock bred and grew profusely, that the livestock owners for perverse reasons of their own kept large numbers of 'useless' (i.e. unproductive) animals, and that these animals could provide a continuous and unlimited supply of meat if the conservative ideas of their owners could be overcome.

Recent studies in both Southern District (HTS, 1974) and Eastern District (HTS, 1976) have done much to disprove the myth of large numbers of unproductive stock, but planners in general have yet to accept that a limit on numbers has been reached and that under present systems of management annual offtake is at a maximum" (Editor's Note)

f) The major problem in this process seems to be the difficulty of influencing behaviour and changing attitudes of nomads overnight in order to adopt modern institutional devices for management, such as cooperatives instead of the traditional one.

In this respect it should be pointed out that such a process must be carefully handled and gradually injected wherever and whenever people are prepared to participate in it, because it is easy to break down a traditional system, but it is difficult to build up a new one.

g) Another major economic problem which the process of grazing land development entails is the unbalanced situation between the annual increase of animals and the off-take. The pastoralists never sell their female cattle unless they are sterile or too old to reproduce calves. It is again a sociological problem which has to focus on changing people's attitudes and beliefs in possessing cattle hand in hand with setting up a proper marketing system which guarantees high economic returns to the producers to encourage them to increase the off-take. At the same time, a better infrastructure of roads, transportation and communication has to be constructed to facilitate marketing activities.

h) Grazing land development is also impeded by the expansion of rainfed agriculture and mechanized farms everywhere in the country, especially in the Blue Nile Province whenever ecological and environmental conditions permit. There is no available data based on socio-economic grounds which indicate the social and economic return of agriculture expansion in comparison with grazing land and animal production per unit area per year. On the basis of such data a well defined policy can be formulated as regards rights of land use in order to realize the optimum utilization of natural resources.

i) The agricultural expansion at the expense of grazing lands has generated hostile attitudes in the nomads against cultivators. This attitude is clearly manifested in the frequent invasions of nomadic herds in the cultivated lands everywhere in the country causing severe damage to crop production. In the Gezira Scheme, for instance, these damages amounted to 2 million Sudanese pounds last year. The annual budget of the Scheme employs 60,000 Sudanese pounds to defend cultivation crops against such raids of nomadic herds. The fact that these raids constitute most of the tribal disputes in Sudan cannot be denied.

j) To cope with all these problems indicated above in the process of grazing land development, an integrated comprehensive approach is to be undertaken. The Government of Sudan may not be able to afford such an approach all over the country. Therefore, it is suggested that this approach is to be adopted in one province, such as the Blue Nile Province, within which many socio-economic and technical factors are found conducive to such development.

These factors are :

Land and water resources are adequate enough to sustain the execution of a variety of integrated projects such as the multiplication of forage seed on irrigated fields, introduction of fodder crops in the crop sequence of the Gezira Scheme, and rangeland development in pilot ranches, such as Abu Rumeila and Gueizat.

The encroachment of rainfed agriculture and mechanized farms upon the grazing lands give the Blue Nile top priority in grazing land development in order to protect the Kenana cattle (the best milking breed known in Sudan) from slow extinction.

Grazing land development in the Blue Nile will alleviate the antagonism between rural cultivators and rural nomadic pastoralists. This will in turn decrease the annual depredation of crops and increase the national income.

To adopt such an integrated comprehensive approach, two aspects should be considered. The first is to strengthen the local field administration of the Range and Pasture Department with a well qualified and trained staff. As a first step, this support can take place in the Blue Nile and Gezira Provinces. The second aspect is to strengthen horizontal and vertical lines of communication among all departments of the Ministry of Agriculture, Food and Natural Resources at both central and local levels.

This is badly needed in order to guarantee all means of coordination and integration of programmes and plans of development on the one hand, and to harmonize their functions on the other. Meanwhile, interrelationships among these departments on both central and local levels depend on mere personal relationships of the staff members. In this respect there is no other way than supporting and strengthening the local government system in order to create a competent administrative field staff which is capable of working hand in hand with the people.

5. Livestock production

- a) Recent estimates ^{1/} put the livestock population of Sudan at
- 14.1 million cattle
 - 13.4 million sheep
 - 10.5 million goats
 - 2.7 million camels

The arid and semi-arid parts of the country concerned by the EMASAR programme contain about 60% of the above cattle population, 80%, 66% and about 96% of the respective sheep, goat and camel populations.

The consumption of meat per capita is estimated at 9,0 kg for beef, 5,0 kg for sheep, 2,0 kg for camel and 0,4 kg for poultry. A considerable quantity of goat meat is also consumed in the rural areas; milk and milk products are an important element in the diet of urban and rural populations.

- b) The animal products which are imported on a large scale are day-old chicks and milk powder. The annual import of milk powder amounted in 1976 to 3,000 T, equivalent to 20,000 T of fresh milk, of an approximate value of US\$2 million.

- c) Livestock and livestock products have represented in value 6 to 10% of the total exports during the last years. In the past, livestock exports consisted mostly of live cattle, sheep and camels. The present situation is more complex. There has been a strong increase in the export of chilled beef and mutton, resulting from sheep and cattle being purchased off the grazing lands and still fed for a short time before slaughter on sorghum grain, cottonseed cake and a limited amount of forage. It is reported that 100,000 animals were finished in this way in 1973. The substantial increase of the price of sorghum in 1974 seemed to have affected the above system.

The export of cattle went from index 100 in 1970/71 to 343 in 1973/74 and the export of sheep from 100 to 229 during the same period.

Saudi Arabia has taken first place as importer of live animals (53,6% of cattle and 83,8% of sheep in 1973/74) while Libya was the prime importer of beef (50,1%) and Kuwait the prime importer of mutton (93,6%). There is also an unrecorded export of livestock on the hoof to the Central African Empire, Chad and Libya.

d) The pressure on exports has resulted in higher prices being paid for livestock in the producing areas, from 100 (1968/69 index) to 235 (1974/75) as regards sheep and from 100 to 330 for cattle during the same period. It has also affected meat consumption which decreased by about 40% between 1970/71 and 1973/74. A ban on livestock export has therefore been taken in January 1975 by the Government in order to satisfy local demand and stabilize meat prices.

e) Cattle marketing is influenced by the season, the lowest prices being fetched in the wet season. Mature cattle (350 kgs; 5 to 6 years old) fetch a higher price than younger animals (200 kgs; 2 to 3 years old) do, the price per kg live weight being 11-13 piastres for the former as compared to 9 for the latter. In terms of price per head, the difference is about 22 to 25 L.S. per head.

This is due to the fact that cattle merchants prefer to buy mature cattle, which can walk long distances to consumer areas; mature cattle are also better adapted to short term finishing before slaughter. The pastoralist himself prefers to market his cattle at a late stage as the majority of the growth between weaning and full maturity is effected on free grazing land.

f) Very little institutional credit is provided for either the production or the marketing of livestock. The system of credit provided by the Sudan Agricultural Bank is long or medium term (10 or 4 years with a 9% interest rate) or short term (seasonal with a 10,5% interest rate); it aims at facilitating the purchase of equipment and the improvement of registered land. The traditional stock breeder who has no guarantee such as crops or land does not seem to be able to use this sort of credit. There is however, a large but unquantifiable volume of non-institutional credit used in the traditional livestock marketing system, which appears to be ruled by a few, but strongly connected families.

g) Government has tried to accelerate the off-take from the grazing lands and expand export by issuing a 15% exchange bonus to livestock exporters (1972). This however, led to such a rise in the price of meat that a 7% and later on, a 22% development tax was imposed on exports. In 1975, a complete ban on the export of live animals was edicted. This led the merchants to curtail their purchases of animals in the traditional areas which resulted in a further rise in the price of meat in the country.

The ban on exports has damaged Sudan's position in the Arabian peninsula where Somali sheep production financed by Saudi Arabian merchants, seems to have replaced Sudan production not only in Saudi Arabia but also in the Gulf States, through re-exportation from Saudi Arabia.

The situation has led the Government to establish an Animal Production and Meat Marketing Corporation. Exporters are also persuaded to get involved in the livestock production process.

IV PROPOSALS FOR GRAZING LAND DEVELOPMENT

The mission has put major emphasis on its recommendations on the central part of the country, or what was called the Blue Nile Province, before it was divided between the Gezira, the White Nile and the Blue Nile Provinces in 1974.

The reasons are as follows :

- several projects have been identified in the western part of the country for integrated land development whereas in the central part, emphasis has been laid on the development of large-scale irrigated perimeters. It has followed that pastoralists and livestock owners of this zone have had increasing difficulties in following traditional transhumance and other land use patterns;

- there is a great need to develop forage seed production which can best be undertaken on a large scale and under irrigation.

- it would be beneficial to integrate dry land, extensive livestock production with intensive, irrigated forage production;

- there is a good social background which would militate for grouping livestock owners of that region. ^{1/}

The mission is therefore proposing for implementation or identification of the following projects :

In the Gezira province -

- National forage seed production unit Priority 1
- Irrigated fodder crop demonstration unit
in the Blue Nile province
- Abu Rumeila cooperative ranch Priority 1
- Seasonal cooperative ranch at Guezat.

In addition, the mission wishes, in view of the past and future efforts on the matter, to propose for the Kordofan province,

- Guidelines for co-ordinated development of towns and water points perimeters.

GEZIRA PROVINCE

General background

The total area concerned with the Gezira board includes now the Gezira scheme, the Guneid scheme and the Rahad project, for a total of about 2 million feddans. Lands out of the irrigated scheme are overgrazed during the rainy season by nomadic cattle coming from the Kassala, Khartoum, Blue Nile and Gezira (West) provinces.

^{1/} For further details, please see Annex 4 "Notes regarding socio-economic factors in the former Blue Nile Province"

Grazing lands are loamy or clayey, with scarce Capparis decidua, Acacia tortilis and Acacia nubica. Some straw of annual grasses remains at the end of the dry season. The size of grazing land available is decreasing, while cattle numbers purchased by the Gezira Scheme tenants are increasing.

In 1972 there were 96,000 tenant farmers (100,000 in 1977), grouped into 700 village councils helped by more than 500,000 seasonal cotton pickers. Each family is authorized to possess one dairy cow; these cows as well as goats and sheep are grouped into enclosures made of thorny bushes.

Cattle pressure is increasing around irrigated lands during the growth season. Damage to cotton was estimated at 2 million Sudanese pounds in 1975. Nomadic and sedentary cattle are however grazing cotton leaves and crop residues after harvesting on :

Cotton	:	600,000 fed.	
Groundnut	:	155,000 fed.	
Wheat	:	150,000 fed.	
Dura (sorghum)	:	300,000 fed.	(1972 census)

Irrigated lands are divided into 90 feddans plots. The livestock policy of the Gezira board was first aimed at the prohibition of fodder crops but since 1971 it has relaxed and in 1972 there were 100,000 feddans of Lobia (*Dolichos lablab*) and 4,500 feddans of Philipesara (*Phaseolus trilobus*). Perennial fodder legumes such as alfalfa (*Medicago sativa*) and *Clitoria ternatea* remain prohibited, for cotton pest control purposes.

Activities of the Range and Pasture Administration (RPA)

The activities of the RPA are carried out in close collaboration with the Gezira board authority in order to check cattle movements in the irrigated crop fields; the Gezira board spent last year 60,000 Sudanese pounds to chase cattle from the fields. The provincial range management officers try to hold back nomadic cattle through rangeland rehabilitation, on the eastern side of the Blue Nile. From March to May 1977, broadcast reseeding by car was carried out on 1,000 acres, with *Cenchrus ciliaris*, *Chloris gayana*, Abu Sabein sorghum and this area will be under deferred grazing through the closing of the watering points with the assistance of the Gezira Board Authority.

For the last two years, forage seed production on marginal loamy soils has been carried out on El Massed over 200 feddans and using furrow irrigation. The following seeds were produced:

- Abu Sabein Sorghum vulgare (70 days growth cycle)
- Phillipesara (Phaseolus tribolus)
- Sorghum sudanese

160 bags of 200 pounds were harvested of Abu Sabein on 20 feddans with a seed yield of 1,600 lb/fed. (1,728 kg per ha). 15 bags of 300 pounds were harvested of Phillipesara on 15 feddans with a seed yield of 300 lb/fed. (324 kg per ha). Hay by-product is sold to small livestock owners. Other crops are on small scale multiplication in nurseries :

Grasses

Cenchrus ciliaris
Chloris gayana
Panicum antidotale
Panicum coloratum
Panicum maximum

Legumes

Desmodium uncinatum
Glycine wightii
Macroptilium atropurpureum (siratro)

Shrubs

Acacia mellifera

1. Forage seed production unit

i) The objective of the project is to produce, at the national level, an important part of the forage seeds required for grazing land improvement and the introduction of the fodder crops in the crop sequence, as per the following plans put forward by the Administration and external assistance :

- 124,000 feddans of grazing land improvement during the next two years;
- 450,000 feddans of irrigated fodder crops in the Gezira scheme;
- 1.700,000 feddans of rainfed fodder crops in the mechanized agriculture scheme,

and in the medium term :

- 1.000,000 feddans of grazing lands belonging to the Kenana around the Blue Nile;
- 4.000,000 feddans of the Rizeigat communal ranch in Darfur;
- 1.000,000 feddans of commercial ranches in the Damazin area;

and in the long term :

- 200 million feddans of degraded grazing lands will need rehabilitation and reseeding.

The Range and Pasture Administration envisages completing the small seed multiplication plots of the provincial services by an additional 4,600 feddans, spread over 12 centres in 8 provinces, with subsequent difficulties related to the dispersion of the necessary inputs.

The mission proposes therefore, the establishment of a central forage seed unit in the Gezira scheme, particularly in the N.E. part where cattle fattening is supposed to be intensified.

ii) The size of the unit would be 3,300 feddans (1,386 ha), which would be able to produce a total of 970 T of seeds. Two harvests per year are planned, the rainfall of 250 mm being compensated by irrigation. The unit should be located near the main canal of the Gezira scheme, in order to have a regular supply of water the year long. This part of the country enjoys a high amount of sunshine. With a seed yield/seed ratio of 25, this unit should be able to supply the forage seeds for 144,000 feddans (60,500 ha), broken down as follows :

20.500 feddans (8,600 ha)	of irrigated fodder crops
58.500 feddans (24.600 ha)	of rainfed fodder crops
65.000 feddans (27.300 ha)	to be used for grassland improvement

The major species will be :

Annual grasses =	"Abu Sabein" sorghum
Annual legumes =	Lablab purpureus (Gubia) (Colichos lablab)
	Macroptilium trilobus (Phillipesara)
	(Phaseolus trilobus)
Perennial grasses =	Cenchrus ciliaris
	Chloris gayana
	Sorghum sudanense
Perennial legume =	Clitoria ternatea

(other species would be eventually added during the project's execution).

iii) The by-products of seed production (hay, straw ...) could be sold on the Omdurman market as such or used for short-term (120 days) or long term (8 months) fattening of beef cattle. It is thought however, that the latter operations are profitable if the price of carcass meat or of choice cuts is increased after fattening or finishing.

Without structural readjustments of the meat prices, it would seem that only long term finishing (8 months) would be able to profit from seasonal variations of livestock prices.

The cost price of the 970 T of seeds produced by the forage seed unit will be :

without scale or use of by-product	=	300 S. £ per T
with sale of 10,59 T of hay	=	245
with use of by-products to finish		
7.500 cattle over 8 months and benefitting		
15% of price differential according to		
the season	=	220
10% price differential	=	250
no price differential	=	300

It is useful to recall here that on the world market the cost price of T of seed is 1070 to 1.710 S.£.

2- Demonstration project on the introduction of a fodder crop in the crop sequence under irrigation

(a) Justification

The gradual transfer of traditional livestock to intensive crop production areas is one of the general objectives of the development of the livestock industry in African countries. In fact, the encroachment of dry land farming upon grazing lands should be compensated by additional forage production in the cultivated areas, so as to sustain the production of meat and milk.

To achieve the introduction of a fodder crop in the crop sequence, the following conditions should be filled :

- . to persuade the managers of large-scale crop production schemes that livestock development will not entail a catastrophic decrease in crop and particularly, cash crop production;
- . to persuade the same managers that a fodder crop, grazed in situ is as or more profitable to the soil than a fallow;
- . to avoid a vegetative cover during part of the rainy season in order to break the cycles of some cotton pests;
- . to define acceptable crop sequences.

(b) A full scale demonstration project should be established to investigate the benefits of this cultural practice on soil fertility and farmers' revenue.

The following crop sequence could be applied -

- 1st plot = cotton (June to April with ploughing in December);
- 2nd plot = sorghum (June to November) with a forage legume sown after the first weeding; grazing from November to March
- 3rd plot = cotton (June to April)
- 4th plot = groundnut (June to end October) Wheat (November to April)
- 5th plot = sorghum and groundnut (June to November).

The forage crop could be one or several of the following legumes :

Dolichos lablab = lubia
 Manoptilium trilobus = Phillipesara
 Phaseolus lathyroides
 Trifolium alexandrinum

Livestock should be tethered. Fattening at farm level would be done from December to April or even June with additional crop by-products and forage.

BLUE NILE3. The cooperative ranch at Abu Rumeila(a) Sociological aspects

The Abu Rumeila area is located 40 kms north of Singa on the western bank of the Blue Nile, at latitude 11°03' and longitude 47° 38'.

It is bounded by the railway line Sinar Roseires. The Range and Pasture Administration has started fencing an area of 300 feddans near the Khour of Abu Rumeila. The whole area which the Administration is going to develop is about 8,000 feddans.

The area of Abu Rumeila was selected by the Range and Pasture Administration for the execution of a pilot cooperative ranch according to the following reasons:

- accessibility of water and pasture almost all the year round, especially in the summer months, when the Sinar Dam is closed and the water level of the river becomes high. In this period the Khour of Abu Rumeila is full of water;
- the possibility of growing pasture plants in good conditions;
- the existence of Kenana cattle in the area which is considered as the best breed for milk production in the Sudan;
- Kenana cattle breeders are semi-settled in the area;
- accessibility of veterinary services;
- accessibility of improved Kenana bulls from the Animal Production Research Station at Am Benein;
- the existence of a small dairy for milk processing in Zanuba Village close to the area.

The people who live very close to the ranch belong to the Arikat tribe, which was in the past a sub-tribe of Rezeikat Baggara from Darfur. Their number is about 5,000 persons living in two villages, Jaka and Zanuba. The Arikat people are semi-settled rural people who practise some rainfed cultivation as marginal activities but their main pursuit is cattle raising. Traditionally, they are used to utilize the area of the ranch for grazing but legally, the area belongs to the government. The livestock they keep amount to :

5,500 cattle
3,500 sheep
3,000 goats

In interviewing them some of the Arikat tribesmen expressed their consent and readiness to follow the guidance and accept the technical assistance of the government. They emphasized that they accept keeping a limited number of their best milking cows on the ranch. The number of animals to be kept on the ranch will be agreed upon.

The Arikat people are relatively open to change due to the impact of the urbanization process in the Blue Nile province. They are very much aware of educating their children in schools, of improving their cattle milk production and of making use of health and veterinary services. Nevertheless, the idea of cooperatives through which they are going to manage their grazing land is still not clear to them. They need orientation, motivation and adaptation to adopt such modern processes.

In this respect, it is strongly recommended that some initial steps are carried out before approaching these people, to establish a cooperative society. A well qualified social agricultural worker who is well equipped with community development techniques, has to be appointed by the Range and Pasture Administration as a socio-technical advisor to the ranch on a full-time basis. He has to live among the people themselves and to guide them on the spot.

The people are to be well informed about the objectives of the scheme, the amount of money and labour required from both sides (the people and the government), the value of direct and indirect return, the role of the people and the government in the management process, and so forth. This is one of the tasks of the social agricultural workers. A committee which assembles the representatives of Arikat beneficiaries is to be formed. The social agricultural worker is considered as an advisor to this committee and the stimulator for its activities. All means of orientation, motivation, mobilization and decision-making are conducted through this committee. One of the main tasks of the social agricultural worker is to stimulate the people's involvement and participation in the management process. This educational task is considered as the cornerstone of his job. He has also to encourage all means of self-help activities to avoid generating any sense of reliance on the government from the onset of the scheme. For instance, he can motivate the beneficiaries to participate in fencing the grazing land of the scheme, in land clearing if necessary, in guardianship, and so forth. This approach will help very much in creating a sense of loyalty and belonging among the beneficiaries to the project. As time passes, it is supposed that the role of the social agricultural worker is gradually decreasing while the role of the people is increasing.

The social agricultural workers is also acting as a link between the people and the government. He has to defend the people's interests and translate them into government programmes on the one hand, and to persuade the people to undertake the government orientation and regulations on the other. Bearing in mind these principles, the social agricultural worker can, in the course of time, influence the people's attitudes and behaviour and direct them towards the desired change. At this stage and within probably one year from the commencement of the scheme, the establishment of a cooperative society can be well regarded by the people. In this case, such an organization will be maintained and sustained by active participation of well-trained members and progressive local leaders.

Finally, it should be pointed out that there are two important aspects which have to be taken into consideration in the planning and execution of the Abu Rumeila scheme : on the one hand, the area is considered as a watering place for animals, and on the other hand, there are two more villages near the ranch area; namely, Um Shoka and Ankaliba (see map). Um Shoka is inhabited with Fallata cultivators who cultivate vegetables and some orchards near the Khour of Abu Rumeila. It happens sometimes, as everywhere in Sudan, that conflict between Arikat and Fallata arises as a result of animal encroachment from the former on agricultural crops of the latter. However, it is

very important to note that the government care to Arikat should extend to cover the Fallata cultivators through technical assistance and other means of extension services.

To articulate the process of planning and execution of Abu Rumeila ranch scheme it is, however, recommended that further socio-economic studies are to be conducted in this respect to cover the following items :

- . the social and economic criteria of selecting the 'farig' or 'farigs' from Arikat people who are going to utilize and conduct the management of the ranch;
- . the social and economic conditions of the selected 'farig' or 'farigs';
- . the number and kind of animals to be kept on the ranch and the way with which the selected farig deal with the rest of its herds;
- . the formulation of training courses for the social agricultural workers of the Range and Pasture Administration to be equipped with community development techniques.

(b) Objectives

To realize on a practical scale, grazing land management for sedentary livestock over 1,500 feddans (630 has) and in a cooperative framework.

(c) Plan of work

During the rainy season (15 June to 15 November), the herds would graze a four-camp system, one being rested, the other three of 144 ha each, will be grazed every fortnight. Milking cows will receive a supplement of 0,5 kg molasses and 0,5 kg seedcake. At the age of 18 months heifers will join the cows for breeding before being sent to the transhuming herds. During the dry season cows and heifers will be in two separate paddocks, and receive hay and concentrates. Hay will be provided by a meadow covering 56 has. Cattle will be watered from artificial ponds in the rainy season and by carrying the water from the Nile in cisterns.

After the first year, the herd will be composed of 100 cows, 2 bulls and 79 heifers. It should total 300 cows, 6 bulls and 237 heifers if grassland improvements are carried out:

- . on the meadow, the application of 30 N, 30 P and 30 K units per ha and sod seeding of alternate strips with a mixture of selected grasses and legumes over a period of four years;
- . on the rainy season grasslands, selective bush clearing and reseeding, following the same principles as above.

The improved grasslands should be self financing if selected categories of livestock are used to graze them.

The above project is a typical pre-investment and pre-extension project which is

needed to increase the productivity of traditional livestock and rehabilitate the production base, i.e. the grazing lands. It is also exploratory in nature as improvement techniques will have to be gradually defined.

4. The seasonal cooperative ranches

The case of Guezat

(a) Justification

With the extension of traditional and mechanized crop farming, the total grazing area is decreasing, and is frequently parcelled out between crop lands. However, it is impossible to avoid transhumance because of the existence of local adverse conditions during the rainy season (insects, flooding) or the dry season (lack of water, forage scarcity ...). Transhumance, which was once a traditional and easy process has now to be organized. A pilot project is therefore proposed.

(b) Sociological notes

From a sociological point of view, it seems that the main problem lies in the process of traditional grazing lands rehabilitation and development as farigs are exercising their traditional communal rights of land use.

As indicated elsewhere, each farig is bound to some segment of its tribal territory where the members of the farig wander and herd their flocks. Therefore, it is not easy to exclude such pastoralists from certain areas unless they are located away from their traditional stamping ground or from water points.

There are two approaches that can be carried out to solve this problem. The first one is to persuade the local leaders of a farig to follow the grazing rotation system proposed, so that improvement can take place. The second approach is to modify the movements of the nomads by closing the water points which are near to a reseeded grazing land in order to keep them away until the suitable time for grazing the pasture comes.

It is recommended however, that the two approaches be undertaken simultaneously. In this respect, it is suggested that a pilot scheme has to be carried out to demonstrate the benefits which the pastoralists are going to receive from such a scheme.

Fortunately there is a big chance to apply this pilot scheme within the Rufaa grazing land in Guezat, near Singa in the Blue Nile province. As indicated in Annex 4, the Union of Rufaa Pastoralists in collaboration with the Popular Rural Councils concerned, can help very much in the achievement and management of this scheme. The same approach and techniques of community development recommended for the Abu Rumeila cooperative ranch is supposed to be undertaken in Guezat range land development.

It should be noted here that the Gueizat area amounts to about one million feddans of which 9750 feddans were registered in the name of the Range and Pasture Administration.

(c) Plan of Work

Some 9,750 feddans (4,100 has) have already been demarcated around a borehole, in the transhumance territory of the Kanana in the Blue Nile province.

One type of rotation would be a three-camp system with one camp being rested one year and the other two being grazed on a fortnightly basis. The stocking rate would be 6,6 feddans per Livestock Unit (or 10 feddans if we include the camp being rested). This stocking rate would gradually increase through grassland improvement to reach 4,4 feddans (instead of 10) per LSU. The total number of cattle would be 975 the first year, with a gradual increase to 2,200 the third year and subsequent adjustment following the success of the improvements made.

Grassland improvement in Gueizat would be gradually effected in alternate strips 20 ms wide ploughed up and sown with Cenchrus ciliaris, Andropogon gayanus, Clitoria ternatea and Stylosanthes fruticosa. Strips would be 50 ms distant or more, in order to reduce the cost of improvement.

KORDOFAN PROVINCE

5. Improvement of perimeters around towns and water points

(a) Justification

In the southern part of the Kordofan province, with a 450 mm annual rainfall, crop farming and livestock are competing for the land, particularly around permanent water points and towns.

To remedy this state of affairs, the Government created in 1952 around El Obeid a forestry reserve; it was fenced and 7,000 feddans were planted with Acacia Senegal while Balanites aegyptiaca was allowed to recolonize the low grounds. Presently, the reserve looks like a fine orchard where, however, forage is eaten by the local livestock in spite of fencing and guards.

A good protection system has to enable the tree vegetation to come back but should at the same time receive the support of the population and satisfy their needs. In order to achieve this, preliminary surveys should ascertain the number and size of cultivated fields, the rights of usage, etc.. With the consensus of the population, the protected perimeter will be established gradually along contour lines, with ditches and banks planted with a mixture of Cenchrus ciliaris, Clitoria ternatea and Acacia Senegal.

Cropping will integrate field food crops, gum and livestock production, according to the following pattern =

- 4 years cropping (millet, sesame, groundnut)
- 1st year fallow = reseeding of *Acacia senegal*
- 2nd year fallow = reseeding of *Alysicarpus ovalifolius* and *Clitoria ternatea*.

Start of grazing by livestock.

4th year fallow = tapping of gum arabic
 12th or 20th year fallow (according to the proximity of urban centres), clearing of all trees except the best specimen of *Acacia senegal* which will be kept as seeders and the start of a new crop sequence.

Livestock categories should be treated differently according to their requirements and production. Milking cows and calves should stay near watering points and should graze :

- . in the rainy season, on shallow or clayey soils, or on the old fallow land (two to three has per cow);
- . in the dry season, on fallows the grazing of a third of which is deferred until April. Cows will receive by-products such as millet stalks and groundnut haulms, with some cotton or sesame seedcake.

The rest of the herds and flocks will be assembled and grazed on land more distant:

- . in the rainy season on shallow or clayey soils, with rotational grazing and a stocking rate of 3 has per LSU;
- . in the dry season, on sandy soils, away from the perimeter with a stocking rate of 7 ha per LSU and rotational grazing. Watering will take place at the village every two days through a corridor fenced with thorny branches.

STATISTICS

Annex 1

Table 1 - Foreign Trade Statistics (1976)

A. Agricultural Exports				B. Agricultural Imports			
Main products	Unit	Quantity	Value (L.S.)	Main products	Unit	Quantity	Value (L.S.)
Cotton fibre	T	190.070	99.955.206	Cereals, Flour	T	121.968	7.656.038
Oil seeds	T	442.783	63.299.823	Sugar	T	145.964	21.527.704
Gum	T	26.811	11.241.091	Tea/Coffee	T	18.672	6.922.795
Animal feed	T	202.157	5.489.537	Cigarettes	T	894	4.171.755
Cereals (sorghum)	T	93.680	4.069.601	Animal Prod.			1.832.635
Grain legumes	T	9.415	1.300.408	Others			135.607
Fruits	T	1.689	225.956	Agricul.mach.			8.004.285
Other vegetab.	T		1.538.777				
Live animals	Head	57.304	1.194.949				
Chilled meat	T	14	6.168				
Hides/Skins		6.549	3.729.699				

Table 2 - Gross Domestic Product by Economic Activity (Current prices 1974/75)

Economic Activities	LS x 106	%
1. Agriculture, Forestry, Hunting, Livestock and Fishing	585,3	38,7
2. Mining and Quarrying	4,6	0,4
3. Manufacturing and Handicrafts	138,3	9,1
4. Electricity and Water	20,9	1,4
5. Construction and Public Works	65,0	4,3
6. Commerce, Restaurants, Hotel, Bars etc.	245,2	16,2
7. Transport, Storage and Communications	89,4	5,9
8. Finance, Insurance, Real Estate and Business Services	111,4	7,4
9. Government services	151,2	10,0
10. Others	99,5	6,6
G.D.P. at Market Prices	1.510,8	100,0

ENVIRONMENTAL DATAAnnex 2I. Geomorphology and Land System

South of the desertic zone, there are roughly four land system zones.

1. the basement complex with granitic intrusive rocks mixed with fluvial and aeolian deposits on gneiss and schists (Jebel Marra and Nyala);
2. the Nuba mountain in the South East of Kordofan province, with steep rock outcrops, gently undulating plains and floodplains;
3. the Qoz system extending from the basement complex zone to the White Nile and between the desert, the Nuba mountain and the Bahr valleys complex (N. of Buram, N. of Gazala Gawazat, North West of Babanusa and El Obeid). This results in sand deposits, sand-hills and calcareous interdunes;
4. the clay plains located in the river network; Bahr el Arab, Bahr el Ghazal, White and Blue Nile from the Ethiopian frontier to the Khartoum latitude.

Within each of the above four zones, there are several soil types and patterns.

II. Grassland types and Production potential

Grassland formations generally follow the rainfall pattern but variations in plant communities reflect differences in soil conditions, particularly as regards sandy or clayey soils.

a) Grassland types100 - 200 mm rainfall - Semi-desert scrub

	<u>Sandy soil</u>	<u>Clayey soil</u>
Shrub	Acacia tortilis Maerua crassifolia Leptadenia pyrotechnica	Acacia mellifera Commiphora africana
Perennial grasses	Aristida plumosa Panicum turgidum	Cymbopogon schoenanthus
Annual grasses	Aristida mutabilis Cenchrus biflorus	Aristida funiculata

200 - 400 mm rainfall - Thornland

Shrub	Acacia tortilis (sand dune) Acacia senegal (stabilized sand) Bauhinia rufescens (stream bank)	Acacia mellifera Acacia nubica Commiphora africana Capparis decidua
Perennial grasses	Aristida sieberana	Cymbopogon schoenanthus

200- 400 mm rainfall - Semi-desert scrub (cont'd)

	<u>Sandy soil</u>	<u>Clayey soil</u>
Annual grasses	Aristida mutabilis Cenchrus biflorus Schoenefeldia gracilis	Schoenefeldia gracilis Aristida adscensionis Aristida funiculata Chloris virgata Dactyloctenium aegyptium
Legumes	Tephrosia purpurea Alysicarpus ovalifolius	Stylosanthes fruticosa

400 - 600 mm rainfall - Low rainfall woodland savanna

Shrub	Combretum glutinosum (cordofanum) Dalbergia melanoxylon Albizia amara ssp sericocephala	Acacia mellifera Acacia nubica
Perennial grasses	Aristida sieberana Andropogon gayanus	Andropogon gayanus
Annual grasses	Cenchrus biflorus Eragrostis tremula Ctenium elegans Aristida mutabilis Loudetia hordeiformis	Schoenefeldia gracilis Dactyloctenium aegyptium Chloris virgata
Legumes	Stylosanthes fruticosa	Stylosanthes fruticosa

600 - 800 mm rainfall - Low rainfall woodland

Shrub	Combretum glutinosum Guiera senegalensis Sclerocarya birrea Albizia amara	Acacia seyal - Acacia fistulosa Balanites aegyptiaca Ziziphus spina-christi Piliostigma reticulata
Perennial grasses	Andropogon gayanus	
Annual grasses	Eragrostis tremula Cenchrus biflorus Ctenium elegans Loudetia togoensis	Schoenefeldia gracilis Setaria pallide-fusca Chloris virgata Dactyloctenium aegyptium
Legumes or herbs	Zornia glochidiata Blepharis linariifolia Cassia mimosoides	

800 - 1000 mm rainfall - High rainfall woodland

	<u>Sandy soil</u>	<u>Clayey soil</u>
Shrub and trees	Guiera senegalensis Combretum glutinosum Albizzia amara	Terminalia laxiflora (brownii) Anogeissus leiocarpus Combretum hartmanianum
Perennial grasses	Andropogon gayanus Hyparrhenia dissoluta Loudetia arundinacea	Hyparrhenia pseudocymbaria Setaria incrassata Beckeropsis uniseta

According to the rainfall, these vegetation types are mixed in the several patterns where sandy and clayey soils alternate.

The tree, Isoberlinia doka, appears around the 1,000 mm isohyet and in the Bahr valley complex, the following types are identified :

- Riverine woodlandShrub and tree

Anogeissus leiocarpus
Diospyros mespiliformis
Mitragyna inermis
Borassus aethiopicum
Hyphaene thebaica

Perennial grasses

Hyparrhenia rufa
Panicum maximum
Themeda triandra
Chloris gayana
Sporobolus robustus

- Riverine grassland on flooded plainsPerennial grasses

Hyparrhenia rufa
Setaria incrassata
Oryza longistaminata
Echinochloa pyramidalis
Echinochloa stagnina

b) Grassland Production and carrying capacity

SHEPHERD (1968) gives the following carrying capacity potential related to area size and livestock census :

i. semi-desert area :

Potential carrying capacity 7 to 20 animal unit (A.U.) per square mile (sq.m)
Area : 190,000 square miles
Livestock census : 4,200,000 A.U.
Potential carrying capacity : 2,900,000 A.U.

ii. low rainfall savanna on sand

Potential carrying capacity : 25 to 40 A.U./sq.m.
Area : 83,000 sq.m.
Livestock census: 3,400,000 A.U.
Potential carrying capacity : 2,300,000 A.U.

Grassland Production and carrying capacity (cont'd)iii. low rainfall savanna on clay

Potential carrying capacity : 15 to 100 A.U./sq.m.

Area : 122,000 sq.m.

Livestock census: 1,900,000 A.U.

Potential carrying capacity : 5,200,000 A.U.

iv. mixed sand and clay patterns (baggara, Regeba)

Potential carrying capacity : 40 to 80 A.U./sq. m.

Area : 61,000 sq.m.

Livestock census : 3,000,000 A.U.

Potential carrying capacity : 3,000,000 A.U.

v. Flood plain

Potential carrying capacity : 50 A.U./sq.m.

Useable area : 80,000 sq. m.

Livestock census : 3,600,000 A.U.

Potential carrying capacity : 4,000,000 A.U.

vi. Southern high rainfall woodland savanna (Isoberlinia)

Potential carrying capacity : 90 A.U./sq. m.

Useable area : 100,000 sq. m.

Livestock census : 600,000 A.U.

Potential carrying capacity : 9,000,000 A.U.

According to the above, sandy rangelands are all overstocked but low rainfall savanna on clay and southern woodlands, are under-stocked.

The forage production of natural grazing lands is estimated in the desert encroachment control report (1976), as well as forage lost through wild fires.

Table 3 - Estimates of natural forage produced and lost through wild fires
(by province)

Provinces	Area millions fed.	Percentage of seasonal burning	Forage production	
			t./fed.	t./ha
Darfur	110	30	2.0	4.6
Kordofan	75	30	1.5	3.5
Khartoum	5	10	0.5	1.2
Kassala	63	20	0.5	1.2
Blue Nile	35	15	1.0	2.3
Upper Nile	17	35	4.0	9.0
Bar el Ghazal	40	40	5.0	12.0
Equatoria	40	45	5.0	12.0

35 p. 100 of the total forage resources are estimated to be annually destroyed by fires, but a lot of tall grasses are unpalatable at the end of the wet season in the southern part of the country and in the flood plains; seasonal burning provides palatable young shoots.

It was hoped in 1978 to protect 20% of the dry season grazing lands by a fireline grid of 12,800 km long. At the moment, the provincial range management officers from the Range and Pasture Administration are maintaining 3,200 km of fire line, 80 meters wide, by hand implement and fire. The cost of this fire line is about 4 to 7 Sudanese pounds per kilometer. Some chemicals are being tried out at Buram in South Darfur province for fireline establishment.

In their livestock and range resources report [annex 3 of the Savanna development project, Phase II (1976)]^{1/}, Hunting Technical Services estimate the theoretical year round carrying capacity on the basis of a daily digestible protein intake (from pasture and crop residue) of 0.33 kg/LSU (livestock standard unit of 300 kg liveweight). This report also lists the chemical composition of grasses, herbs, browse and crop residues.

The effective carrying capacity is said to be determined by the :

- accessibility of range resources and water supplies;
- the importance of wild fires;
- the encroachment of crop farming.

The following estimates of carrying capacity ^{1/} of some grazing land formations in the Sudan are proposed hereunder :

^{1/} Carrying capacity = number of animals expressed as livestock units (LSU) that can be carried per unit area on a sustained yield basis.

Table 4 - Seasonal carrying capacity estimates for selected areas in S. Darfur

Land system	Carrying capacity LSU/km ²	(July - December)		(January - June)	
		area available km ²	Total LSU	area available km ²	Total LSU
Habbanyia Qoz (range)	12	2.212	26.544	2.010	24.120
Habbanyia Qoz (crop residues)	20	-	-	341	6.820
Baggara (range)	15	10.074	151.110	10.074	151.110
Baggara (crop residues)	20	-	-	1.356	27.120
Basement	4	531	2.124	-	-
TOTAL		12.817	179.778	13.781	209.170

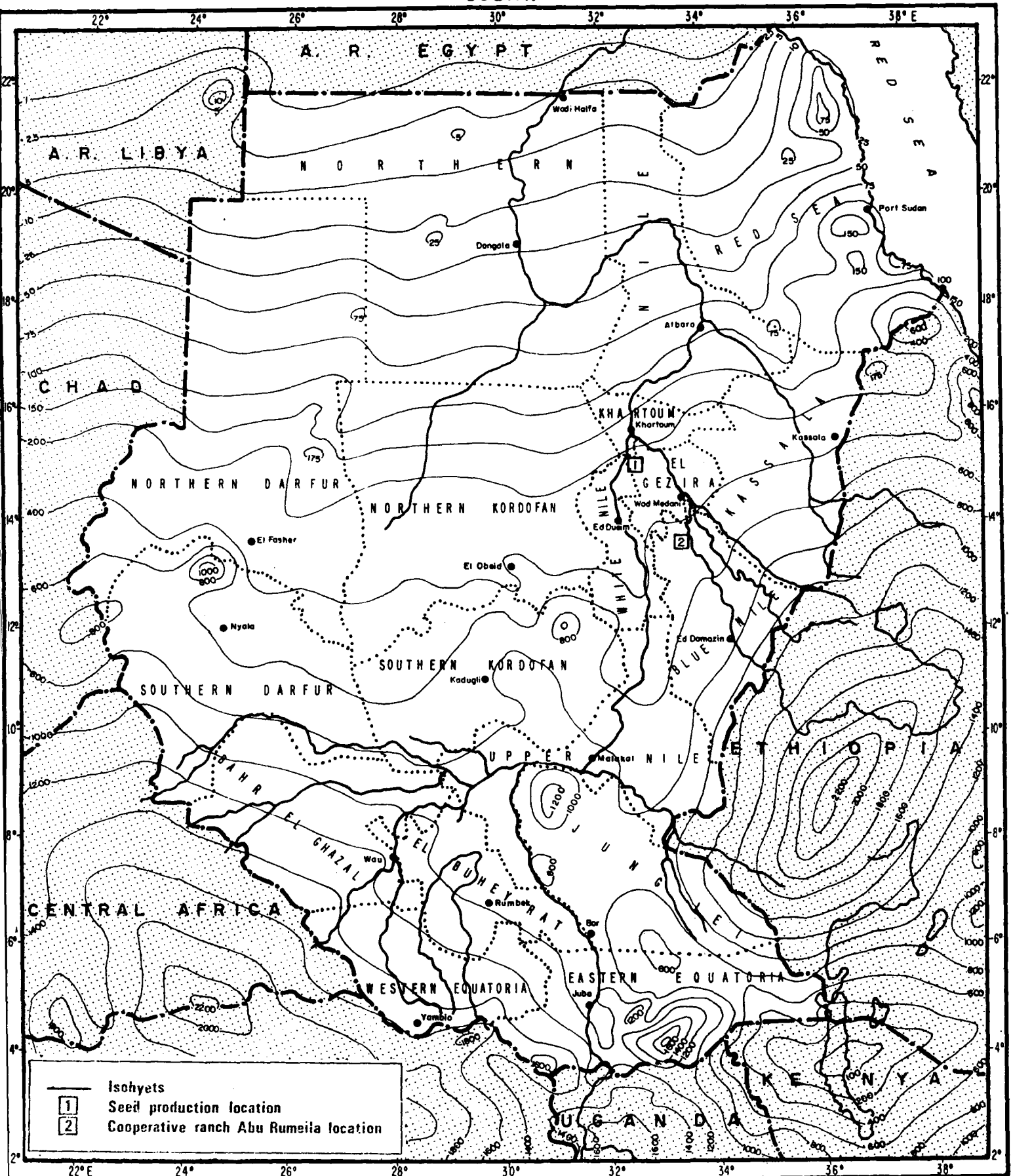
Table 5 - Sustained yield carrying capacity and observed livestock numbers in the Habbanyia Qoz, Basement and Baggara land systems

Months	Livestock units at sustained production levels	Observed livestock units
July and October/November	180.000	1.440.000
August - September	180.000	640.000
December	180.000	600.000
January	209.000	600.000
February - June	209.000	280.000

The above table shows that the carrying capacity at sustained production levels is exceeded throughout the year. The impressive figure for July and October/November comes from the presence of long term transhumants together with other stock-breeders. Short-term transhumants and sedentary stock breeders are present together in August, September and January whereas the latter are left alone during the mid and late dry season.

The above estimates of the effective carrying capacity (production at sustained level the year long) are based on a certain number of analyses and assumptions (i.e. a daily intake of 330 grs of digestible protein per LSU). Due to the lack of measured data regarding the daily requirements of the different classes and categories of livestock, as well as the exact quantities provided by grassland formations and crop residues and ingested by animals, carrying capacity and stocking rates estimates may be very approximate.

AVERAGE ANNUAL RAINFALL 1931-1960 (mm)
SUDAN



THE RANGE AND PASTURE ADMINISTRATION1. History

From October 1955 to December 1957, P. Bonnemaïson, a F.A.O. agronomist, worked on grassland improvement and pasture development at the Ghazal - Gawazat research station where he participated in setting up a Range Management section within the Ministry of Animal Resources.

From June 1966 to June 1967, W.O. Shepherd, a F.A.O. range management officer assisted M.M. Baasher in the Range Management section. He was requested to advise the government on the reorganization of the Range and Pasture Section, research priorities and the organization of a training programme for staff. In 1968 he proposed the creation, inside the Rural Water and Development Corporation, of two separate but coordinated departments, in close relationship with the directors of animal and agricultural resources :

- The Range and Forage Resource Department, comprising
 - . range development planning and survey division
 - . technical management and extension division
 - . technical training division
- The Range and Forage Research Department, comprising
 - . range ecology, management and improvement research division
 - . cultivated pasture and forage crops research division
 - . plant improvement and seed technology research division
 - . range economics research division

In 1968, the Sudan Almanac mentioned a pasture research section and a pasture section inside the Animal Production Department, under the Ministry of Animal Resources.

In July 1974, Malecek and Norton, from Utah State University (Logan, Utah), submitted to U.S. Agency for International Development, an assistance proposal to the Range Management Division of the Ministry of Natural Resources for a planned programme of research in potential forage production and adult education through "demonstration ranch".

In December 1974, Mr Rashid Abdulel Majid was nominated Director of the Range and Forest Administration, Directorate of Natural Resources; this administration being responsible for :

- range management investigations in order to advise the most suitable ecological and economic development in the 70-300 mm rainfall belt;
- forage investigations in order to advise the directorate about irrigated fodder crops and the most suitable types of forage plants to use under irrigation at specific locations.

In July 1976, a Pasture and Range research section working in the Ghazala Gawazat station under the Agricultural Research Corporation is mentioned in the Development Plan of the 'Savanna development project Phase II'.

In 1975, the FAO International Meat Development Scheme mission recommended that "services for animal production and range and forage production be grouped as sections under an Under-Secretary for Animal Production, Range and Forage Production, parallel and closely associated with the present Under-Secretary of Animal Resources within the Ministry of Agriculture, Food and Natural Resources".

2. Terms of Reference

The existing Range and Pasture Administration is a Directorate under the Under-Secretary of Natural Resources of the Ministry of Agriculture, Food and Natural Resources.^{1/} There are three divisions at the headquarters in Khartoum :

1. Range Management and Dry-lands division
2. Ranching division
3. Irrigated pastures division.

There are Provincial Range Management officers working at provincial level with local government who have the authority since 1971 through the People's Rural Councils to regulate and manage the use of grazing lands and participate in fire protection schemes involving the investment of council funds.

Provincial projects consist mainly of firebreaks, range surveys, enclosures for vegetation trend studies. Long-lasting herbicides to assist in the establishment of firelines are experimented at the Buram farm (South Darfur) and water spreading in Kassala and Blue Nile provinces.

The major activities of the Pasture and Range Administration reside in establishing pilot and demonstration trials and stations, connected with grassland management and forage investigations, research on livestock production parameters and educational aspects. Such activities are required in order to provide basic information and data, on the nomadic, transhumant and sedentary sectors of the traditional livestock economy and on sustainable range carrying capacities needed for the numerous livestock development projects proposed or in progress.

^{1/} - See the chart at the end of the present annex regarding the structure of the Ministry of Agriculture, Food and Natural Resources, Sudan

3. The Six-Year Plan Proposals from a sociological perspective

The Range and Pasture Administration has prepared three main projects to be financed by the six-year plan which commences in July 1977. These projects are range improvement, range perimeters, and the cooperative ranches. At the first stage of implementation, it is suggested that these projects will be carried out as pilot and demonstration schemes. It is also the intention of the Administration to enrich its staff members' knowledge and experience through application and feedback information.

Range Improvement

Two approaches were suggested by the Range and Pasture Administration to improve deteriorated range lands, as follows :

1. to establish completely protected areas through fencing, building of fire-breaks and closing all watering points in order to allow for plant recovery to take place;
2. to protect an area by fencing and firebreaks and seeding it with carefully selected species adapted to local conditions.

The latter approach, though expensive, is rather quicker than the former, but in both cases fencing and fire lines are required. It is suggested that in some reseeded areas like ranches, grazing land management should be modified according to modern techniques of development. It is however, a sociological problem to change the attitudes of pastoralists through a long-term process of persuasion, orientation, motivation and mobilization.

Range perimeters

The objectives of the scheme are to :

- improve deteriorated grazing land sites around towns;
- to reduce the time spent by the grazing animals in search of food far away from the town and to
- provide enough forage for the milk producing animals.

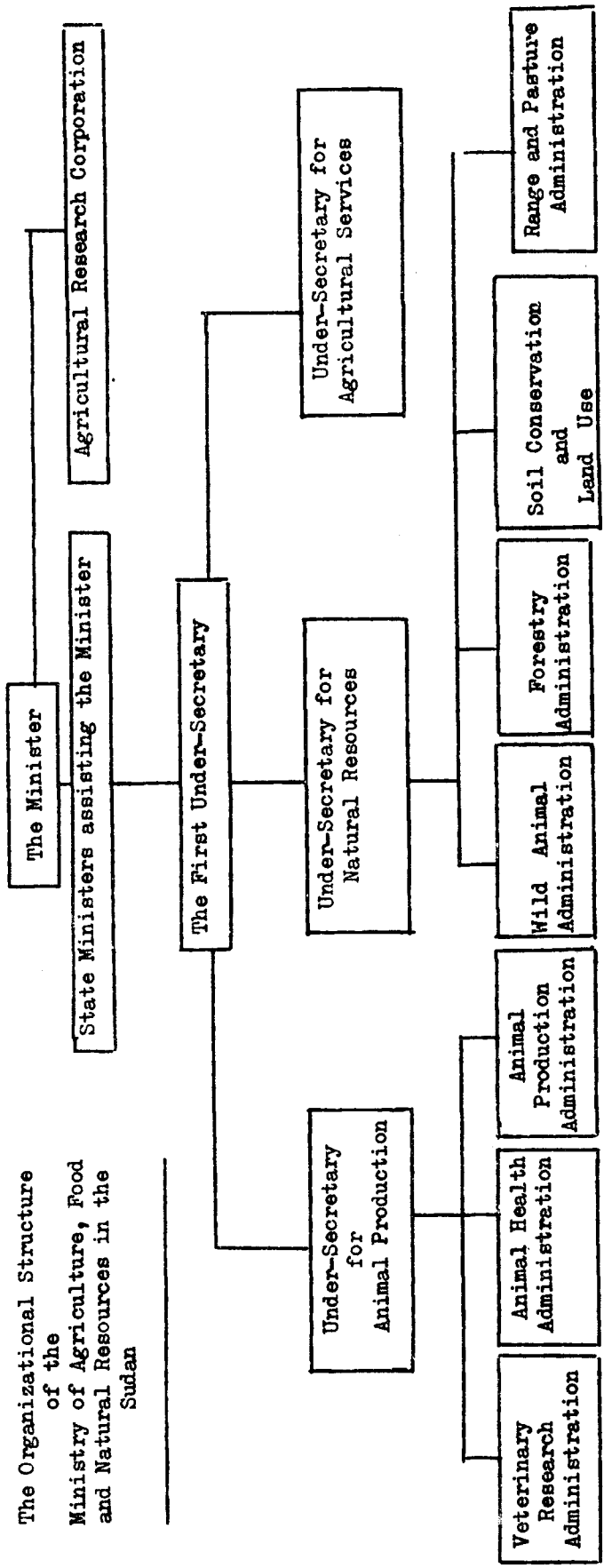
The idea of this project, though it may seem sound, cannot be practically applied. For example, grazing perimeters around towns and cities have to be fenced and guarded, which is very expensive; furthermore, the lands around the towns and cities are usually not used by one individual tribe, but they are for all people coming in and going out of the city for purposes of business, marketing, services and so forth.

Cooperative ranches

The main objective of this project is to conduct proper cooperative management on traditional grazing land so that efficient use of pasture and optimum utilization of natural resources can be realized. It is assumed that the semi-settled rural populations are involved in such process.

It is important to note that the total public funds which were allotted to the three above-mentioned projects in the budget of the year 1977/1978 amounted to 747,000 Sudanese pounds. These funds are very meagre to cope with the problems of grazing land development in the Sudan, especially if they are to be compared with the annual revenue from animal taxes which are supposed to be collected. According to the estimated numbers of animals shown in table 1, these annual taxes should amount to about 10 million Sudanese pounds.

The Organizational Structure
of the
Ministry of Agriculture, Food
and Natural Resources in the
Sudan



NOTES REGARDING THE SOCIO-ECONOMIC FACTORS IN THE FORMER BLUE NILE PROVINCE1. Characteristics of the Blue Nile Province

In 1974 and after the census of 1973, the Blue Nile province was divided into three provinces, namely the Gezira, the White Nile and the Blue Nile. Therefore all data mentioned here refer to the provinces before the division, unless specific reference is made elsewhere.

The Blue Nile province is inhabited by 3,804,000 people, the majority of whom (more than 74%) is of Arab origin. From a demographical point of view the province has some significant features which are not found elsewhere in the Sudan if we exclude Khartoum. These features are :

- the density of the population is 28.0 person per square kilometer ^{1/} which represents the highest density among all provinces except Khartoum;
- it has the biggest rate of population growth (3.50)
- the rural population (3,106,200) constitutes 85.73% of the total population of the province of whom 78.87% are rural settled population (2,857,761) and 6.86% are rural nomadic (248,439).

The population of the Blue Nile province is living on an area of 136,000 square kilometers, the majority of which is clay plains known as the most fertile soil in Sudan. Agriculture and animal raising are the prevailing pursuit of the rural population. The main agricultural crops are cotton, wheat, groundnuts, sesame and dukhn ^{2/} Figures in table no. 3 show areas of irrigation and rainfed crops in the year 1973/1974 in feddans.

Areas of Irrigation and Rainfed Crops in the Year 1973/1974 in feddans

Type of Agriculture	Cotton	Groundnut	Wheat	Sesame	Dukhn ^{2/}	Total
Irrigation	589.573	249.000	268.000	3.000	-	909.573
Rainfed	-	46.000	-	372.000	109.000	527.000
Total	589.573	295.000	268.000	375.000	109.000	1,436.573

Extracted from the statistical Year Book 1974, Department of Statistics, May 1977

^{1/} Figures mentioned above are extracted from the census of 1973
^{2/} (Dukhn) = millet

As regards the animal population of the province, the following figures express the livestock estimates in 1973/1974 in million heads - cattle: 1.2, sheep: 3.6, goats: 2.4 and camels: 0.3.

Figures are extracted from the same source mentioned above. It is important to point out that Kenana cattle is the prevailing strain in the Blue Nile province. Kenana is known as the best milk breed in the Sudan.

2. The socio-economic organization of the rural population of the Blue Nile

The majority of the rural population of the Blue Nile (78.87%) are settled cultivators, who retain a considerable interest in raising cattle. They practise rainfed agriculture where they cultivate, Dukhn, sesame and groundnut while in irrigated fields in Gezira they cultivate cotton, wheat, groundnut and sesame. They are mostly Arab in origin who belong to many tribes and sub-tribes, the most well-known of whom are :

Kenana, Rufaa Al-Hoi, Ingessana, Fulani, Rufaa Esharg, Kawakla, Batahin, Shukriya, Lahawin, Arikat and others.

Their social structure is commonly based as elsewhere in the Sudan on kinship relationships. The extended family is the smallest social unit in their tribal structure. A number of extended families related to one man (awlad el ragil, literally: the sons of the man) constitute a farig. The farig represents the migratory social unit in the nomadic section of the tribe, whose members are used to exercise seasonal migration for grazing, together. The farig (literally: the team) refers to the people and their herds together. A number of farigs, that are related to one founder is called "Khashm beit" which is considered as a sub-tribe. When this sub-tribe increases its numbers generation after generation, it stands up as a tribe having its own independent entity and is named in the name of its grand founder.

Each farig has a sheik who is responsible for the resolution of disputes among his farig's members and for the collection of taxes. He is also delegated from the Rural Popular Council to give rights of land use for rainfed agriculture. In this respect, the size of agricultural holding is defined according to the capacity of the holder, namely, the number of his sons and his financial ability to hire labourers. The sheik plays an influential role among his farig's tribesmen though it is now affected by the efficacy of the popular rural councils. Each family has its own holding of land and its own property of animals. The settled families do not usually keep big numbers of animals. An average of 50 animals is kept by each family.

The division of labour among the family members is clearly defined. The father and mother assisted by their daughters are involved in cultivation while sons of ten years and above are looking after the family herd. The younger sons from ten to thirteen usually take care of sheep and goats while the older are in charge of cattle. They do not usually go far from home for grazing like the nomads. However, the distance they go depends on the accessibility of water and grass.

Members of each tribe who live in the same village are accustomed to cooperate with each other on a traditional communal self-help approach called El-Nafir. According to this approach a man's house can be built in one day by the assistance of his relative tribesmen. It is normal that in cases of sickness, disaster or social occasion, all the farig's members act and interact as one group.

The nomadic pastoralists of the Blue Nile follow certain seasonal migratory routes which are called "Morahil", in pursuit of grass and water. The most influential and wealthy cattle breeders of these tribes are the Kenana and Rufaa tribes. The Kenana goes southwards as far as Roseires from October to June. When the rainy season starts in June, they move northwards until they reach the southern part of the Gezira scheme, where they stay until October and then return, thus completing the migration cycle.

As regards Rufaa movement, they start at the beginning of the rainy season in June to move from east to north west, until they reach the southern part of the Gezira, where they stay until October. From October they drive their cattle back to the south east near Roseires, where they stay until June. Some other sections of the Rufaa go from Agadi to the southern boundaries of the province in October and back to the north as far as Agadi, in the beginning of the rainy season.

3. The Union of the Cooperative Societies of Rufaa and Kenana pastoralists

The nomadic pastoralists in the Blue Nile are now facing the problem of grassland degradation in quality and quantity, because of the rapid expansion of rainfed agriculture and mechanized farms on the one hand, and due to the overstocking of animals on the other. This state of affairs has motivated both the Kenana and the Rufaa tribesmen to organize themselves, by the assistance of the popular rural councils, in the form of cooperative societies. Within each tribe, each farig is entitled to formulate a cooperative society which is considered as a member of the union of the cooperative societies of the pastoralists at tribe level. The Union is responsible for looking after the pastoralists' interests and for solving their problems in cooperation with the popular rural councils. The Union of Rufaa has been registered and the Union of Kenana is under registration. The Union of Rufaa is composed of 65 cooperative farig societies. The Union is also represented in the Popular Executive Council of the province under the chairmanship of the Governor.

It should be pointed out that this is the first time so far in the Sudan, that such an organization exists for the pastoralists. It is interesting to know that many of the pastoralists as members of the cooperative societies of the Rufaa Union were persuaded to deposit their savings in the bank. The Sudanese Government also encouraged the establishment of the union by subsidizing it with 5,000 pounds.

One of the main objectives of the Rufaa Union for Pastoralists is to find suitable locations in cooperation with the Government to settle the Rufaa nomads. The process of settlement as it was suggested by the chief of the union, is to settle each farig on a piece of land adequate enough to support the agricultural activities of the farig's members and at the same time provide grazing and watering facilities to a considerable number of animals.

In this respect, the Popular Rural Council Officer of Abu-Haggag indicated that he has received five claims from five farigs to settle. Another three claims from farigs were submitted to the Popular Rural Council of El Mazmum. He also pointed out that one of those farigs who claimed for settlement has built up a complete new village within four months of receiving the land from the council. These facts, however, emphasize the trend towards settlement among the Rufaa nomadic tribesmen.

Further economic studies are required for detailed information about both Rufaa and Kinana tribes in order to conduct this trend of settlement and the traditional rights of land use for grazing and cultivation for the optimum use of natural resources.

4. The Land Tenure System and rights of land use in the Blue Nile

The majority of the lands in the Sudan has come into the hands of the Government since the issue of the Unregistered Land Act in 1970. Consequently, the Government lands were divided into two types: the first one is the government land subject to no rights and the other is the government land subject to rights vested in a community or individuals.

Rights of land use for grazing are invested by the Government in each tribe within a given territory. Within this territory grazing is commonly practised by all segments — "farigs" of the tribe under the control of their tribal leaders, the "Sheiks", who have to settle disputes in this regard among their tribesmen.

Each farig, as a social migratory unit, is accustomed to sticking seasonally to some specific place within its tribal territory, where its members move, camp and live together. Therefore, each farig considers that it alone has the exclusive right to graze on the ground with which it has been associated for generations. But it should be pointed out that in years of drought and famine mutual cooperation and help come to the fore. All boundaries of farigs and even tribes are opened to others to feed their herds and water their animals. The communal rights of land use for grazing is in fact one of the important elements of tribal cohesion and solidarity though it is conducive to range development only if proper management of grazing is conducted over these traditional rights.

Rights of land use for rainfed shifting agriculture is invested by the Sheiks in families or individuals. The size of holding as mentioned above is defined according to the physical and financial capacity of the holder. In the Blue Nile province rights of land use for agriculture is subject to the approval of the popular rural council. The size of holding should not exceed one hundred feddans.

As regards mechanized farms, there is a periodical declaration by the Government in this respect based on the government plan and policy for increasing agricultural production. The claims of the people for such farms are examined through certain procedures and the maximum size of each farm is one thousand feddans. But there are no regulations which specify the type of managers of these farms and their background experience in farming activities. In this respect, preference should be given to the local inhabitants of the province.

If the population pressure on land, in the Sudan as such, has not yet given the land an exchange value, the case in the Blue Nile province is completely different because of the following reasons :

- density of population per km² (28.0) is higher than that in any other province except Khartoum;
- fertile clay plain soils;
- an infrastructure of roads, transportation and communication facilities, which is relatively better than that in other provinces.

the implementation of many agricultural governmental and private schemes.

All these reasons have motivated population pressure on land for cultivation, a state which has created competition and antagonism between pastoralists and cultivators. It is therefore suggested that rights of land use should be regulated or even legislated in the Blue Nile if optimum utilization of natural resources is to be obtained.

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