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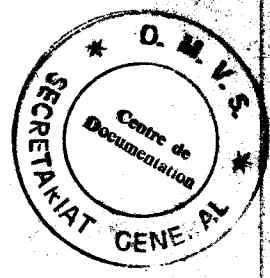
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ISLAMIC REPUBLIC OF MAURITANIA

Honor — Fraternity — Justice

Ministry of Economy and Finance

Directorate of Studies and
Programming



RAMS PROJECT

Rural Assessment and Manpower Surveys

Livestock Subsector Study

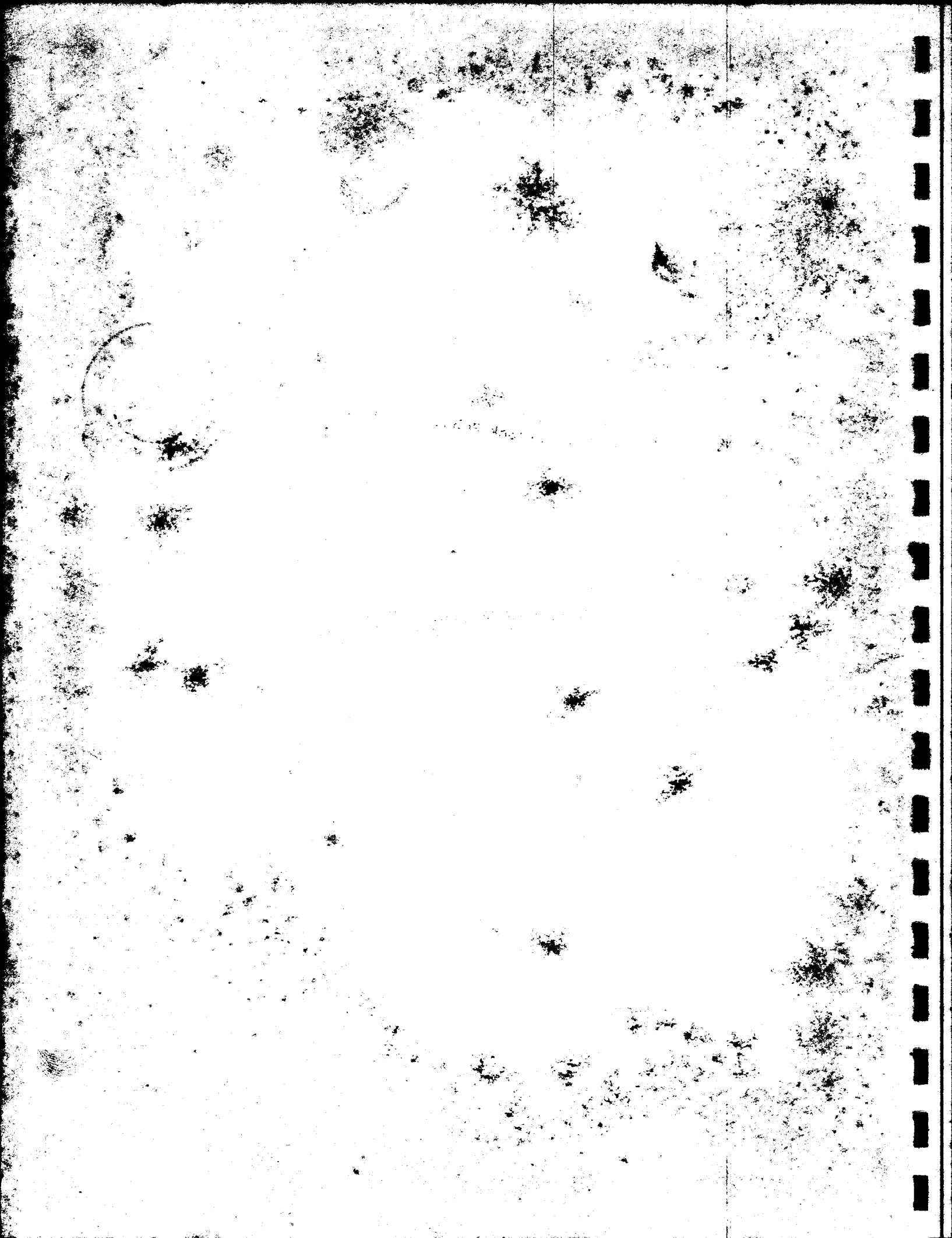
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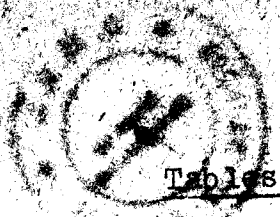


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1980

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I. Introduction, Summary and Conclusions, Recommendations

Introduction

The purpose of this study is (1) to review the actual status of livestock production in Mauritania and evaluate the constraints (natural and man imposed) upon that production, and (2) to evaluate production potentials.

This study covers all phases of livestock production, including animal health and marketing. It is, in essence, a summation of the Mauritanian livestock industry in the traditional sense as it is now, with estimated potentials.

Since the study was initiated in February of 1980 and conducted during the dry season, it has been necessary in some areas to make estimates based on literature reviews, discussions with persons in the livestock field who have a knowledge of animal production in Mauritania, and experience gained in livestock production in other Sahelian countries.

For the purpose of this study, the four classes of livestock (cattle, sheep, goats and camels) that are vital to the production systems practiced in Mauritania have been considered. Donkeys and horses have been excluded from this analysis since they do not contribute to gross domestic product (GDP), the consideration of which is a vital part of this study. Poultry was added in the economic analysis because it contributes to GDP even though it makes no demand on the grazing resources.

Summary and Conclusions

A. Livestock Production

1. Livestock plays a major role in the agricultural capacity of Mauritania. It represents 23% of the

gross domestic product (GDP) at factor cost and 21% of the GDP at market prices, making the subsector far and away the most important contributor to national output in the traditional portion of Mauritanian economy.

2. The total land area for Mauritania is some 1.03 million km² or 103 million hectares. Of this, an estimated 55 million hectares or 53% of the total is suitable for pastoral production. The carrying capacities of the pastoral lands vary greatly, ranging from an estimated 70 hectares/Unite Betail Tropicale¹ in the Saharan zone to 4 hectare/UBT in parts of the Sahelian zone. The estimated average is some 14 to 16 hectare/UBT.
3. Livestock populations for 1978, as estimated by the Mauritanian Central Bank, were 1.186 million cattle - 7.512 million sheep and goats and .728 million camels. Using a methodology developed by the Central Bank, supplemented by RAMS field estimates, a chapter of this study analyzes and projects herd numbers, value of output and value added to the GDP by the Livestock Subsector. According to this projection, with herd composition, growth and offtake as specified in the model, the limit to the carrying capacity grazing resource would be reached before the year 2000. Growth in value added after that time will depend solely on increased productivity from an existing herd (principally increased meat

(1) Unite Betail Tropicale (UBT)

1 camel	= 1.00 UBT
1 mature cow	= 0.75 UBT
1 sheep or goat	= 0.15 UBT

Note: some sources equate the UBT to a 250 kg. animal, although theoretically this measure is a function of forage requirements.

offtake and more milk production per animal) rather than on increased numbers.

4. Time limitations permitted only a single field observation of the grazing areas at the height of the dry season. It was observed that in some areas the grasslands have undergone serious degradation. In other areas deterioration is evidenced by the marked increase of lower quality vegetable species. Some recovery of the deteriorated areas is probably possible by controlling stocking rates. Complete recovery of the totally degraded areas is doubtful and would, in any case, require a number of years. In assessing the cause of the degradation and deterioration, over-grazing is probably secondary. The major cause is believed to be climatic. The southward movement of the rainfall isohyets has in all probability caused more damage than animal concentrations.
5. There are areas in Mauritania that are not currently being utilized for grazing because of the lack of water for animals. If these areas are opened by providing watering points, there is a danger that they will be subjected to the same degradation found elsewhere, unless provisions are made to control grazing. It is also possible that limited availability of underground water would make some of these areas too costly to provide wells for.
6. Each year large numbers of Mauritanian animals are marketed in Senegal and Mali, but it is not possible to quantify the total. Any future attempt to close the borders to prevent this movement, as was done in 1975, would probably be unsuccessful. Considering the limited grazing season in Mauritania, the herds must have access to the additional grazing lands in Senegal and Mali to survive.

7. The present system of migratory animal production is the only suitable production system for Mauritanian conditions. Also, the grazing system must include cattle, sheep, goats and camels, to fully and efficiently utilize the vegetative resources of Mauritania.
8. The breeds of animals presently found in Mauritania are well adapted to local conditions, having already been subjected to a number of years of natural selection. Consequently, it is concluded that it would be unwise to attempt to alter the genetic composition of these populations by the introduction of exotic breeds from foreign sources.
9. Any interventions in livestock production should be introduced as deviations from the traditional production patterns. It is concluded that alterations in livestock production and management systems that are not based on variations of traditional patterns would not be successful.
10. One of the more valuable by-products of the livestock herds of Mauritania is milk. Milk is used throughout the country and is a basic component in the diet. Even urban dwellers commonly keep two or three goats for home milk supply.

B. Animal Health

1. When judging the importance of an individual livestock disease, it is necessary to consider such factors as: frequency of occurrence, cost of control, morbidity and production losses, and mortality. It is concluded that rinderpest and contagious bovine pleuropneumonia are the most critical diseases found in Mauritania. Anthrax is next in impor-

tance in cattle. Sizeable local outbreaks occasionally occur.

2. Little is known about the diseases of sheep and goats. Small ruminant plague is important, but other specific diseases are not diagnosed in the field. Sheep pox, internal parasites, and various respiratory infections are felt to be more important. Small ruminants are reported collectively in Mauritania, greatly reducing the usefulness of diagnostic information from the field.
3. In Mauritania, trypanosomiasis is important in camels only. There are no tsetse flies in Mauritania, so cattle are not infected unless they transhume far south into Senegal or Mali. Although gastro-intestinal helminths are considered important by the field service staff, production losses have never been evaluated.
4. In considering the overall importance of animal disease as constraints to production, it is concluded that they are more important now than at any time since rinderpest and pleuropneumonia were brought under control. However, the chief economic effect is due to morbidity and reduced efficiency of production rather than through death losses.
5. Herders and their families suffer from a variety of zoonotic infections (diseases that are transferred from animals to humans such as brucellosis.) The extent of this is not known, and it is not considered to be a medical priority.
6. Many infectious and parasitic disease problems stem from an inability to properly manage herds struggling to share limited pasture and water during

the dry season. There is a lowered resistance to disease caused by the stress of over-crowding, dehydration, caloric insufficiency, negative nitrogen balance, over-heating, and excessive walking between sources of feed and water. The inability to segregate sick animals from the rest of the herd greatly facilitates the spread of infectious and parasitic diseases.

7. There are many animal health problems especially specific infectious diseases, that cannot be adequately diagnosed in the field. Specimens for laboratory diagnosis are difficult to transport from the field to the laboratory in Nouakchott in viable condition due to heat and transportation problems. As a consequence, data on specific disease incidence are incomplete and of questionable value. Data are also lacking on the seasonality of diseases which prevent the design of well coordinated control programs.

C. Livestock and Veterinary Service

1. The Livestock Service is highly veterinary oriented, especially in the field stations. As a consequence, no meaningful production and management programs are being conducted.
2. Donor efforts are presently largely uncoordinated. A central coordinator located within the service would not only prevent duplication of donor efforts but could inform the various donors of other donors' activities and prevent implementation of projects that have been tried and have failed.
3. Livestock research is carried out by the autonomous

National Center for Animal Husbandry and Veterinary Research in Nouakchott. This institution has two functions, to provide a diagnostic backstop for the field service, and to carry out research on problems relating to Mauritania's livestock industries. This is a well-equipped laboratory which is unable to function as it should because of lack of Mauritanian senior scientists and insufficient vehicles for field studies. At present, the laboratory appears to be a costly operation, but it would require considerable additional funding to make it fully effective and relevant to Mauritania's needs.

4. The frequent reposting of livestock field personnel is viewed as a weakness since it leads to reduced incentive and precludes the design and implementation of long-range research and extension activities. Further, it does not allow the individual technician to become thoroughly acquainted with the specific problems of an area.
5. Graduates of the National Agricultural Training and Extension School at Kaedi have a broad based knowledge that could be applied in the field to programs guided by professional livestock personnel. However, the new graduates do not have the medical knowledge and experience of the older foreign-trained graduates.
6. The Livestock Service is seriously hampered by budgetary constraints, especially in the field, where the staff is expected to conduct annual vaccination campaigns without sufficient vehicles and fuel.

Recommendations

1. To facilitate future planning, it is recommended that a long-term study be initiated to fully assess and evaluate the vegetative resources of Mauritania. This study should not only be agristolic in nature but should include estimates of the percentage of pasture land that is totally degraded.
2. Before the areas not presently being utilized for grazing due to lack of water are opened by providing watering points, careful consideration must be given as to the consequences of such action and plans formulated to insure the proper management of these lands.
3. It is not recommended that any major change be made from the current traditional extensive system of livestock production.
4. While it is not recommended that any attempt be made to close the borders to animal migrations (except as necessitated by disease control measures), it is recommended that an estimate of the magnitude of these migrations be obtained. Since the female stock left behind to provide milk for the families undoubtedly suffer severe weight and condition losses during the dry season, it is recommended that some indication of replacement procedures be obtained. When replacements for the next season are being drawn from the migratory herds, productive capacity is decreased.
5. Consideration should be given to an expanded utilization of camels as a meat source. They are presently utilized to some extent for this purpose but their main value is milk production

and use as beasts of burden.

6. Although the Livestock Service is divided into Animal Health and Animal Production divisions, this division is not carried over into the field organizations. It is recommended that a cadre of field technicians be trained abroad in animal production with special emphasis on range management. These should be posted to each regional office and be given responsibility for the implementation of programs to improve the production methods currently being practiced.
7. Annual immunization of all cattle over three months of age against rinderpest and pleuropneumonia is obligatory in Mauritania as it is in other Sahelian countries. It is recommended that these continue to be given at no cost. However, the present policy of free vaccinations and treatments for all other diseases should be discontinued, especially the botulism vaccination which is the most expensive (10 UM per dose).
8. Although the zoonotic diseases are given a low priority by the Public Health Service, it is recommended that some estimate of zoonotic diseases among the herders be evaluated with a view to possibly assigning a higher priority to their treatment.
9. Future training in veterinary medicine should emphasize population medicine rather than individual diagnosis and treatment. The field programs should be restructured so that major emphasis be on herd health although this would require orientation on the part of some of the senior field staff.

10. It is recommended that the entire price control policy be reviewed from an economic view point. In fact, the marketing system should be the subject of a more detailed study.

II. Resources Available

A. Animal Resources

1. Livestock Population

Livestock population figures in Mauritania, as elsewhere in the world, are of necessity based on estimates. The reliability of these estimates is naturally dependent on the source base from which these estimates are made. In Mauritania, as in other countries of the Sahel, there are more than one set of estimates of livestock populations. In fact, three sets of estimates are available.

- (1) The Livestock Service agents in each sector estimate herd numbers from the number of vaccinations they give and then compile their best guess of herd size in the area. These are then forwarded to their respective regional headquarters which are then put together, readjusted then forwarded to the national service headquarters in Nouakchott. The national Livestock Service compiles the estimates from all of the regions, amends them according to its best judgment, and these become the service estimates of herd demography. As a general rule, these estimates tend to give inflated herd size.
- (2) The second method of estimating herd strength involves projecting herd size based on an assumed growth rate and data for a base year. With this method figures are often published without any explanation as to how the base year was selected or how the assumed growth rate was derived. Unless some method of periodic inventory checks are built in, this method is extremely unreliable and misleading.

- (3) A third method utilizes a measurable exogenous variable and relates numbers and/or growth rates to changes in that variable. This method is currently being used by the Central Bank of Mauritanie (BCM). In that model, livestock numbers and growth rates are related to rainfall.

Since this study was conducted during the dry season during the time herds were in Mali and Senegal, it was not possible to make field observations in order to get a visual collaboration of which of the estimates were the closest to being correct. The herd population figures available were tested using 1968 and 1973 as base years with various growth rates. Finally, it was decided to use the RAMS 1967-1979 rainfall model figures as a basis for all calculations⁽¹⁾. The Livestock Service estimates especially for cattle were considered to be somewhat inflated, and there was a discrepancy between the figure given on the summary sheet for 1979 of 1.9 million head of cattle and the 2.1 million total obtained when adding the raw data for the various regions.⁽¹⁾ During the UN seminar on desertification held in Niakchott in May, 1980, the cattle population and other livestock population was estimated as follows (in thousand head):

Cattle	1,186
Sheep and Goats	7,512'
Camels	718
Total	<u>9,416</u>

1) Example of various data received are included in Annex A.

2. Breeds

a. Cattle

The only types of cattle found in Mauritania are Zebu, varieties of the species Bos Indicus. Of these there are two distinct types, the Zebu Maure, and the Zebu Peuhl.

The Zebu Maure is the lightest of the two breeds. Males of slaughter age (6-7 years) weigh from 320 to 360 kgs. The females produce some 500 liters of milk per 200-220 day lactation period. The breed is characterized by a piebald coat and short horns. They are extremely thrifty range animals.

The Zebu Peuhl is noted for its long, loose-limbed conformation and its mottled coat. Mature bulls weigh around 350 kgs. The females produce some 300 liters of milk per 180-200 day lactation period. These animals are crossed with the Zebu Maure in some areas, as cattle owners graze the two together.

Both breeds or types of Zebu cattle found in Mauritania are good range animals in that they are long legged, a characteristic necessary in covering the distances between grass and water and the large areas which must be covered under sparse vegetative conditions. They are, however, highly susceptible to trypanosomiasis. This is often cited as one of the reasons for movement north from the Tse-Tse fly infested areas of Mali and Senegal during the

rainy season. It is also the reason that annual movements of Malian cattle are made from the so-called "delta" region between Mopti and Segou into the extreme southeast of Mauritania around Bassikounou.

It is felt that the animal breeds, particularly cattle, found in Mauritania are the best that are available for the conditions existing here. They have undergone a number of years of natural selection and are at this point truly suited to produce efficiently and effectively under existing conditions.

b. Goats

Goats are found throughout Mauritania in both rural and urban areas. Many city dwellers keep one or two goats for milk production. The Sahel Goat is the most common. These animals are long-legged and heavy when mature (15 to 25 kgs.). They are multi-colored (grey white, reddish brown, and black). They average some 70 liters of milk per 120 day lactation period. The goat, being a browse animal, can exist where cattle and sheep can not and are sometimes found in areas after the cattle and sheep have migrated. For this reason they are often blamed for degradation caused by other species of animals. They are also commonly used in the rural areas for meat.

c. Sheep

There are two breeds of sheep found in Mauritania - the Peulh and the Maure.

Peulh Sheep are smooth-haired animals with bi-colored coats (black and white or dark brown and white). They have long legs and bodies and reach a live-weight of 20 to 30 kilos when mature. They are good meat animals and are found throughout Mauritania. When penned and fattened, as is

sometimes done for the religious feast of Tabaski, the rams will often reach a live-weight of some 35 kgs.

Maure Sheep are distinguished by their long-haired black coats; they possess an ability to browse in more barren areas. Because the hair is utilized in the weaving of cloth which is used in making the black tents that are highly prized in Mauritania, the Maure sheep are now highly valued by the herders.

d. Camels

The animal found in Mauritania is the *Camelus Dromedarius*, or single humped camel. Although they are primarily used for transportation and milk, they are also a source of meat and traction. The average milk production is 400 liters per 270-360 day lactation period. Dromedaries have been bred for specific purposes - namely riding and packing. While this specific selection has not produced the marked differences as found in the various breeds of cattle, the camels of the various countries do carry hereditary traits which distinguish one from another. The camel of Mauritania is long-limbed, medium-boned animal weighing from 450 to 550 kgs. While there still exists in Mauritania a class of camels strictly selected for riding, the bulk would be better classed as family beasts of burden. Camels, because of their ability to browse and their low water requirement, as well as their high susceptibility to Trypanosoma Evansi, are raised in the more arid regions of the country. They migrate south during the dry season but very seldom migrate into Senegal since the Senegalese have banned camels because they, being browse animals, destroy trees. They do, however, migrate to Mali during the dry season.

In actual fact very little consideration (other than health services) has been given to the role of the camel in Mauritania. Camel's milk is a staple for many of the people although how much of it finds its way into commercial channels is a matter of question.

B. Grazing Areas

The total land area of Mauritania is given as 1.03 million km² or 103 million hectares. Of this approximately 55 million hectares are classified as pastureland.¹ Almost all of the grasses found in the grazing areas are annual species which have a limited period (4-6 months) in which they may be utilized by animals. In addition, productive capacity of these areas vary from year to year and location to location because of the irregularities in rainfall amounts and patterns. Consequently, climatic conditions serve to limit the distribution of livestock species throughout Mauritania. Maps II-1, 2, and 3 illustrate these general areas of production. It should be pointed out that, because of the seasonality of the vegetative (biomass) availability and the low carrying capacities found in the lower rainfall zones, the only satisfactory production system is one which involves migration of the herds.

Carrying capacity estimates are normally measured in terms of hectares per Unite Betail Tropical (UBT).² This

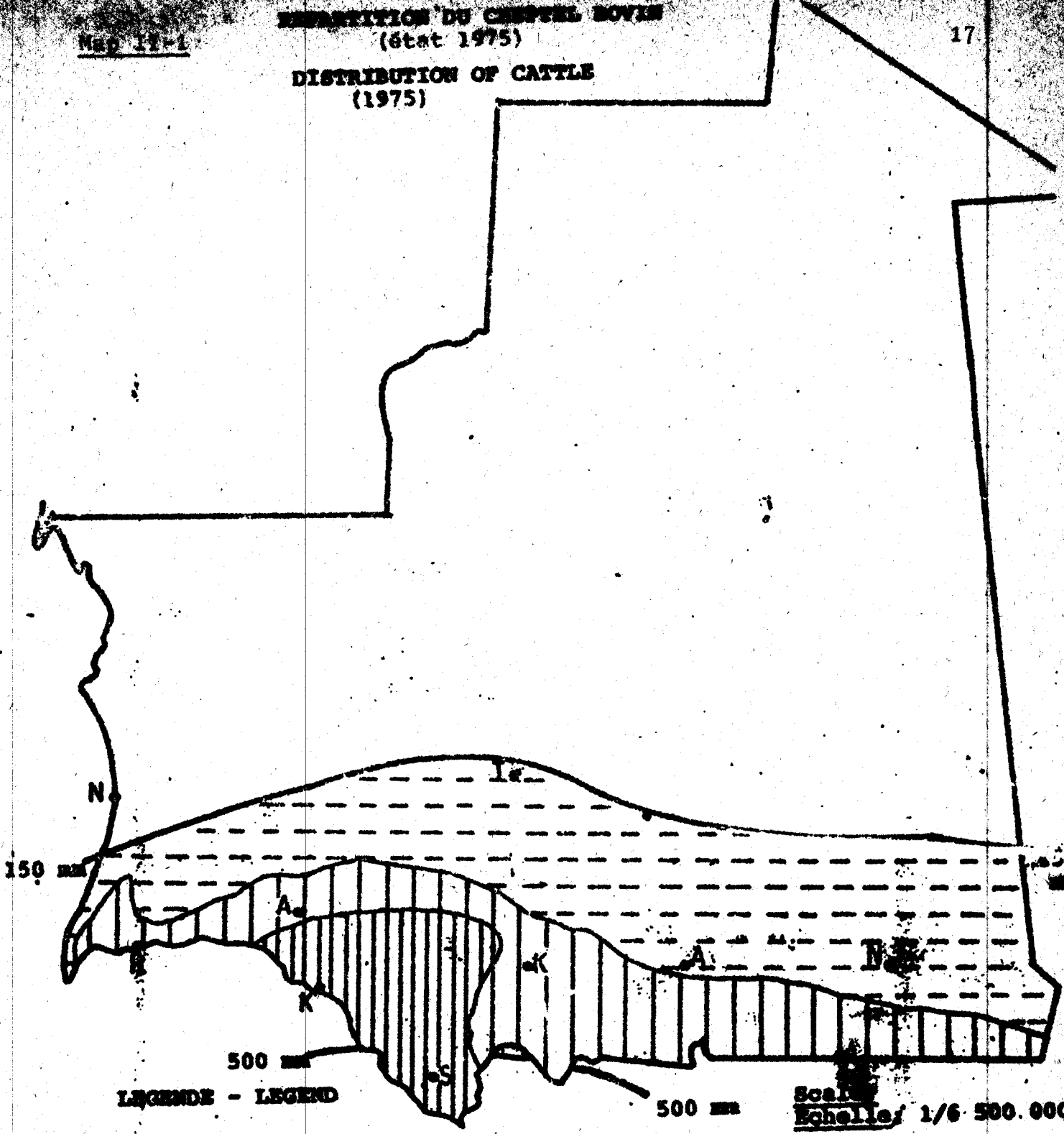
1) CILSS - Provisionary report, January 1980.

2)

1 Adult camel	= 1.00 UBT
1 Adult cow	= 0.75 UBT
1 Adult sheep or goat	= 0.15 UBT

These UBT values were adopted by FAO several years ago, and since they have not been standardized, caution should be exercised in comparing carrying capacity estimated from different sources.

DISTRIBUTION OF CATTLE
(1975)






LEGENDE - LEGEND

Scale
Echelle: 1/6 500.000

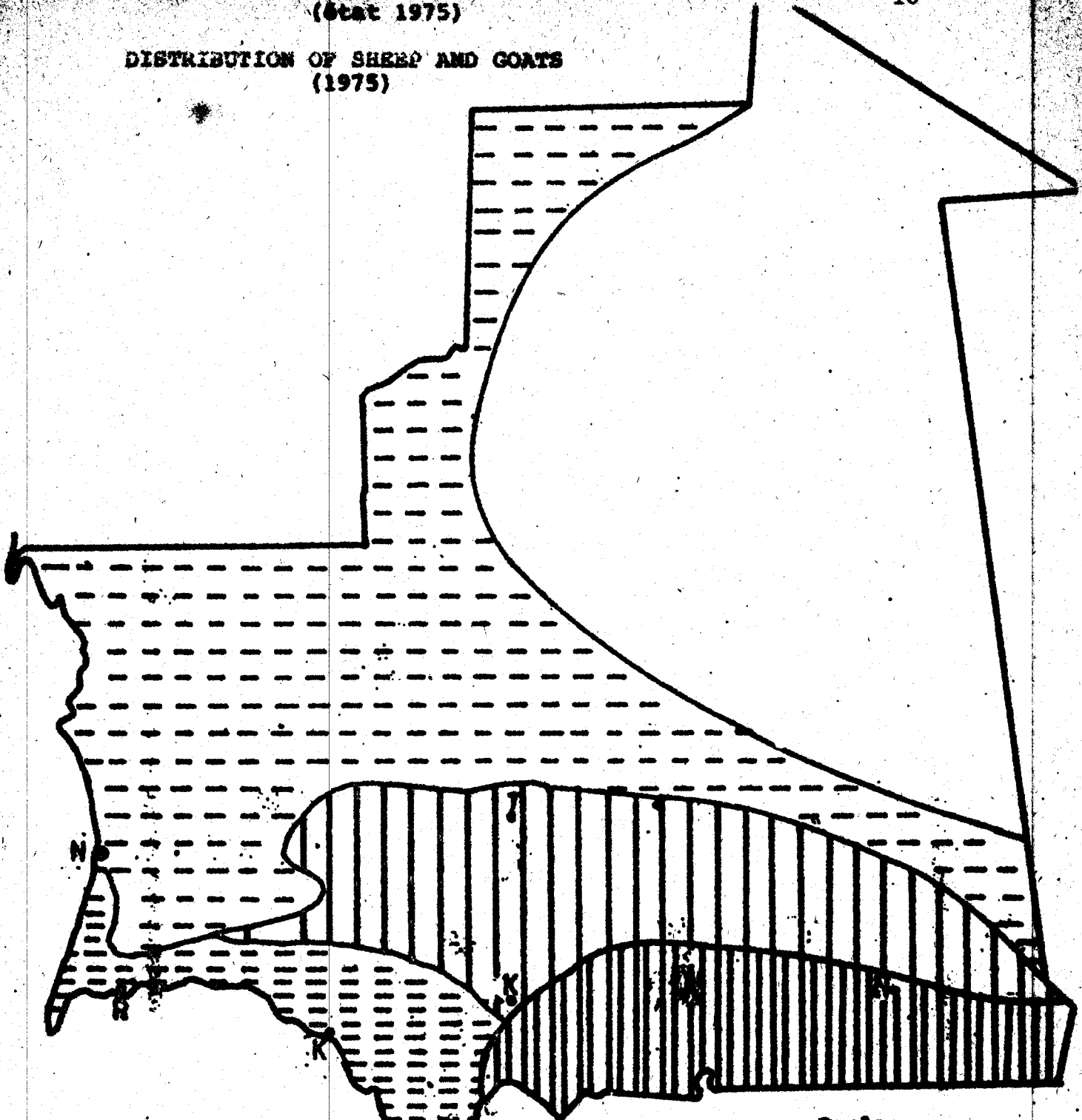
150mm Limite septentrionale de l'élevage bovin
 150mm Northern limit of cattle raising
 Nombre de têtes au km² - Number heads/km²

0 100 200 300km

-  Moins d'une tête - Less than 1 head
-  De 1 à 5 têtes - 1 to 5 heads
-  Plus de 5 têtes - More than 5 heads

Source: adapté du IIIe plan de développement 1976 - 1980
 adapted from III Development Plan.

DISTRIBUTION OF SHEEP AND GOATS
(1975)



LEGENDE - LEGEND

Nombre de têtes au km²

Number heads/km²

Scale:

Échelle: 1/6 500 000



Zone vide - Empty zone

Moins de 2 têtes - Less than 2 heads

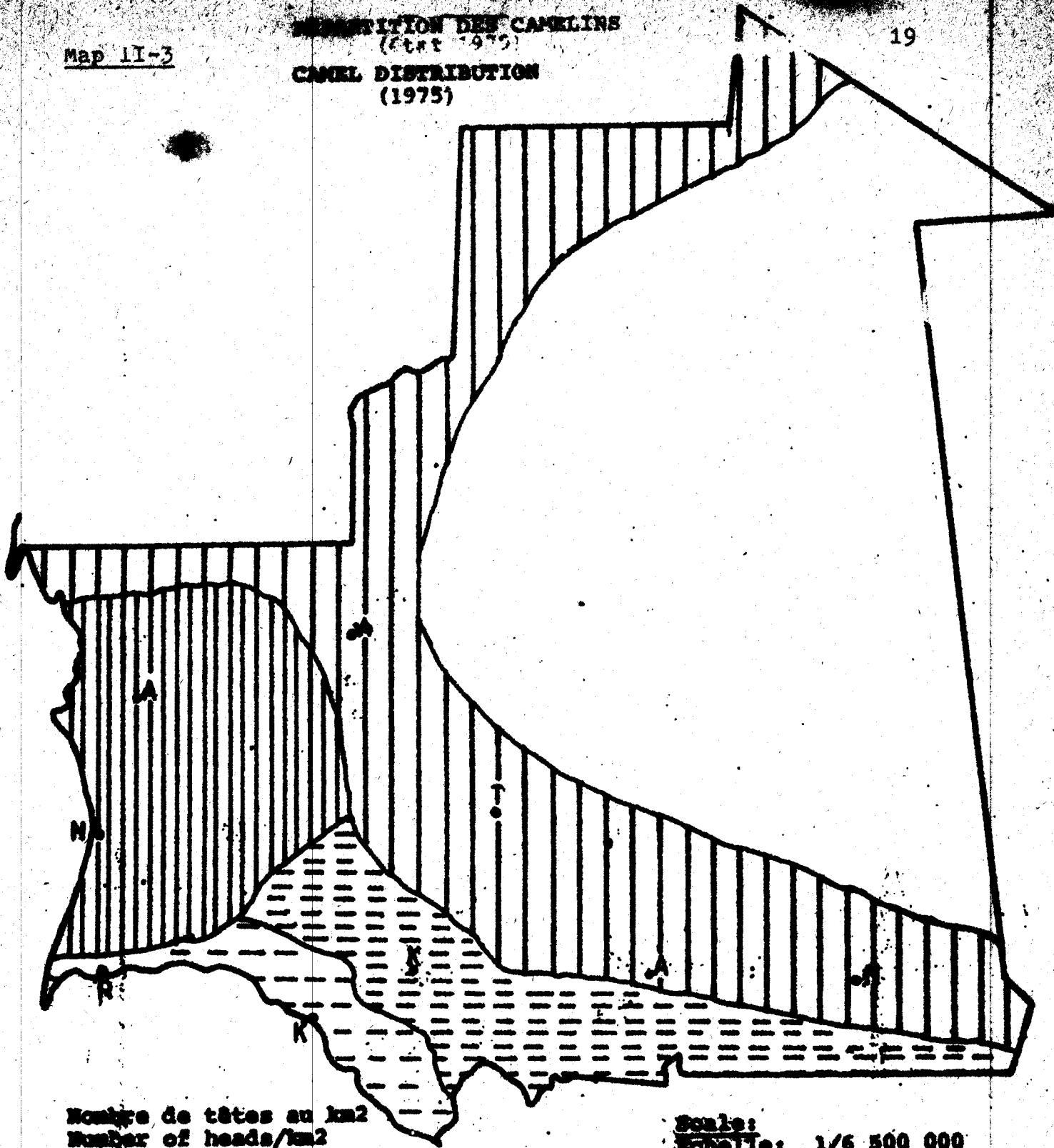
De 2 à 9 têtes - 2 to 9 heads

De 9 à 13 têtes - 9 to 13 heads






Plus de 13 têtes - More than 13 heads

Source du III^e plan de développement
1976 - 1980

DISTRIBUTION DES CHAMELINS
(Etat 1975)
CAMEL DISTRIBUTION
(1975)



Nombre de têtes au km²
Number of heads/km²

-  Zone vide
Empty zone
-  Moins d'une tête
Less than 1 head
-  De 1 à 2 têtes
1 to 2 heads
-  De 2 à 3 têtes
2 to 3 heads
-  Plus de 3 têtes
More than 3 heads

Scale:
Echelle: 1/6 500 000



Source: Adapté du III^e plan de développement 1976 - 1980
Adapted from III^e plan of development

measure provides a standardized common measuring device to
 to account for differences in:

1. Forage consumption and grazing habits of different species of animals
2. Bio-mass produced both between and within various areas
3. Nutritive values between vegetative species
4. Weight, sex, age and other variables within a given species

Estimated carrying capacities in Mauritania range from a high of 4 ha/UBT in the extreme south to as low as 70 ha/UBT in parts of the Saharan Zone. Based on an extensive literature search coupled with a number of years of detailed field observation, RAMS team members have made generalized estimates of Mauritania's over-all carrying capacity based on amount and distribution of rainfall over periods of several years, (in ha/UBT) as follows:

Good rainfall, well distributed	9-11
Moderate rainfall, adequate distribution	14-16
Low rainfall, poor distribution	19-20

A further problem in estimating carrying capacities in Mauritania is that many of the annual grass species tend to be low in nutritive value. When green the water content is high, and when they are dry, the cellulose content is high.

C. Water

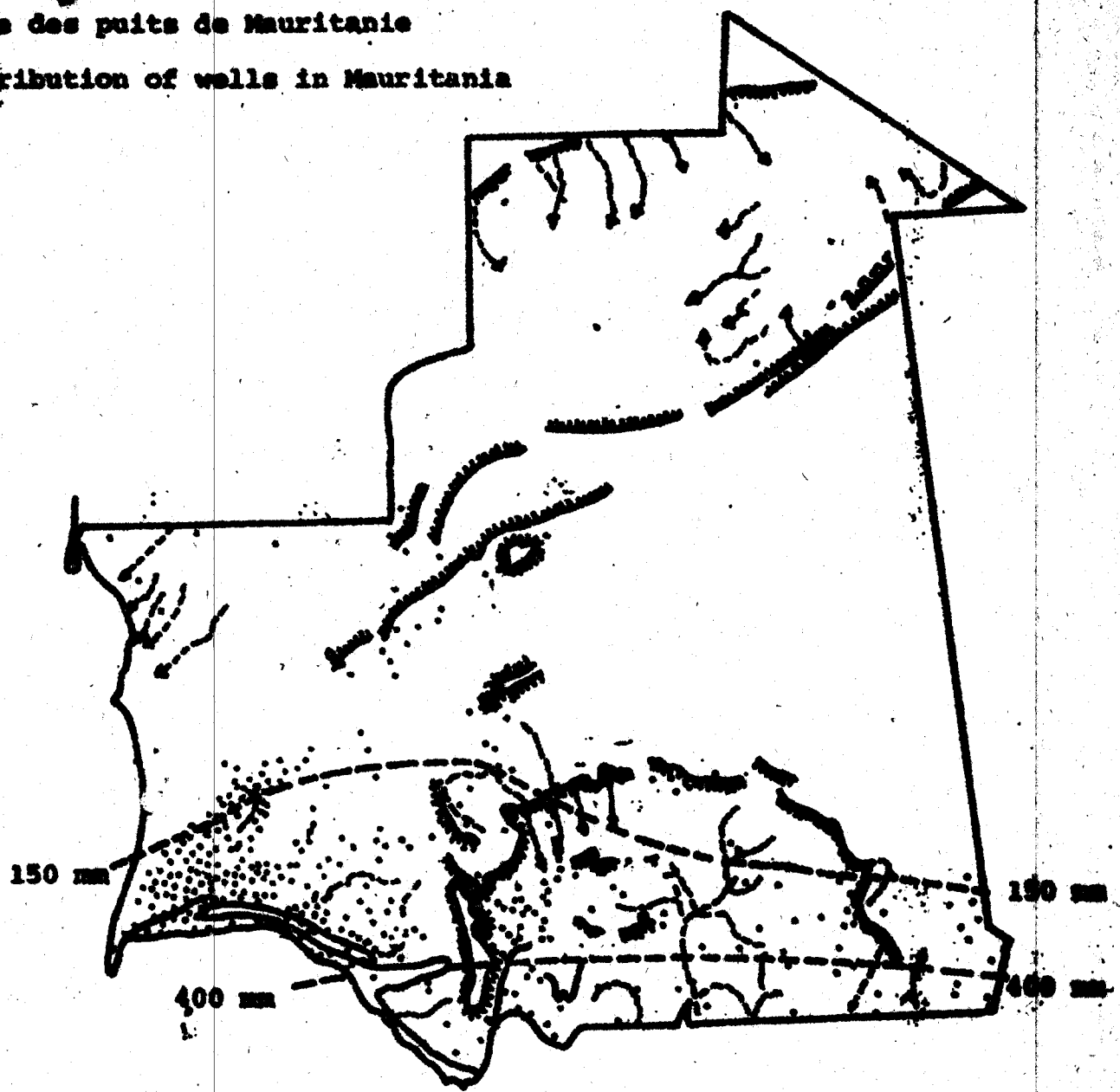
Without water, animal life could only be sustained for a short time. The average daily requirement varies with the temperature, amount of water in the forage and,

of course, with the species and the breed within that species, as well as the age of the animal. The camel is the most efficient user of water, requiring some 5-30 liters of water a day depending primarily on the amount of water ingested with the forage. Heat apparently has little or no effect on camels as their body temperature regulatory system is such that they are able to stand extreme temperatures without apparent discomfort and able to go some 15 to 20 days without water. The average daily water requirement for Zebu cattle is given as 32 liters, with a minimum of 20 liters, it is not unusual for Zebu in Mauritania to go two days without water. The average daily requirement for sheep and goats in Mauritania is considered as five liters of water per day. Consequently, it can be seen that an adequate water supply on a timely basis is of even greater importance to the herder than adequate pasture, as an animal on a low plain of nutrition will draw on body reserves to keep alive.

Water for livestock use is found in ponds, rivers and wells, and the availability and source are not only seasonal but are among the most important factors a herder must consider in planning herd movements. During the height of the dry season, when many of the natural ponds dry up, greater dependence must be placed on the traditional wells. Map II-4 shows the location of these watering points, many of which were put in by the government, others of which the herders themselves had dug. As a rule, each watering point is made up of three or four wells dug in close proximity. Consequently, the number of wells in Mauritania is not as important a factor as the number and location of the watering points. Since with few exceptions the only bore holes found in Mauritania outside of urban centers are those drilled along the Nouakchott-Nema road by the road construction company, the herders must rely on traditional hand-

Map II-4

Carte des puits de Mauritanie
Distribution of wells in Mauritania



LEGEND

- | | | |
|--|-----------------|--------------|
| | Escarpments | Escarpements |
| | Wells | Puits |
| | Water cours; | Cours d'eau |
| | Isohyetal lines | Isohyètes |

Source: USAID 1979

dug wells.

As many observers have pointed out, there are certain areas in Mauritania that have unused vegetative cover because of the lack of water. Consequently, pressure is exerted on the GIRM to open these areas by providing watering points, whether these be bore holes, hand-dug wells or catchment basins. What must be considered is that, instead of spreading the present livestock population over a wider area as some seem to believe would happen, the provision of additional water would probably lead only to an increased herd size. Consequently, it is felt that unless strict controls are maintained, these areas would be subjected to the same mismanagement practices as seen in other parts of Mauritania.

The other point to be considered is that the geological structure in these areas is such that any wells dug might not be productive or that they might be so costly as to make them unfeasible.

III Production System

This discussion of production methods in Mauritania livestock subsector is subject to the following modifications:

- No attempt has been made to differentiate between those common classifications of nomadic and transhumance migrations. Primary concern is with animal mobility as it affects the utilization of natural resources. In fact, as will be discussed, herds from sedentary villages participate in annual movements. Whether these participants then fall under the heading of semi-sedentary does not in any way effect the overall pattern of production.
- It should be recognized that animal movements are an integral and essential part of the efficient utilization of a natural resource base. This is a basic concept of good production practice and is generally accepted by those livestock producers in areas that for one reason or another cannot sustain life on a year round basis.

There are numerous livestock migrations, including examples of (1) the movements of animals to the more mountainous regions of Europe and the United States each spring and summer to utilize pastures which are snow-covered in the winter, (2) the annual migrations of the Caribou herds in Lappland and elsewhere, and (3) seasonal movements in the drier regions of Australia, East Africa, the United States and elsewhere in order to provide sufficient forage for the animals.

There are wide differences in management system practiced by the different ethnic groups and a brief outline of the various operations is in order. The two major systems are migratory and sedentary although, as pointed out earlier, sedentary herders are also migratory to a degree. In addition, rather noticeable changes have occurred over the past decade in

terms of sedentarism. The following FAO figures indicate what has happened.

	<u>Population Composition (%)</u>	
	<u>1968</u>	<u>1979</u>
Rural Nomads	72	36.5
Sedentary	15	38.5
Town Dwellers	13	25.0

There are no estimates of how long the nomads will remain sedentary, nor is it clear exactly what effect sedentarism has had on production practices. It is believed that, if Mauritania experiences several years of adequate rainfall, the percentage of nomads could conceivably increase.

The four ethnic groups which, by and large, own the bulk of the livestock in Mauritania are:

1. Soninke - Members of this tribe are not traditionally classed as pastoralists. Many of them have migrated to France for short periods of time and have invested their savings in real estate and livestock. Since they are not oriented to animal production (in fact, they have no desire to tend their own herds), they hire herders (usually Peulh) to take care of their animals.

It is noteworthy, since they have no emotional attachment to their animal, they probably adapt to changes in herd management and herding techniques more readily than the other ethnic groups. They are, for the most part, urban dwellers and usually are engaged in business with animals as a sideline.

2. Peulh - The Peulh probably own more cattle than any other ethnic group, although exact estimates were impossible to obtain. They closely control their own herding, generally using family members for this purpose. During migratory movements, they usually move slower, graze several hours longer in the evening and are the only group that makes an effort to seek out salt water wells for their cattle. They also buy salt for their animals when it is available.

3. Toucouleurs - By and large, they are sedentary agriculturalists. What cattle they own are grazed on a cooperative basis usually, by family members, mostly young men. As it becomes necessary to move the cattle any distance away from their villages, Peulh herders are engaged. In so far as possible, animals owned by the Toucouleur do not participate in the longer migratory movements such as practiced by the Peulh and Maure. Most frequently, the animals are not moved more than 40 to 50 kilometers if grass and water are available. Movement of over 100 kilometers are rare and only made when absolutely necessary.

4. Moors⁽¹⁾ - An estimated 85% of the camel population of Mauritania is owned by Moors. In some cases their only livestock holdings may be camels, plus a few sheep and goats. Animals are herded by members of the extended family in so far as possible. When it becomes necessary to hire herders, they hire other Moors in preference to Peulhs as a rule.

When hired herders are utilized the arrangements for payment vary. The herder may be paid on a per head or per herd basis. The per head payments are generally made when the herd is composed of animals owned by several peo-

(1) For a more complete picture see RAMS Study - Sociological Profile - the Moors.

He and is more common in the case of small ruminants. He also may be paid in kind or in cash or a combination of the two. Rates for different species are different, as are the number of animals entrusted to each herder. A single herder is usually responsible for 150 to 200 herd of cattle during the rainy season and 75 to 125 head during the dry season. When trekking to market a herder is generally not responsible for more than 50 animals, because a market herd is composed entirely of mature animals. Small ruminants are usually herded by children. However, when a hired herder is used, the herd size is normally limited to 25 - 35 animals especially in the case of goats although herds of somewhat larger size have been observed in the field. It is interesting to note that, when cattle move on an extended trek, a lead animal is often used - a mature animal, usually a steer, that is specially selected for his manageability and trained to lead the herd. In many cases, the herder becomes very attached to his lead animal and will not part with that animal until it becomes too old to be of further service.

As stated earlier, cattle owner-herder agreements vary. Examples of such agreements are:

- The herder receives one or two animals of one or two years of age for a year's work. He normally receives millet, tea and sugar for his own use.
- The herder receives 500 UM per month plus a boubou (native robe), turban and a pair of sandals. He usually eats with the family when at home and is given millet to carry when the herd is away. While on trek, he may have milk for his own use but is not allowed to sell milk. This type of agreement is most common among the Soninke.

In the case of small ruminants, the herder may receive 40 UM/day or 1,200 UM/month. He may or may not be given a boubou (native robe) but is usually given tea and sugar or in some cases millet. He is allowed milk for his own use only. If the herder is working on a per head basis, he usually receives 20 UM/head/month. He may receive some tea, sugar or millet as well.

In the sedentary herd management, the cattle are returned to the village each evening. Migratory movements are only made when it is absolutely necessary. The animals are kept in brush kraals or individually staked around the village perimeter. When there are no growing crops, the animals are moved from field so that the fields may be fertilized. This practice is of doubtful value in climates as hot and dry as found here, since the nitrogenous value of the manure declines rapidly. Each morning and evening the women partially milk the lactating cows and afterwards the calves are allowed to suckle. Usually as the dry season advances and milk production per cow declines, the calves receive less and less milk. The calf herd is kept separated at all other times. The Peulhs who have sedentarized normally allow their calves more milk than do other ethnic groups. Also, in extremely dry years, they allow the calves to run with the cow so they can consume all milk produced and improve their chances of survival. Milk in excess of family needs is in most societies the property of the women and may be sold or bartered. While it was not possible to determine the price for milk in the villages in May, it was selling for 5 UM per teacup in Aioun in the local market.

Surprisingly, there is very little difference in herd composition among herds owned by the various ethnic groups.

The following table is a general estimation of herd compositions.

<u>Animal Class</u>	<u>Soninké</u>	<u>Peulh</u>	<u>Maure</u>
Bulls	2.6%	2.6%	3.1%
Steers	8.7%	9.0%	11.6%
Adult females	73.9%	67.3%	65.6%
Animals under three years of age	14.8%	21.1%	19.7%

No estimate was obtained for the Toucouleur herds, but field observation in 1975 and 1976 in Mauritania and Senegal leads to the conclusion that herd composition resembles that of the Peulh. It will be noted that in each case the number of steers exceeds that which is generally considered economically sound. These animals serve as walking "check books" and are used to meet expenses when the animals are on the move (taxes, fees, and other charges and expenses). Since nearly all payments are made in kind, this eliminates the necessity of utilizing productive animals in order to meet expenses.

Animal production in Mauritania is, of necessity, often migratory and, even in villages that have been established since the drought, the men spend a portion of the year "on trek". Most animals are moved to Mali or Senegal during the dry season when there is insufficient water and forage to maintain the herds and return with the onset of the rains when grass and water again become available and external parasites (ticks) and diseases (i.e. trypanosomiasis) become a problem in the south.

The timing of the moves are determined by the timing and amount of rainfall. Last rainy season (1979), most areas in Mauritania received an average of one-half

the rainfall that is normally expected. Consequently, the animal movements began earlier than normal during the 1979-80 season. While the southward shifting of the isohyets effect the timing of the migrations, the routes taken generally follow the same pattern (Map IV-1). In interviews with herders and personnel at the livestock inspection stations, it was estimated that approximately 90% of the herders follow the same route every year. These routes are determined by: (1) availability of water, (2) availability of grass, and (3) accessibility. The latter has been a source of friction since the drought, as farmers have moved into areas not previously cultivated, and the herders feel that these grazing areas belong to the herders by traditional right of usage. The herders very carefully scout any area they are moving into prior to making the move and generally try to avoid trouble, if possible. Litigation over crop destruction tends to be long and costly and neither the cultivator nor the herder actually gains in the end. In recent years, resentment on both sides has been strong. The herders feel that they are blocked from using grazing land that is traditionally theirs, and the cultivators feel that, when their crops are destroyed, they are not receiving fair treatment in the courts. These difficulties will continue unless comprehensive land utilization policies are adopted by the government. Disputes between livestock producers and cultivators are universal as well as historical.

As population increases, the demand for crop production land must increase. In Mauritania marginal lands are now being brought into production. There is a feeling in some quarters that this may actually abet desertification as it did in the United States during the dust bowl era of the 1930's. More important, however, it means that land traditionally utilized for grazing is no

Legende de la Carte de l'Elevage en Mauritanie
Legend of the Map of Livestock Raising in Mauritania

▼ Cattle-Bovine 50 000

● Camels-Cameline 50 000

● Camels-Cameline 10 000

↗ Summer camp-Campment d'été
Nomads migration axis-Axe de nomadisation
↙ Winter camp-Campement d'hiver

▽ Sheep-Goats Ovins-Caprins 250 000

▽ Sheep-Goats Ovins-Caprins 50 000

Northern limit of Peulh transhumance

———— Limite septentrionale de la transhumance Peulh

- - - - - 150 mm Ischetal line - Ischyète 150 mm

———— Escarpments-Escarpements

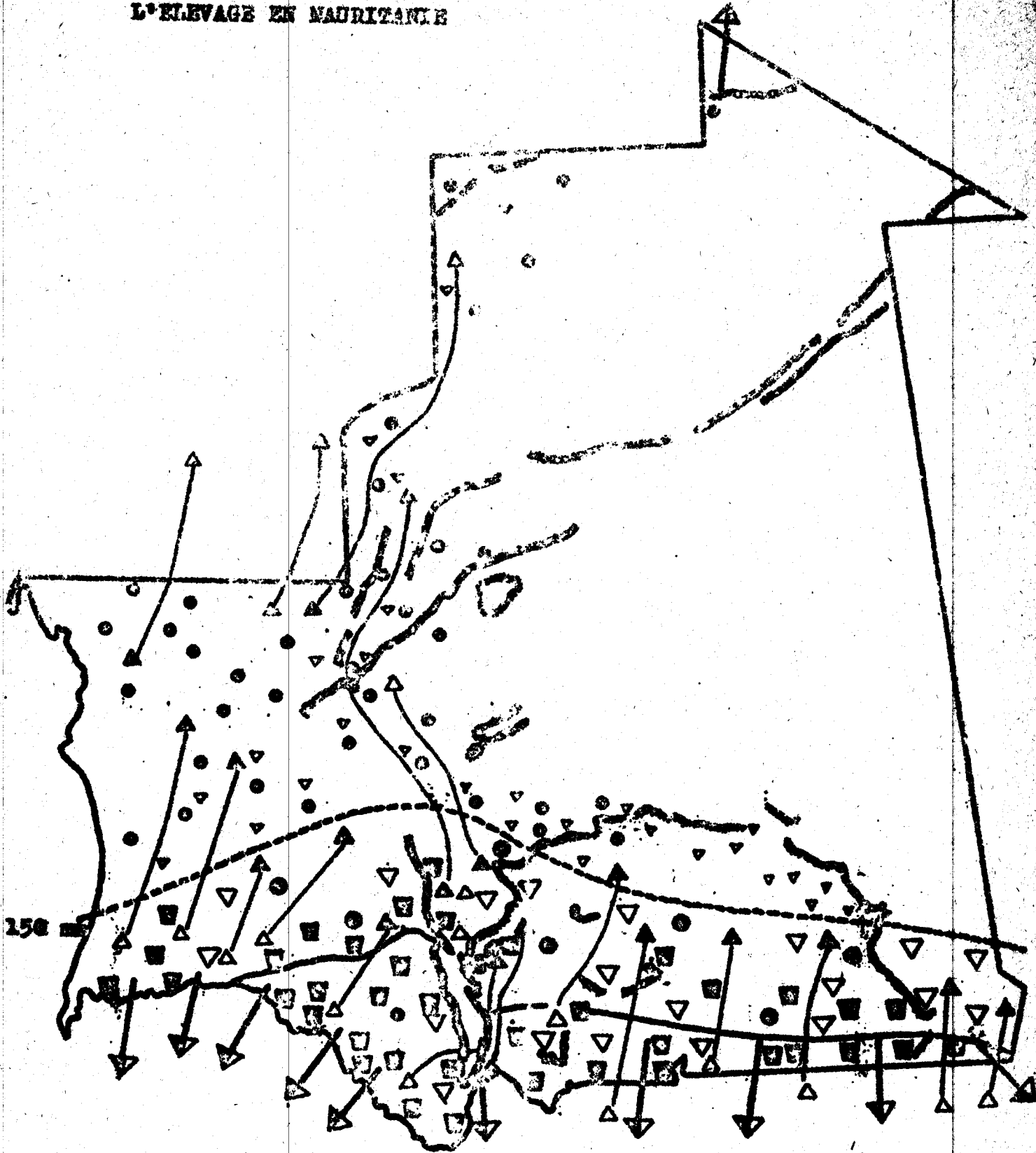
▶ Exportation live animals - Exportation du bétail
sur pied

Source: Adapté de l'atlas "JEUNE AFRIQUE" 1977

Adapted from the atlas "JEUNE AFRIQUE" 1977

LIVESTOCK RAISING IN MAURITANIA

L'ELEVAGE EN MAURITANIE



15°

SCALE

ECHELLE: 1/5 500 000

longer available for that use. It, therefore, becomes the government's responsibility to implement some type of land classification and utilization policy which is simple, understandable, and enforceable. Complicated deviations from the traditional patterns generally meet with resentment and resistance.

IV Animal Health

Identification and evaluation of the importance of specific livestock diseases in Mauritania are subject to considerable error. The government field Veterinary Service lacks the manpower, transportation and diagnostic capacity required for accurate monitoring of animal health. Nevertheless, a cautious appraisal can be made if official morbidity and mortality reports are analyzed in conjunction with field observations, interviews with herders and veterinary personnel, and consideration is given to animal health conditions in other parts of the Sahel.

Three reports on livestock health in Mauritania were published in 1976. One of these was a general appraisal, one was a regional report, and the third was a review of the 1976-76 epidemic of foot and mouth disease.¹ The present analysis focuses on animal health and disease problems since 1976.

Mauritania maintains a relatively short list of reportable diseases. Official forms specifically call for the reporting of outbreaks of rinderpest, sheep and goat plague, anthrax, blackleg, botulism, bovine pleuropneumonia and mange. Foot and mouth disease and rabies are also reportable but are not listed on the forms. Vaccinations, some treatments, and a few other categories of information also appear on the form (Table V-1). Information is given by species, goats are grouped together as "small ruminants" and fowl diseases are only reported from commercial poultry operations in Nouakchott. Summaries

1) La Santé Animale en Mauritanie, GTZ/SEDES, May, 1976; Enquêtes sur les Maladies du Bétail dans la Région de Selibabi et de la Région de Bakel, INERV, Dakar-Hann, June 1976; Mission d'information sur l'épidémie de fièvre 1975-1976 en Mauritanie, IEMVPT, June 1976.

Table IV-1

Information Contained in Official Livestock Monthly

Post Report Forms

General herd status (nutrition, water, herd health, pasture condition, etc.)

Immunizations and/or Outbreaks

- Rinderpest
- Sheep and goat plague
- Anthrax
- Blackleg
- Botulism
- Bovine pleuropneumonia
- Mange

Treatments

- Pleuropneumonia
- Trypanosomiasis
- Internal and external parasites
- Castrations

Preditor Attacks

of official reports appear in Tables IV-2 and 3.

Major Infectious Diseases in Mauritania

Rinderpest and pleuropneumonia are potentially the most destructive infectious diseases for cattle. Mauritania has been able to constrain these by annual vaccination, so that mortality losses are sporadic and numerically unimportant. However, because of the need to continue indefinitely with costly mass vaccination, these two diseases should be considered among the most economically important. In fact, they alone continue to provide the major economic justification for maintaining Mauritania's veterinary service.

Official statistics do not show blackleg as an important cause of cattle deaths. Nevertheless, there is government-sponsored vaccination throughout the cattle grazing regions (Table IV-4). It is not possible to evaluate whether vaccination is affecting the incidence of blackleg. Field observations indicate that the vaccination program is not as efficient as it might be since many adult cattle which are at no risk are being vaccinated.

Anthrax is important in that period outbreaks cause large local losses. Epidemics occurred in 1974, 1977 and reputedly again 1978. The importance of anthrax is increased by the human health hazard. Only a small effort is made to vaccinate against anthrax. The distribution of the vaccine does not correspond to the geographical distribution of outbreaks.

Botulism has a reputation for being one of the commonest causes of mortality during drought years. There is, however, no practical field test to confirm the bacterial intoxication. It is unlikely that the veterinary staff

Table IV-2

Official Morbidity and Mortality Data

1976 - 1979, All Regions

	Total Morbidity (% Mortality)		
	1976	1977	1978
Rinderpest	3 (67%)	456 (60%)	254 (60%)
Cattle Pleuropneumonia	39 (41%)	271 (52%)	11 (100%)
Anthrax	18 (100%)	1638 (100%)	33 (10%)
Blackleg	225 (32%)	107 (94%)	12 (92%)
Bovine Botulism	855 (49%)	869 (39%)	749 (52%)
Sheep/Goats Plague			7373 (18%)

Source: Documents prepared by the Animal Health Division, Livestock Directorate, Ministry of Rural Development.

Table IV-3

Regional Distribution of Reportable Diseases

Region	Morbidity (Mortality)						Foot and Mouth		Small Ruminant Plague				
	Bovine Pneumonia 1975 1976	Bovine Pneumonia 1976 1979	Botulism 1976	Botulism 1979	Blackleg 1976	Blackleg 1979	Arthraz 1976	Arthraz 1979	1976 1979	1976 1979			
I	3(2)	20(15)	25(12)	11(11)	565(335)	200(98)	134(94)	12(11)	0	83(10)	74(0)	0	0
II	0	15(82)	0	0	5(3)	490(275)	64(64)	0	0	0	0	0	0
III	0	68(52)	2(2)	0	145(67)	0	10(10)	0	0	0	0	0	0
IV	0	0	0	0	130(6)	37(7)	0	0	0	0	0	53(0)	188(50)
V	0	0	4(2)	0	10(7)	0	17(17)	0	0	0	0	61(0)	0
VI	0	0	8(0)	0	0	0	0	0	0	18(18)	0	0	0
VII	Region Not Reported												
VIII, XI	Region Not Reported												
IX	0	0	0	0	0	0	0	0	0	0	0	0	268(130)
X	0	15(14)	0	0	0	17(8)	0	0	0	0	0	147(0)	06920(1102)
XII	Region Not Reported												

1) Thought to have occurred but not officially reported.

Source: Documents prepared by the Animal Health Division, Livestock Directorate, Ministry of Rural Development.

Table IV-4

Official Livestock Vaccination 1976 - 1979

	<u>All Regions</u>			
	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Rinderpest	636,207	570,875		608,031
Bovine pleuro pneumonia	267,255	335,035		239,971
Botulism	294,665	210,685	Data	73,791
Blackles	157,427	125,580	Not	31,790
Anthrax	7,595	13,243	Available	15,457
Hemorrhagic septicemia	103,903	166,439		
Small pox/rinderpest		24,338		10,636

Source: Documents prepared by the Animal Health Division, Livestock Directorate, Ministry of Rural Development.

would be able, for example, to differentiate botulism from terminal septicemias in starving cattle. The official statistics could be the "tip of the iceberg", or they could include many false positive diagnoses.

Foot and mouth disease is endemic in Mauritania. Its importance is generally under-rated because it is self-limiting and not fatal. However, in over-stocked grazing zones, morbidity is more important than mortality; therefore, in assessing the importance of foot and mouth disease, it should be compared with other causes of morbidity. The official statistics are probably under estimates because herders will tend not to report problems unless their animals are dying. Unfortunately, even if foot and mouth disease is relatively important, there is no control program that would be practical at the present stage of Mauritania's livestock development. Vaccination is costly and complicated, and it would fail without a strict pan-Sahelian policy for herd regulation and quarantine.

The only disease of sheep and goats which is officially reported is plague (peste de petits ruminants). In 1979, a serious outbreak was reported from Region 10 (Guidimaka); it was followed by a local vaccination campaign. Considering the general lack of emphasis on small ruminant health, it is likely that the incidence of this disease is underestimated. The Division Sante Animale (Animal Health Division) would like to increase the emphasis on small ruminant health, but in order to move in this direction it would be absolutely essential to begin disease reporting for sheep and goats. Efficient programs of intervention require a knowledge of the differences in disease patterns between the two livestock species.

Although trypanosomiasis is not reportable as such, treatments for it are reported, since it is reasonably

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assumed that most cases which are diagnosed are also treated. There have been no confirmed reports of tsetse in Mauritania. However, if transhumant cattle herds are taken too far south, they may return with trypanomiasis. This is especially true of the vivax form which can be transmitted mechanically, after it is brought into Mauritania.

Camels are very susceptible to Trypanosoma evansi which is always transmitted mechanically. The disease Dourine is serious and common, and treatments are given in all regions of the country. Dourine also affects horses, but it is not often diagnosed in this host.

Treatments for internal and external parasites are also reported, but data from regional reports do not always appear in the annual Livestock Service report. The number and distribution of treatments for gastrointestinal helminthiasis in 1976 is shown in Table V-5. No information is given as to which species of livestock were treated but, as the table shows, most of the treatments were given in the southwestern region of Mauritania.

There was decreased emphasis on the treatment of parasitic diseases in 1979. Only 1,138 treatments were recorded for trypanosomiasis and 71,780 for gastrointestinal helminthiasis. This was probably due to drug shortages, although by April, 1980 all posts had at least some antiparasitic drugs. Veterinary personnel may, however, be reluctant to use some drugs which they consider to be in inadequate supply, and which might be needed in an emergency.

The greatest problems with external parasites occur in the southwestern regions. This is especially so in the Rosso area which has a severe year-round tick problem. Donkeys are affected and die during the dry season, probably as a result of malnutrition and dehydration. At the present time little emphasis is placed on the control of external

Table IV-5
Regional Distribution of Veterinary Interventions

Region	Number of Vaccinations ¹⁾									
	Fingerrest		Bovine, Pleuro-pneumonia		Botulism		Blackies		Anthrax	
	1976	1979	1976	1979	1976	1979	1976	1979	1976	1979
I	113,541	183,110	7,834	81,001	31,347	41,949	23,330	10,931	2,541	6,006
II	40,319	137,350	3,098	72,712	38,799	50,307	20,488	8,807	0	0
III	87,580	24,756	0	5,900	49,758	2,233	23,107	860	60	1,930
IV	170,304	44,358	131,287	30,287	105,654	3,200	61,086	7,560	4,340	579
V	111,247	91,026	42,410	43,690	300	3,355	2,887	3,972	0	0
VI	6,347	10,187	6,539	0	0	0	10,384	0	654	0
VII	Region Not Reported									
VIII, XI	Region Not Reported									
IX	17,219		9,255	0	6,861	0	0	0	0	0
X	107,520	37,114	66,832	5,695	61,507	2,747	15,145	2,860	16	6,868
XII	Region Not Reported									

1) Total doses regardless of number per animal doses recommended for proper immunization

Source: Documents prepared by the Animal Health Division, Livestock Directorate, Ministry of Rural Development.

Table IV-5 (Cont'd)

Regional Distribution of Veterinary Interventions

No. of Vaccinations	Number of Treatments		
	Sm. Ruminant 1975-2	Plague 1979	Gastrointestinal Helminthiasis 1976 1979 1979 1979
0	3,075	1,601	
0	614	4,988	
0	255	5,216	
800	1,606	28,672	
0	3,193	23,011	
0	341	16,319	
0	2,500	21,158	
9,878	997	17,898	

- 2) Vaccine not used
- 3) 1,138 total treatments
- 4) 71,780 total treatments.

parasites. Only 15,400 treatments were given in 1979; most of these were for mange and ticks.

Livestock in Mauritania harbor a number of infectious and parasitic diseases which are transmissible to man. These undoubtedly affect the herders and their families, who are always in close contact with their livestock. There is very little information on these zoonoses other than scattered records of their occurrences. They include diseases such as animal tuberculosis, brucellosis, salmonellosis, anthrax and hydatid disease. There are, at present, no medical programs aimed specifically at herders and their families, and the zoonoses will undoubtedly remain low-priority public health concerns during the next five-year period.

Reporting

There are no published data on the seasonal distribution of disease problems in Mauritania. Post reports are submitted monthly to the regional inspection headquarters from which monthly summaries are sent to Nouakchott. The monthly data are added together for the entire year before being published in the annual summary; in this way information on seasonality is lost. By reexamining the monthly post reports, an epidemiologist might be able to identify data which would be useful in designing more efficient disease control programs.

In addition to the mandatory reporting of a few specific diseases, the field service staff submits a list of diagnoses made during the previous month. Since each post produces its own list, the diagnostic categories vary from post to post. A typical list is shown in Table V-6; it is a mixture of etiologic diagnoses, clinical signs and lesions.

Table IV-6Clinical Syndromes and Diagnostic Categories Used by Region A
Headquarters in Monthly Reports

Abscess
Cameline brochopneumonia
Stronglosis
Trypanosomiasis
Constipation
Luxation
Mange
Cutaneous infections
Mastitis
Diarrhea
Metritis
Bronchitis
Conjunctivitis
Liver fluke infection
Coccidiosis
Lymphangitis
Hickettsiosis
Fracture
Strangles
Colic
Stomatitis
Insect bite reactions
Coryza

Notably absent are metabolic, toxic and many specific infectious diseases. There is, likewise, no consideration given to starvation, primary dehydration or temperature regulatory failure ("heat stroke", etc.).

Deficiencies in the diagnostic list can be appreciated by comparing Annex 11 with a list of the infectious diseases which United Nations specialty organizations recognize as endemic in Mauritania (Annex 11). There are at least seventeen clinically important infectious diseases of cattle, sheep, goats and equines which do not even appear in the veterinary post list. Consequently, there is a lack of exact information on livestock diseases which occur in Mauritania.

The point of this discussion is that the field veterinary service is being called upon to provide a diagnostic service which is beyond its technical capability. Livestock pathology is more complex in the tropics than it is in temperate climates, not less so as it would appear from an examination of veterinary post documents. An animal health service which is based on individual treatment requires consistently accurate diagnoses which cannot be provided by a paraprofessional staff which has no laboratory resources at its immediate disposal.

Mauritania will not be able to develop an effective program based on individual treatment in the foreseeable future. The best way to improve the veterinary service would be to eliminate most individual treatments and to shift to a national herd health program. This would be based on strategic interventions given to entire populations of livestock. Preventive measures and herd management would be stressed. The reorganization necessary to implement this type of program is discussed elsewhere in this chapter.

Economic Significance of Livestock Diseases

In order to evaluate the economic significance of livestock diseases it is necessary to consider the production goals of the herders themselves, of the government, and of aid donor agencies. Production goals may be complementary at times, but more often they are competitive so that the attainment of a high priority goal requires production methods which are less than optimal for other low priority goals. Because of this competitive nature, there is selective allocation of forage energy for conversion to wealth (large herd size), food, transportation, disposable income, utilitarian by-products, labor and fertilizer. Herders are forced to prioritize their goals and to manage their production system accordingly.

Problems in livestock development are encountered when governments and aid donors, in order to stimulate economic development, attempt to reprioritize production stability, increased national wealth, and environmental conservation. These long-term objectives are poorly understood by pastoral herders who, until independence in 1960, had no meaningful national affiliation; also, herders were not, until recently, in serious competition with each other for exploitable rangeland.

To be specific, Mauritania's independence has created a new need for national wealth, but since 1960 the human population has doubled while the rangeland resource has been reduced by perhaps as much as 50% due to the 1968-1974 drought. This has resulted in an economic decline for the livestock producers, and has forced an assessment of livestock production priorities.

Food production by livestock must now be accorded the highest priority. After this, disposable income should

be emphasized. When a choice in production methods is made, it should favor these goals rather than wealth in the form of large herd ownership. Increased use of animal labor (traction) and fertilizer should be cautiously encouraged in relation to agricultural development. The use of animals for transportation and as a source of utilitarian by-products should continue at the traditional level, most importantly when they are needed to support nomadism and transhumance which will continue to be important management tools for utilizing natural resources.

How important, then, are disease processes as constraints to increased production, given the new high priority goals of food production and cash income? Field observations, veterinary data, and production indices strongly suggest that diseases are more important now than at any other time since rinderpest and pleuropneumonia were brought under control.

The important losses, however, are no longer due to death, but to morbidity and the loss in production efficiency which is suffered by sick, parasitized animals. Infectious and parasitic diseases can no longer be viewed as isolated phenomenon unrelated to animal husbandry practices. Mauritania's grassland resource is being taxed to provide enough fodder to support the large herds, and watering points are over-crowded during the dry season. The accumulated stress from caloric deficiency, negative nitrogen balance, dehydration, exposure to mid-day sun, over-crowding and extended walking in search of feed and water increases the animals' susceptibility to disease. Infections are then easily spread when herds are brought into contact with one another regardless of health status.

The efforts are most dramatic in sheep, which suffer from a variety of undiagnosed illnesses. However, obser-

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vations on cattle indicate that they, too, commonly suffer from infectious diseases as there are often large variations in body condition between individual animals within a given herd.

A reduction in the infectious disease status of Mauritania's herds cannot be achieved by increasing the level of usage of secondary or non-essential vaccines. These vaccines protect against diseases which have high mortality rates but generally low morbidity rates. That is, only a few animals are affected in each herd, but those that are affected usually die.

The only practical way to significantly improve the animal health status of Mauritania's herds is to lower the number of animals while, at the same time, introducing management control to guide orderly foraging and watering. Mass treatments can be given when applicable, and sick herds can be separated from healthy ones as best as possible. Only through a combined effort of herd health and animal husbandry can the infectious and parasitic disease constraints be removed for increased food production and disposable income.

V. Livestock and Livestock Product Marketing

In Mauritania as elsewhere, livestock marketing is a complex subject requiring assessment of production factors, population trends (both animal and human), price policies, managed prices, consumption and consumption preferences to mention only a few of the basic considerations. Assessment of these is complicated by insufficient data as well as the presence of conflicting data presented in the various papers published in recent years. Where data were lacking "guesstimates" were made. In the case of conflicting data, several alternatives have been considered and a rationale has been presented for utilizing the data that seems closest to being the actual case. The small ruminant sector is definitely the least understood area in the marketing picture as well as in production. Given the large number of animals involved as well as the dietary importance of small ruminants in Mauritania, it is suggested that this is one area that requires further investigation.

Herder behaviour is often listed as a constraint. Many observers feel that the herders are not practicing efficient offtake strategies by retaining unproductive females and steers beyond optimum age for economic sale. The fact is that little is known concerning the commercial strategies pursued by the individual herders. However, it is suggested that it is very improbable that the herders are not fully aware of their own economic interest when they make offtake decisions. In fact, there is every evidence to indicate the herders will increase offtake when they have sufficient reason to do so. There is also an indication that the herdsman will actually decrease individual herd size when it is to their advantage, such as in periods of extreme climatic stress. The major constraint to increased offtake is apparently negative price incentives coupled with the desire for insurance reserve against adverse grazing seasons.

Consequently, if offtake is to be increased some form of positive price incentive must be offered the herder. (1)

Offtake is simply a product of autoconsumption, local slaughter and export. Conceptually, the net annual offtake is either domestically consumed or exported. Since live animal export figures are generally unrecorded for Mauritania, an attempt has been made to make deductive estimates of exports (Chapter Q). In the case of cattle where very few animals are slaughtered outside of official channels, the estimated export is obtained by subtracting legal slaughter from the total calculated offtake numbers. This method does not permit estimations of what portion are sold in Mali nor how many animals reach markets in Senegal. Live animal imports into Mali are also largely unrecorded, so attempts to formulate estimates based on Malian import data were not possible. Export estimates for small ruminants is a far more complicated process. The bulk of the small ruminants which are domestically consumed is slaughtered outside of official channels. While an attempt has also been made to estimate the magnitude of small ruminant exports, the reliability of such an estimate is open to question. The primary purpose for attempting this is to try to get some crude estimate of the annual production which is not available to meet local consumption demands.

The livestock owners themselves prefer to sell their animals for Malian Francs or CFA. This became evident in 1975 when they risked confiscation of their herds after the borders were closed. The incentives for selling livestock on the foreign markets are as follows:

1. Livestock prices are usually higher in other West African countries than in Mauritania;
2. Since the Mauritanian currency is not recognized as an international currency, herders prefer to sell in foreign markets;

(1) RAMS Study Agricultural Production, 1981.

3. When livestock are sold on foreign markets, the sellers have a variety of goods (transistors, etc.) to purchase. These trade items are either re-sold at a much higher price in Mauritania or used as an item of barter when purchasing livestock here:
4. The lack of an organized internal marketing system forces the seller to seek foreign outlets.

Traditionally livestock, normally cattle, are bought in the bush from the herd owners by a cattle trader or middleman (djoula). These buyers may be operating on their own or acting as agents for others. At one time, many of the djoulas took cattle on assignment, paying the owner after the animal was sold. This is no longer the case, and the owner demands to be paid in cash when the trader receives the animal. It is common for the trader to carry with him goods (cloth, transistors, soap, tea, batteries, etc.). These he either sells at high price in the bush or uses in bargaining with the owners.

The trader goes from village to village ~~or~~ to various encampments until he has acquired a number of animals. The size of the accumulated herd depends on the purpose for which it is to be used. If the trader is not making a long trek, but merely collecting for a local market, he collects only the number of animals he feels can be sold on that market. It is not uncommon for those acting as agents to take the animals to a collection point where they are gathered for the long trek to Senegal and Mali. In Mauritania, there are also several towns, including Abdel Begrou and Koboni, that have weekly markets except during the height of the dry season. Animals may also be purchased at these markets for trekking to Mali. During treks, animals may be sold to butchers along the way. The bush trader may buy

breeding animals as well as slaughter animals for selling to stockmen interested in increasing their herds. However, if the animals are to be treked to a foreign market, only slaughter animals are purchased.

A second middleman (teffanke) operates in the local markets. He may act as a go-between for the djoula and the butcher or he may purchase the animal himself for later resale to the butcher. The teffanke may supply animals to the butcher on credit, or two or more butchers may buy a single animal. Generally, the local trade is controlled by a small number of these cattle brokers.

It should be pointed out that this traditional system of marketing does not apply to the herders who normally make the animal migration to Senegal and Mali. They already have access to foreign markets and, therefore, sell directly to the foreign market, thereby, by-passing the djoula.

Since the drought of 1968-74, while the traditional marketing system is still in effect, certain noteworthy changes have taken place.⁽¹⁾ The influx of herders from the north, many of whom were sedentary, into grazing areas in the south has increased the grazing pressures. As a result, sedentary herders already in the south have been forced either to sell off a portion of their herds or to seek grass and water

(1) RAMS study; Evolution of Modes of Accumulation, Income and Wealth and Social Transformation, 1980.

farther south themselves. Those owners already employing herders simply sent their animals directly to the foreign markets and, again, the djoula was by-passed. It was not possible to fully evaluate to what extent these changes have occurred. There is a reluctance on the part of cattle owners to discuss their operations, or even disclose the numbers of animals they own. It is, however, apparent to the casual observer that a large percentage of the Mauritanian livestock production, especially cattle, are not slaughtered in Mauritania. It is recommended that such a study be initiated since other animal producing countries are competing for the same markets, and a market flow analysis will be necessary in order to formulate long-range policies. However, it is strongly felt that given time and budgetary constraints, other studies such as grasslands inventory, should receive priority. Since many of the studies, such as the aforementioned grassland survey, are of necessity long-term undertakings, it will also be necessary to attempt to formulate some type of time flow estimates. Fortunately, there are several animal marketing studies either recently completed or in progress, especially in Mali, that can be drawn upon to evaluate the market potential of such markets as Abidjan.

Producer Prices

Table V - 1 shows trends in producer prices for the various species of livestock from 1970-79 as reported by the GIRM's Statistical Office. Preliminary field observations by RAMS team members indicate that these prices are currently above average prices paid in Mauritania when all classes of livestock are considered. It is possible that these prices are for mature high quality animals sold in urban markets by traders rather than prices received by

herders. The price range indicates seasonal variations. Table V - 1 does show, however, a very rapid rise in prices for all classes of livestock, a two or three-fold increase since 1974. 1979 producer prices as developed in the RAMS Sample Survey of Agricultural Production are shown in Table V - 2. These data show a wider range of prices than do the estimates of the Statistical Office. In addition, price variations between different types, ages, and weights of animals are shown. It should be remembered, however, that the survey was limited to sedentary livestock raisers and farmers. Prices received by nomadic herders are not included.

Table V-1

Producer Prices for Live Animals 1970 - 1979
(expressed in UM)

Species

<u>Year</u>	<u>Cattle</u>	<u>Sheep</u>	<u>Goats</u>	<u>Camels</u>
1970	2 836	340 - 650	650	5 500
1971	3 000	480 - 720	540	5 520
1972	5 400	400 - 700	600	10 000
1973 ¹⁾	1 500 - 2 500	500 - 1 600	300 - 1 000	5 000 - 7 000
1974	3 400 - 9 500	1 000 - 2 500	560 - 1 800	5 500 - 15 000
1975	4 000 - 10 000	1 500 - 3 000	600 - 1 900	6 000 - 16 000
1976	6 000 - 14 400	1 500 - 3 500	650 - 1 950	12 000 - 20 000
1977	10 000 - 15 000	1 600 - 3 600	1 000 - 2 000	15 000 - 25 000
1978	11 000 - 16 000	1 700 - 4 000	1 000 - 2 100	15 000 - 26 000
1979	11 000 - 16 000	1 700 - 4 000	1 100 - 2 400	16 000 - 26 000

1) Large scale movements to markets occurred in 1973 because of lack of pasturage.

Source: Directorate of Statistics

Prices Paid to Farmers for
Livestock, 1979
(UM/Head)

	<u>Low</u>	<u>High</u>	<u>Estimated Average</u>
<u>Cattle</u>			
Bulls	4 000	16 000	10 000
Cows	4 000	20 000	9 000
Young Bulls	3 500	12 000	7 000
Heifers	3 000	6 000	5 000
Calves	1 500	5 000	3 000
<u>Sheep</u>			
Rams	1 600	3 000	2 200
Wethers	700	2 200	1 500
Ewes	800	5 300	1 800
Heavy Lambs	700	1 800	1 200
Baby Lambs	400	1 000	600
<u>Goats</u>			
Adults	600	2 500	1 300
Yearlings	600	1 500	1 200
Kids	300	1 200	400
<u>Camels</u>			
Adults	7 000	27 000	20 000
Young	5 000	18 000	10 000

Source: RAMS Production Survey, 1980.

SONICOB (Societe Nationale pour l'Industrialisation et la
Commercialisation du Betail

An attempt to nationalize livestock marketing was initiated with the construction of a slaughterhouse at Kaedi, located some 400 kilometers southeast of Nouakchott, which was opened on March 19, 1969. It was originally under the control of the Compagnie de Commercialisation des Viandes de Mauritanie (CO VI MA) and was capitalized at 20 million CFA. It has a refrigeration capacity of 3 000 metric tons of beef per year. The rationale was that fresh beef could be supplied to other towns within Mauritania and to foreign markets primarily the Canary Islands. Unfortunately, neither objective has been realized. Internal transportation problems and local butcher resistance were such that the goal of supplying internal markets (Nouakchott, Nouadhibou, etc.) could not be attained. Trade with other countries never materialized because the animal disease problems within Mauritania are such that fresh meat produced here could not meet the import standards of the countries in which it was hoped a market could be found.

Later, two other factors caused still further problems for CO VI MA. The first was the political decision in 1972 to change the national currency from the CFA to the Ouguiya. This effectively curtailed trade on the world market. The second unforeseen factor was the drought of 1968-1974. These severely affected the supply of animals available to the slaughterhouse. By mid-1975, CO VI MA found itself in serious financial trouble.

On the 12th of August, 1975, CO VI MA was replaced by the Societe Nationale pour l'Industrialisation et la Commercialisation du Betail (SONICOB). In addition to operating

the slaughterhouse at Kaedi, it was also given authority to market live animals both in Mauritania and outside the country.

Apparently, the only attempt to market live animals abroad was in 1976 when a number of rams were collected (mostly in Guidimakha), taken to Kidira in Senegal and shipped by rail to Dakar, in time for Tabaski, a Moslem holiday. At that time the Senegalese government was involved in making a special effort to provide Dakar with rams for Tabaski.

At present, the slaughter facilities are being operated at far below capacity. The facility is processing some 525 metric tons of meat per year, strictly for the Kaedi trade. Considering the number of employees and maintenance and up-keep expenditures, the facility must be suffering severe losses. But of far more serious consequence is that, even if sufficient animals and a ready market should become available, the plant would require extensive and costly renovation before it could be brought back into full production. The machinery and mechanical equipment are antiquated and devoid of minimal safety devices. In fact, when the plant was visited in late April, no safety precautions of any kind were being practiced.

It is felt that the Kaedi facilities will never operate on a paying basis. Information on present operating losses could not be obtained, but considering the number of people employed and the number of animals being processed, it seems implausible that it could be a viable operation.

A preliminary price monitoring system at the Nouakchott abattoir was initiated in early December 1980. The abattoir

was visited on a weekly basis. Table V - 3 through V - 6 show the results of the survey. While only 10 weeks data have thus far been collected, the daily live price spreads paid for the various types of animals within a class clearly indicate the butchers concern with carcass yield. It is recommended that the central statistical service in the Ministry of Rural Development establish a price monitoring service at selected markets throughout Mauritania. Included in the sites selected should be the markets at Abdel Begrou and Koboni where animals are sold for export to Mali. Table V - 7 has been included to indicate the numbers of animals slaughtered in Nouakchott through official channels.

Table V-3

Nouakchott AbattoirCattle

Year	Day	Number	Live Price			Carcass Price		
			Big	Medium	Small	Big	Medium	Small
1980	09 December	45	20 000	13 000	10 000	23 000	15 000	13 000
					11 000	25 000	17 000	15 000
	16 December	53	22 000	17 000	12 000	26 500	20 000	17 500
	23 December	50	22 000	20 000	15 000	26 000	24 000	20 000
	30 December	51	17 000	13 000	7 000	20 000	15 000	9 000
			20 000	15 000	8 000	25 000	18 000	12 000
1981	06 January	52	18 500	15 500	8 000	20 000	18 000	12 000
			20 000	18 000	14 000	25 000	20 000	16 000
	13 January	60	18 500	15 500	10 000	22 500	18 000	14 000
			20 000	18 000	15 000	25 000	22 000	18 000
	22 January	68	16 000	12 000	9 000	18 000	15 000	10 000
			20 000	15 000	11 000	20 000	17 000	14 000
	27 January	61	23 000	15 000	13 500	24 000	21 600	16 200
26 000					27 600			
03 February	53	16 600	13 500	9 700	30 000	25 500	18 500	
10 February	65	14 000	12 000	10 000	18 000	16 200	14 400	
		558						

Source: RAMS, 1981.

Table V-4

Nouakchott AbattoirSheep

Year	Day	Number	Live Price			Carcass Price		
			Big	Medium	Small	Big	Medium	Small
1980	09 December	50	4 000	3 000	2 000	6 500	3 500	2 700
			5 000	3 500	2 500		5 000	3 500
	16 December	63	4 500	4 000	3 000	6 500	5 000	3 500
	23 December	34	3 000	2 500	1 500	3 500	2 500	2 000
30 December	38	3 000	2 500	1 500	3 500	3 000	2 000	
		3 500		2 000				4 500
1981	06 January	42	2 000	1 500	1 000	2 500	2 000	1 200
			3 500	2 000	1 500		4 000	2 500
	13 January	35	3 200	2 500	1 500	3 500	3 000	2 000
			3 500	3 000	2 000		4 000	3 500
	22 January	40	2 000	1 500	1 000	2 600	2 200	1 200
			2 500	1 800	1 300		3 000	2 400
	27 January	50	4 000	3 500	2 800	4 800	3 900	3 600
03 February	45	4 500	3 500	1 600	5 000	4 200	3 000	
10 February	40	3 500	3 000	2 500	5 100	3 750	3 000	
		437						

Source: RAMS, 1981

Table V-5
Nouakchott Abattoir
Goats

Year	Day	Number	Live Price			Carcase Price		
			Big	Medium	Small	Big	Medium	Small
1980	09 December	40	4 000	3 000	2 000	4 500	3 500	2 500
			4 500	3 500	2 500	5 500	4 500	3 250
	16 December	20	4 500	4 200	3 000	5 000	4 000	3 500
	23 December	14	2 500	2 000	1 200	3 500	3 000	2 000
1980	30 December	15	3 500	2 000	1 200	4 000	2 500	1 500
				2 500	2 000		3 000	2 500
1981	06 January	16	2 000	1 500	1 000	2 500	2 000	1 200
			3 500	2 000	1 500	4 000	2 500	1 800
	13 January	15	3 200	2 500	1 500	3 500	3 000	2 000
			3 500	3 000	2 000	4 000	3 500	2 500
	22 January	23	2 000	1 500	1 000	2 600	2 200	1 200
			2 500	1 800	1 300	3 000	2 400	1 700
	27 January	31	2 500	2 200	1 800	3 500	3 240	2 700
	03 February	22	3 000	2 400	1 800	4 000	3 500	3 000
10 February	34	3 300	2 500	2 000	4 500	3 600	2 700	
		230						

Source: RAMS, 1981

Table V-6

Nouakchott Abattoir

Camels

Year	Day	Number	Live Price			Carcass Price		
			Big	Medium	Small	Big	Medium	Small
1980	09 December	07	30 000	20 000 25 000	10 000 15 000	32 000	26 000 30 000	15 000 18 000
	16 December	10	30 000	20 000	15 000	35 000	26 000	18 000
	23 December	11	20 000	18 000	15 000	26 000	24 000	20 000
	30 December	09	25 000 28 000	23 000	15 000 18 000	20 000 25 000	15 000 18 000	9 000 12 000
1981	06 January	10	18 500 25 000	15 000 18 000	9 000 14 000	25 000 28 000	18 000 24 000	14 000 18 000
	13 January	09	20 000 22 000	18 000 19 500	12 000 16 000	22 000 24 000	20 000 22 000	14 000 18 000
	22 January	08	16 000 18 000	12 000 14 000	8 000 11 000	22 000 25 000	18 000 21 000	9 000 16 000
	27 January	11	22 000	18 000	15 000	25 300	21 450	17 600
	03 February	12	26 400	22 500	12 600	29 000	24 000	16 000
	10 February	14	17 000	15 000	12 000	22 000	18 700	14 300
			101					

Source: RAMS, 1981

Number of Animals Slaughtered
at the Nouakchott Abattoir - 1980

Month	Cattle	Sheep	Goat	Camel	Total
January	1 286	457	493	171	2 407
Fébruary	1 226	489	480	212	2 407
March	1 252	376	383	308	2 319
April	1 184	286	298	326	2 094
May	1 128	216	207	418	1 969
June	604	199	236	599	1 638
July	486	253	145	894	1 778
August	540	385	393	983	2 301
September	1 140	369	577	527	3 113
October	1 219	990	597	242	3 048
November	1 558	1 186	624	293	3 661
December	1 650	1 532	387	244	3 813
Total	13 273	7 238	4 820	5 217	30 548
Average	1 106	603	402	434	2 545

Source: Inspection d'Elevage

Urban Markets

The traditional markets in Nouakchott and other urban centers are still supplied by traditional methods with the animals being trailed to market. Seasonal price fluctuations of live animals are extreme since the supply is highly dependent on the availability of animals in the vicinity of the market. Because mutton is preferred throughout most of Mauritania, sheep prices per head show the greatest spread.

While no reliable national figures are available on the number of animals slaughtered under either controlled or uncontrolled conditions, Mauritania is considered to have the highest per capita meat consumption in French West Africa. The 1977 FAO estimates⁽¹⁾ of per capita meat consumption were:

Mauritania	26.8 kgs
Mali	13.8 kgs
Senegal	14.0 kgs

No breakdown between livestock species was given, but observations indicate that a rather high percentage of the meat consumed is sheep and goat. Visits to a number of slaughter labs were made, and the general observations indicate that only a very small percentage of the small ruminants are slaughtered under controlled conditions. Discussions with householders and livestock personnel indicate that, while cattle are normally slaughtered at the local slaughter labs, most of the small ruminants are slaughtered outside of official channels and autoconsumed.

(1) FAO Annual Production and Commerce Report - 1977.

Mauritania had adopted retail price controls on a number of consummable items, one of which is meat. In actual practice two prices are set for meat, one for the traditional meat markets and the other for the modern meat shops and supermarkets as shown in the following tabulation (UM/kg).

	<u>Beef</u>	(per kg) <u>Mutton</u>	<u>Camel</u>
Modern Butchers and Supermarkets	140-300	160	-
Local Markets	90	110	75

No allowance is made for seasonal fluctuations in live animal prices.

In the case of beef, the price of a 250-300 kg. animal (125-150 kg. carcass weight) can cost a butcher as much as 9-10 000 UM¹⁾ or 60-80 UM/kg, scarcely enough margin for any profit.

Consequently, the butcher mixes 5th quarter (offal) meat with the red meat when he serves a customer. In all probability, a customer desiring all carcass meat may get it but at an additional cost.

The supermarkets and modern butcheries cater to the expatriate and more affluent local trade. The controlled prices are much higher and vary with the cost of the meat. Meat in these markets is primarily from local sources. However, they do handle the bulk of the imported meat consisting

1) \$1.00 = 45 UM

largely of pork and specialty products (i.e. prepared meats, sausages, etc.).

As previously stated, the value of the milk produce is nearly equal to the value of meat production. Some observers feel that meat may be the by-product of milk production. The bulk of the milk produced is autoconsumed although in some areas it may be bartered for cereals during certain seasons of the year. Chapter 10 evaluates the contribution of milk production to GDP.

Transportation

One of the more recent developments in livestock marketing is the trucking of animals to the Nouakchott market. Traditionally, animals were hauled only when other back haul loads were not available, with sheep and goats being preferred to cattle. Since the construction of the hard surface road between Nouakchott and Kiffa, animals are now arriving in Nouakchott from Aleg and Kiffa. It is assumed that as the road is extended, animals will be transported from points beyond Kiffa. A survey is now being conducted to determine the extent of this trade and to collect cost data for an economic survey of transportation costs. As the road systems in Mauritania are expanded and improved, an increasing number of animals will be moved by truck..

VI Training

Since the establishment of the National Agricultural Training and Extension School in Kaedi, Mauritania has been able to provide all necessary training of the field staff for the Livestock Directorate. Graduates are posted as veterinary assistants or veterinary nurses at either Regional Inspection Centers, Sector Headquarters or Veterinary Posts.

There are significant differences in outlook between those staff which have received training at Kaedi and those which had received out-of-country education before the founding of the training institute. The foreign-trained graduates are more veterinary-oriented and are more skilled in the arts of clinical diagnosis and individual animal treatment. The service which they provide is sought and appreciated by herders. However, the economic benefit resulting from individual treatment is small since sick animals have already sustained a period of reduced production efficiency, and a very limited number of animals can be handled on an individual basis. These veterinary assistants are aware of the widespread nutritional differences and lack of adequate drinking water, but have little or no idea of what actions to take to correct these problems.

The Kaedi graduates have a broader base of theoretical knowledge. They are more aware of the inter-relationships between malnutrition, dehydration, poor management and diseases. They are also better informed about production losses due to non-fatal diseases, such as gastro-intestinal parasitism. They are knowledgeable about, and interested in, certain programs such as supplemental feeding, grazing reserves and strategic anthelmintic treatments which could be used to improve livestock production.

In spite of their broader knowledge, the new Kaedi graduates are unable to assist producers other than by providing small-scale demonstrations and by giving advice. This type of assistance will have little practical impact since the producers are reluctant to experiment with new methods which they do not fully understand. Moreover, assistance is being proposed by an extension agent who has nothing to lose should the new procedures fail. Even the simplest changes will have to be developed through institutionalized programs that apply to all of the producers within a region. A demand will only be created when the producers see that benefits will accrue.

When this stage is reached the broader knowledge of the Kaedi graduates will be useful in guiding livestock production. Until that time, however, the Kaedi graduates will not make a greater impact on livestock production than the foreign-trained veterinary assistants. Kaedi graduates have not been trained to a level that would allow them to design and implement new programs on their own, and they do not have the managerial skill to introduce new programs on a regional basis. They would be unable to judge which interventions, if any, would be technically, economically and sociologically feasible within the framework of Mauritania's current livestock production systems.

In order to fully utilize the potential of Mauritania's field staff, several Mauritanian veterinarians from the livestock service should be given the opportunity to continue their studies abroad to the Master of Science level. Such advanced training would give Mauritania the technical capacity to develop and implement the types of programs which would have an impact in the field.

In the medium to long-term, Mauritania should make an effort to recruit candidates with a background of field experience in livestock

for training at the undergraduate level. Future veterinarians should be trained at the Institute of Veterinary Medicine, University of Dakar, rather than at overseas universities. Currently, one Mauritanian student is studying at this institution. Ideally, a total of eight trained veterinarians would allow the posting of one at each of the southern administration regional inspection centers with an additional veterinarian posted in the north. Other suitable candidates should be sent for undergraduate training in livestock production. These persons could also be placed in the field, thus giving a balance between animal health and animal production in Mauritania's future extension program. This staffing pattern would conform to the re-organized field service described in Chapter IV.

Table VI-1

Undergraduate-Level Training

	<u>Non-Research Veterinarians</u>	<u>Rangeland Livestock Production Specialists</u>
Current Personnel	4	0
Total Requirements	12	8
Deficit	8 ¹	8

1) One student is currently undergoing training. If he is successful, this number can be reduced to seven.

Students who are selected for training, whether they receive scholarships from abroad or from Mauritania, should receive full GIRM support in the form of a guaranteed position upon graduation. In turn, the student should be legally obliged to join the GIRM service for a specified number of years after graduation. There should be explicit understanding that the posting, at least during initial period of governmental service, would not be in Nouakchott. If necessary, incentive pay should be awarded for service in outlying posts.

Mauritania also needs to secure training to the M. Sc. level for several researchers at the National Center for Animal Husbandry and Veterinary Research (CNERV). The research capability of this laboratory could be extended to provide answers to practical field problems. One researcher should be trained in field epidemiology and another in rangeland disciplines. These disciplines should be studied at overseas universities located in semi-arid regions.

Total Training Requirements

	<u>Animal Health</u>	<u>Animal Production</u>	<u>Research</u>	<u>Total</u>
Undergraduate	8	8	-	16
graduate	1	1	2	<u>4</u>
				20

VII. Government Organization

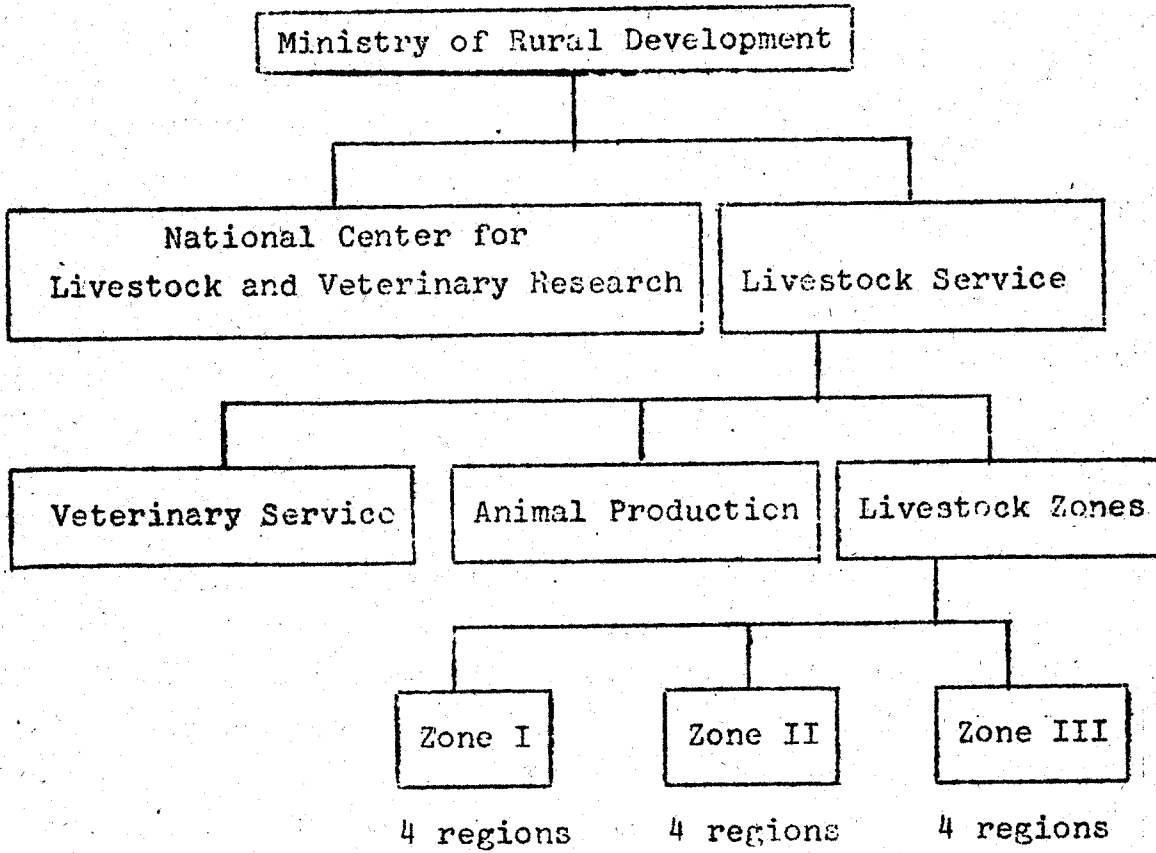
A. Livestock and Veterinary Service

All livestock production and veterinary services are the responsibility of the Ministry of Rural Development. The Direction d'Elevage (Livestock Directorate) is located within the Ministry as one of 5 operating divisions and is specifically charged with guiding all veterinary and veterinary production programs. In Mauritania as in other former French colonies, the service is highly veterinary oriented, especially in the field operations where the bulk of the effort is given to animal health programs. Livestock data are also compiled for transmission to the national headquarters, but little or no attention is paid to improved production practices.

The Livestock service is composed of several divisions (Figure VII-1), each with a director. The director of the division of animal health oversees inspection procedures. However, policing powers to enforce inspection regulations are not vested in the service. The director of the division of animal production is responsible for animal husbandry interventions and the monitoring of livestock production, although there are no trained productionists in the field at this time. The zone directors are responsible for programs within their geographic areas, as well as the logistics of the various stations within their area. They work closely with but are not subordinate to the other two directors. Veterinary research and feed-stuffs analysis is the responsibility of the National Center for Animal Husbandry and Veterinary Research (CNERV). This laboratory, while under the Ministry of Rural Development, is not a direct part of the Livestock Service.

Figure VII-1

Organization of the Livestock Service



Source: Livestock Service

There are twelve Inspection headquarters which are responsible for service within administrative regions and for the submission of monthly reports to the Livestock Directorate. Each of these is supported in its activities by up to four Sector Posts. There are a few Veterinary Posts which are administratively below the Sector Posts. All three levels of posts are involved in the implementing programs under the central guidance of the Livestock Directorate. Table VIII - 1 and Map VIII-1 give the locations of the various livestock and Veterinary Posts.

The Director of the Division of Animal Health is a professionally qualified veterinarian. Regional posts of all levels are staffed by paraprofessional personnel. Veterinary assistants are in charge of Inspection headquarters, and veterinary nurses are in charge of Sector and Veterinary Posts. Several lower-level vaccination and treatment assistants are assigned to each post.

The Animal Production Division is presently primarily concerned with the collection of data on animal numbers and other production information. No livestock programs are being conducted. Consequently, there is room for considerable expansion of livestock programs of all kinds. The Director of the Animal Production Division is also highly qualified but lacks the field staff to implement livestock improvement and production programs.

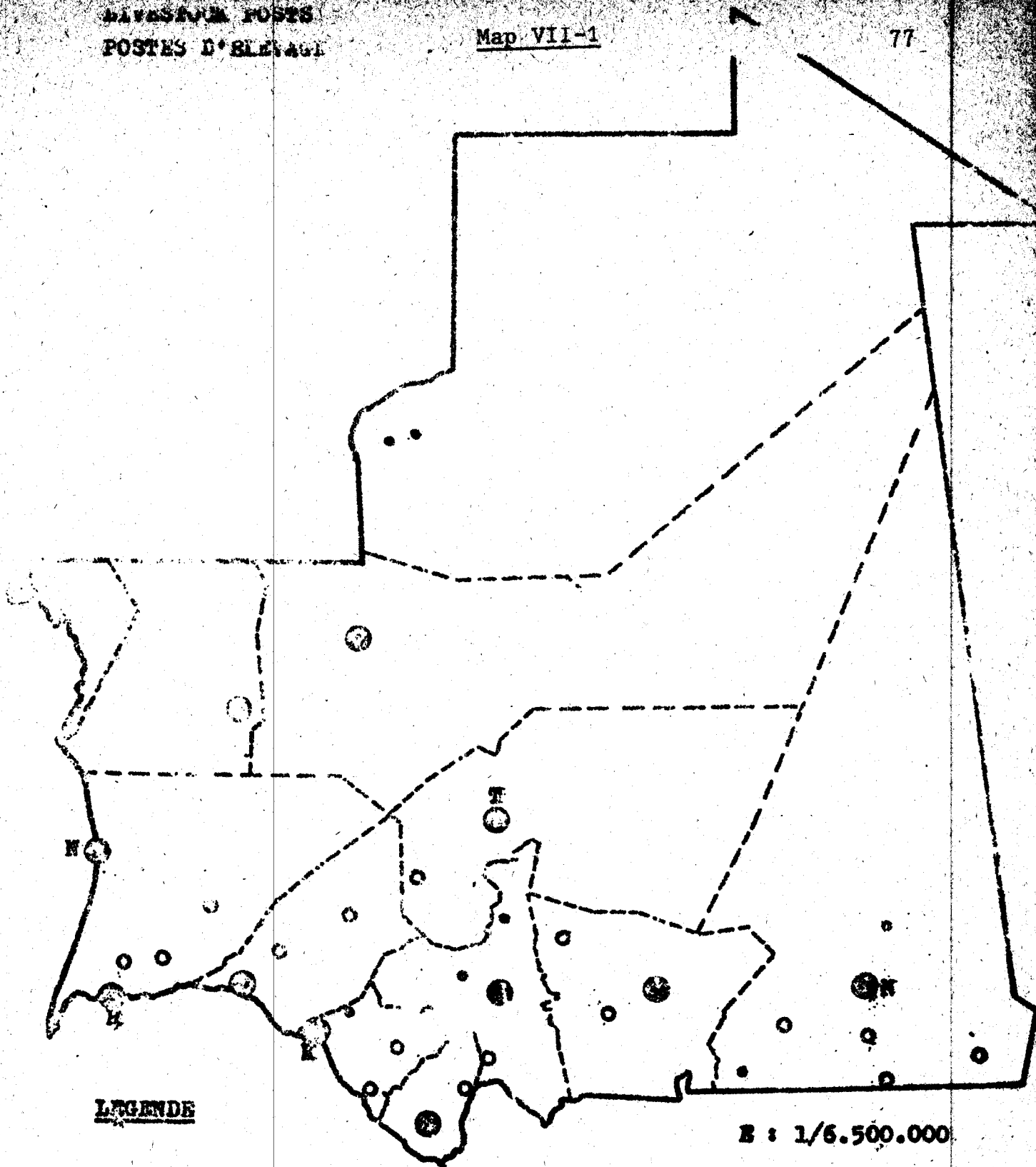
Administrative System

Individual personnel within the Livestock Service would profit from additional technical training. This particularly applies to persons responsible for managing field programs. A much greater program capability could be realized if a professionally trained livestock productionist and veterinarian were posted at each regional inspection post. Details of the overall training needs

Table VII-2
Livestock Posts

Region	Inspector	Headquarters	Sector Posts	Veterinary Posts
I	Hodh Charhbi	Mema	Abdel Begrou, Amourj Bacikrouncu, Timbedra	Oualata Djiguani
II	Hodh Charhbi	ALOU	Tamchakett Tintane	
III	Assaba	Kifra	Kankossa	Bounded Gueroi
IV	Gorgol	Kaedi	Hachama M'Bout	Monguel
V	Brakna	Fogge	ALES Magta-Lahjar	
VI	Traza	Rossc	Boutillimit Nederdra, R.Kiz	
VII	Adrar	Atar		
VIII	Dakhlet	Nouadhibou/Nouachibou		Zouerat-F'Derik
IX	Sagant	Tidji'ja	Moudjeria	
X	Guidimaka	Selibabi	Ould-Yenge	
XII	Inchiri	Akjoujt		
		Nouakchott		

Region XI has no headquarters; it is administered through Region VIII (Dakhlet - Nouadhibou) (Tizi Zemmour) Source. Livestock Service



LEGENDE

E : 1/6.500.000

- Inspection headquarter
Chef-lieu d'inspection
- Sector Post-Secteur d'élevage
- Veterinary Post-Poste vétérinaire
- Administrative boundaries
frontières administratives

Source: Service de l'Élevage - Livestock service Avril 1958

appear in section VII of this report. At present, no co-ordinated livestock production programs are being conducted in the field. What little is being done is done by foreign donors but, here again, the bulk of the effort is directed at supporting the veterinary medicine activities.

At present, chiefs of posts are being re-assigned every two years. This does not allow sufficient time for these personnel to plan or implement meaningful livestock or veterinary programs. Nor does it provide an incentive to do a better job.

One objective of the Livestock Service is the promotion of animal production by enhancing livestock health and reducing mortality. The principal activity which is directed at achieving this is the annual campaign against rinderpest and bovine pleuropneumonia. This is carried out during the first three to four months of the dry season, October through January. Other efforts include diagnosis and treatment of individual cases, the investigation of epidemics, and vaccination, or treatment, on a herd-by-herd basis.

Another objective is to prevent the spread of contagious diseases by migrating herds of cattle. Owners of cattle herds that are to be moved between two administrative regions are supposed to obtain official documents indicating that the animals have been vaccinated against rinderpest and pleuropneumonia within the one-year period preceding the transit date. A similar document is issued in the case of transhuming herds which are destined to cross international boundaries. Veterinary assistants are responsible for verifying documentation on herds entering their region.

B. Veterinary Research

Mauritania's animal health research is the responsibility of the National Center for Animal Husbandry and Veter-

inary Research (CNERV) in Nouakchott. This laboratory, founded in 1972, receives autonomous funding from the GIRM. Past research activities have included studies in diagnostic bacteriology (especially on matitis in goats), diagnostic parasitology and chemical analysis of animal feeds. The laboratory currently has capabilities in serology, hispathology, microbiology, parasitology and feeds analysis.

Although it is relatively well equipped, there are serious problems which prevent it from contributing significantly to solving Mauritania's livestock problems.

For example, there is only one Mauritanian researcher (and four foreign scientists) actively working in the laboratory; there are no eligible training candidates for the foreseeable future. Due to a lack of vehicles, it is not possible to work on field problems except those which occur in the Nouakchott area. In fact, an epidemiologist working at the laboratory is unable to do epidemiological research because of this.

The CNERV could potentially contribute to livestock production by investigating and providing laboratory confirmation of field outbreaks of disease. This has been done in the past but, unfortunately, is no longer possible because of the lack of transport into the field.

A large expenditure would be required in order to make the laboratory responsive to Mauritania's animal health research needs. If training and field support are funded, the following policies would promote a greater practical return for investment in research:

- 1) Greater emphasis should be placed on field research, such as applied epidemiology of common infections and parasitic diseases.

- 2) Field trials should be undertaken for control procedures for external parasites.
- 3) Research priorities should be established: anthrax, blackleg, respiratory diseases of small ruminants, botulism. These would be suitable priorities at the outset.
- 4) Research should be goal-oriented and should focus on questions of economic importance. For example: Is botulism vaccine worthwhile when used in response to an outbreak? Should animals be treated for internal parasites in January as the plane of nutrition is declining, or in May after the low plane of nutrition has affected animal body condition?

VIII. Livestock and Environment

The issue of environmental degradation is a matter which is of the utmost concern, and it is important enough to merit further in-depth study. Such study must, of necessity, be of a long-term nature. (The RAMS study was conducted at the height of the dry season, following a rainy season of below normal rainfall, and is far from conclusive.) There are several questions which must ultimately be considered:

1. Has true degradation actually occurred, or is it merely a cyclic short-term change which has had a negative impact on the productive capacity of the natural vegetative cover of the pastoral areas?

From field observations made during this study, the conclusion could be reached that the traditional grazing areas have, in fact, deteriorated. Even utilizing the definition of range degradation as a clear reduction in the capacity of the range to produce vegetative species which are palatable to livestock, many areas in Mauritania would fall into this classification at the present time. The most classic example of this are those areas suffering from dune encroachment. Only when one considers that in other areas many of the more nutritious species have now disappeared and have been replaced by less nutritious species does the question of cyclic change enter. It is impossible to determine at any single point in time whether or not the deterioration is irreversible. To do this would require a study covering a span of several years. Such a study could and should be incorporated with a study to more fully evaluate the carrying capacity of the traditional pastoral areas.

2. How extensive are the areas in Mauritania which have indeed become totally degraded, and unable to produce vegetative species palatable to livestock?

Again, single dry season field observations can not begin to produce any estimates as to the area now suffering total degradation. The possibility of using remote sensing to provide these estimates should be investigated. If it is possible to obtain such estimates the further possibility of incorporating this phase into studies already under consideration for other purposes should also be considered. It would make far more sense to widen the scope of a project now in planning stage than to initiate a new project for this specified purpose alone.

3. What are the causes of degradation?

Because degradation is discontinuous and localized, livestock have for many years been cited as the cause. While it is true that one of the areas of concentration is around watering points, especially deep bore holes, where excessively large numbers of animals congregate, it is equally true that degradation occurs at the interface between pastoral and agricultural zones where the cultivation of rainfed cereals intrude into the lower rainfall regions. While animals can and should be blamed for the former, the cultivators themselves are totally responsible in the second case. The cultivation of marginal areas is a high risk venture. In years above normal rainfall the crops produced are to the cultivator's way of thinking worth the risk. During the periods of crop failures, the cultivators simply move out, and the damage they do is blamed on livestock since it is traditionally pastoral land. The third area of discontinuous degradation and one that is probably more important in Mauritania than any other

Sahelian country and, therefore, commonly neglected in discussions on desertification is that caused by the fluctuations of the isohyets or, in other words, climatic by nature. One of the factors that is also frequently overlooked is that in pastoral zones over-grazing generally seems to victimize the animals more than the environment. In general, vegetative cover possesses a certain amount of resiliency, the ability to re-seed its annual grasses once the stocking pressure is reduced. How long a time span is required and to what extent this rejuvenation will take place is dependent on a number of factors (i.e. climate, seriousness of degradation, how much the stocking rate is reduced etc.). It is strongly felt that the bulk of the actual degradation found in Mauritania can, in fact, be attributed to climate.

But the most important point is that Mauritania should have an agrostological and ecological inventory and analysis to provide guidance for future planning. At this point, it is not necessary that these be detailed and in-depth studies. But because of the discontinuous nature of the problem, the majority of the pastoral areas should be included. We believe that it would be wise to initiate a series of range-recovery programs without first establishing the extent to which, area by area, degradation has occurred.

IX Donors

At present, the most active agencies in livestock programs in Mauritania are the United States Agency for International Development (USAID), the European Economic Community (Fonds Européan de Développement), the International Bank for Reconstruction and Development (IBRD), the Food and Agricultural Organization of the United Nations (FAO), the French Agency Fonds d'Aide et de Coopération (FAC), and the Netherlands Aid Program (ITC).

The IBRD project and the FED 4th Fund project are perhaps the most viable. The projects were designed to complement each other, and both contained three elements in common.

1. Building of firebreaks
2. Support of the livestock service in the form of animal health equipment and supplies
3. Water supply in the form of new wells and refurbishing wells currently in existence.

It was mutually agreed that the IBRD 4th (Gorgol), 5th (Brakna) and 6th (Trarza) project would cover the 4th, 5th and 6th regions of Mauritania, whereas the FED project would be restricted to the southeast (1st, Hodh Charkhi), (2nd, Hodh Gharbi), and (3rd, Assaba regions). The IBRD project has now been completed and the FED project, a longer term activity, is nearing completion. Both projects were beset by difficulties from the start: both projects started late, went through major changes and had to be extended. Neither project was able to fully accomplish the scope of work as outlined in the initial agreements. This was, in part, due to the effects of the drought but primarily the result of inflation and the com-

plexity of local procedural requirements.

The FED is now in the process of developing a new project which is more directly targeted at herder assistance, the first step of which will be a survey to more accurately determine herder wants and needs. This is still in the discussion stage.

The Netherlands project is currently in the implementation stage. The major portion is to be pasture research and development in the vicinity of Kankossa.

At present, FAC contributions are in the form of assistance to the Central Veterinary Pharmacy and are largely logistic in nature.

The FAO in 1977 sponsored joint emergency efforts with USAID. The funds were used for vaccines, animal feed and equipment to haul water from the Senegal River as a one-time emergency relief effort.

The African Development Bank (ADB) and FAO have both sponsored studies of animal fattening schemes, the ADB for a fattening farm near Kaedi and the FAO for a fattening farm near Rosso. As far as can be determined both studies were negative; consequently, no proposal was developed. FAC and OMVS attempted a fattening unit near Kaedi, but this unit has now been discontinued as being uneconomical.

The USAID Rural Development Project near Selibaby in region 10 (Guidimakha) has a large livestock component. Veterinary interventions and pasture trials make up the major portion of the project. Animal extension services are also to be provided. As this project is in the early stages of implementation, no results have been achieved to date. USAID has at present another livestock project under consideration. The exact type of pro-

ject that is to be proposed has not been determined.

In summation, the livestock projects sponsored by the various donors have met with varying degrees of success. Project maintenance cost have been high, and efficient operation was made difficult by the numerous governmental administrative channels involved. Counterpart funds were often inadequate due to the budgetary constraints of GIRM. In the past it has also been incumbent on the individual donors to identify location and project objectives and provide a description of the project.

X. Forecast of Herd Production

Forecasts of herd size fluctuations to the year 2000 have been made based on calibrations of the 1967-1979 rainfall model. Three scenarios were calculated using twenty-one iterations. These were based on logarithmic, linear, and exponential functions. The base years utilized in making these forecast projections were 1975-1979.

The underlying reason for these forecast scenarios is not to attempt to predict the future but to provide a basis for forward planning. Judicious utilization of these calculations will provide planners working in the livestock field a tool to utilize in decision-making. The scenarios presented here are merely guidelines and should be used as such.

As the various scenarios in Tables 10-1 through 12 are reviewed, it becomes apparent that as the population increases there will be insufficient meat produced to adequately feed that population at present consumption rates and patterns, even if exports totally ceased. In all likelihood there will be:

1. A reduction in red meat consumption. (Mauritania consumes more red meat on a per capita basis than any other Sahelian country.) and
2. A shift in meat consumption patterns utilizing greater quantities of poultry and fish.

The forecast scenarios should be reviewed and updated if future planning is to have validity.

Unite Betail Tropicale (UBT) projections were also calculated for each of the three scenarios. These are given in Tables 10-16, 17, and 18. These merely indicate the carrying capacity of the grasslands in Mauritania, assuming that the area available for grazing remains constant. It must be remembered, however, that when additional hectareage comes under cultivation the result is a lowering of the overall carrying capacity in excess of the total of the area made unavailable for grazing. As stated in Chapter II, the estimated carrying capacities range from four hectares to seventy hectares per UBT, with an estimated 14-16 hectares as a national average under conditions of moderate rainfall. It is always the better or more productive areas that come under cultivation. Consequently, as the more productive areas are removed from the area available for grazing the estimated national average is increased with a resultant lowering of the per hectare capacities farther than the per hectare capacities of the areas coming under cultivation.

Poultry, unlike the other species of animals being considered, are not affected by rainfall. Consequently, it was necessary to adopt another factor in making the forecast projections to the year 2000. It was ultimately decided that a linear progression was best suited for this purpose. This method seemed more logically to explain the increase in the national flock, even though it shows the flock increasing every year. The flock showed a yearly increase from 1967 to 1979, and there is no reason to believe that this trend will not continue. As in the case of the other species, the base years used in making the forecast projections were 1975-1979. A factor of two and one-half percent was utilized as the constant for the mid-line of average projections. This constant representing human population growth seemed more accurately to fit the base-line pattern (1967-1979). In

order to calculate the other two scenarios, a constant above and below the mid-line was utilized. Again, these were arbitrarily chosen at 3% and 2%.

As in the case of the 1967-1979 calculations, it was assumed that the entire national flock was replaced on an annual basis. A factor of .79 was applied to obtain the metric tonnage of poultry meat produced. This is the same conversion factor utilized by the FAO for the last three years of the 28 June 1980 computer print-out.

Metric tons of eggs for consumption is calculated by number of eggs produced less losses and eggs for hatching. The figure is then converted to metric tons by using a conversion factor of 35 grams per egg.

It will be noted that this type of a projection maintains a status quo between increased human population and national flock size. If the consumption of poultry meat per person is going to be increased by the year 2000, it will require either an increased national flock size or a shift from the small native village flock bird to a heavier faster growing bird maintained for meat production.

Table X-1
Mauritania: Forecast of Cattle Production
Scenario A
(in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Herd
1980	192	1453	-2	141	1,060
1981	230	1488	174	140	1,094
1982	256	1524	187	140	1,141
1983	241	1560	79	135	1,085
1984	267	1598	187	135	1,136
1985	256	1636	97	132	1,101
1986	241	1675	57	127	1,032
1987	253	1715	183	127	1,088
1988	277	1757	190	128	1,150
1989	259	1799	92	124	1,118
1990	244	1842	52	120	1,050
1991	280	1886	180	120	1,109
1992	271	1931	118	119	1,109
1993	244	1978	52	115	1,046
1994	232	2025	40	111	975
1995	252	2074	173	111	1,036
1996	224	2124	66	108	994
1997	182	2175	-54	102	837
1998	220	2227	141	102	876
1999	253	2290	152	102	926
2000	270	2336	166	103	990

Table X - 2

Mauritania : Forecast of Cattle Production

Scenario - B
(in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Herd
1980	192	1453	2	141	1,060
1981	230	1488	174	140	1,094
1982	271	1524	182	140	1,136
1983	244	1560	49	134	1,051
1984	232	1598	17	129	942
1985	252	1636	164	126	980
1986	224	1675	42	121	901
1987	182	1715	67	112	722
1988	220	1757	120	111	730
1989	253	1799	125	110	745
1990	270	1842	132	110	767
1991	237	1886	36	106	697
1992	236	1931	32	102	628
1993	244	1978	113	101	640
1994	240	2025	77	99	617
1995	266	2074	108	98	627
1996	292	2124	111	98	640
1997	308	2175	115	97	658
1998	282	2227	56	95	619
1999	281	2280	52	93	578
2000	308	2336	103	92	589

Table X-3

Mauritania: Forecast of Cattle Production

Scenario C
(in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Herd
1980	192	1453	-2	141	1,060
1981	230	1488	174	140	1,094
1982	236	1524	194	142	1,146
1983	244	1560	203	143	1,206
1984	240	1598	118	140	1,184
1985	266	1636	204	142	1,246
1986	292	1675	216	143	1,319
1987	308	1715	234	145	1,408
1988	282	1757	91	143	1,356
1989	281	1799	84	140	1,300
1990	308	1842	234	142	1,392
1991	322	1886	250	144	1,498
1992	310	1931	155	144	1,509
1993	295	1978	115	142	1,482
1994	275	2025	89	139	1,432
1995	254	2074	63	134	1,361
1996	238	2124	67	130	1,298
1997	224	2175	80	127	1,251
1998	216	2227	101	125	1,227
1999	230	2280	225	128	1,324
2000	244	2336	233	132	1,425

Table X-4

Mauritania: Forecast of Sheep Production

Scenario A
(in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Produc- ion	Offtake	End of Year Flock
1980	192	1453	481	736	2,634
1981	230	1488	1,048	770	2,912
1982	256	1524	1,121	807	3,226
1983	241	1560	799	819	3,206
1984	267	1598	1,231	860	3,577
1985	256	1636	939	879	3,637
1986	241	1675	631	875	3,393
1987	253	1715	1,270	917	3,746
1988	277	1757	1,430	967	4,209
1989	259	1799	1,034	986	4,257
1990	244	1842	658	978	3,937
1991	280	1886	1,534	1,032	4,438
1992	271	1951	1,212	1,060	4,590
1993	244	1978	669	1,049	4,211
1994	232	2025	558	1,031	3,738
1995	252	2074	1,420	1,075	4,083
1996	224	2124	862	1,077	3,868
1997	182	2175	39	1,022	2,885
1998	220	2227	1,149	1,049	2,985
1999	253	2280	1,162	1,075	3,073
2000	270	2336	1,156	1,099	3,130

Table X-5

Mauritania: Forecast of Sheep Production
Scenario B
(in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Produc- ion	Offtake	End of Year Flock
1980	192	1453	481	736	2,634
1981	230	1488	1,048	770	2,912
1982	271	1524	1,239	814	3,337
1983	244	1560	715	821	3,232
1984	232	1598	635	820	3,047
1985	252	1636	1,203	860	3,390
1986	224	1675	699	863	3,226
1987	182	1715	235	833	2,629
1988	220	1757	1,087	865	2,851
1989	253	1799	1,154	899	3,106
1990	270	1842	1,217	936	3,387
1991	237	1886	675	933	3,129
1992	236	1931	664	930	2,862
1993	244	1978	1,106	958	3,010
1994	240	2025	862	968	2,904
1995	266	2074	1,137	998	3,064
1996	292	2124	1,216	1,030	3,249
1997	308	2175	1,267	1,064	3,451
1998	282	2227	808	1,064	3,195
1999	281	2280	780	1,063	2,912
2000	308	2336	1,155	1,080	2,979

Table X-6
 Mauritania: Forecast of Sheep Production
 Scenario C
 (in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Flock
1980	192	1453	481	736	2,634
1981	230	1488	1,048	770	2,912
1982	236	1524	930	800	3,042
1983	244	1560	1,133	829	3,346
1984	240	1598	799	840	3,305
1985	266	1636	1,269	883	3,691
1986	292	1675	1,409	933	4,166
1987	308	1715	1,560	991	4,735
1988	282	1757	850	995	4,590
1989	281	1799	805	997	4,399
1990	308	1842	1,672	1,059	5,012
1991	322	1886	1,862	1,130	5,744
1992	310	1931	1,210	1,151	5,803
1993	295	1978	1,000	1,157	5,647
1994	275	2025	831	1,150	5,327
1995	254	2074	660	1,133	4,855
1996	238	2124	612	1,113	4,353
1997	224	2175	601	1,095	3,859
1998	216	2227	608	1,079	3,388
1999	230	2280	1,260	1,110	3,538
2000	244	2336	1,312	1,143	3,707

Table X-7

Forecast of Goat Production

Scenario A
(in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Herd
1980	192	1453	589	727	2,513
1981	230	1488	930	752	2,691
1982	256	1524	979	779	2,891
1983	241	1560	757	789	2,859
1984	267	1598	1,040	818	3,080
1985	256	1636	827	831	3,077
1986	241	1675	758	838	2,996
1987	253	1715	1,077	867	3,206
1988	277	1757	1,163	901	3,468
1989	259	1799	899	914	3,453
1990	244	1842	820	920	3,353
1991	280	1886	1,229	956	3,626
1992	271	1931	986	972	3,641
1993	244	1978	850	977	3,513
1994	232	2025	797	979	3,331
1995	252	2074	1,206	1,010	3,526
1996	224	2124	849	1,014	3,361
1997	182	2175	555	997	2,919
1998	220	2227	1,082	1,019	2,982
1999	253	2280	1,093	1,041	3,035
2000	270	2336	1,094	1,061	3,068

Table X 8
 Mauritania: Forecast of Goat Production
 Scenario B
 (in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year
1980	192	1453	589	727	2,513
1981	230	1488	930	752	2,691
1982	271	1524	1,068	780	2,979
1983	244	1560	784	797	2,966
1984	232	1598	685	801	2,850
1985	252	1636	1,034	829	3,055
1986	224	1675	790	839	3,006
1987	182	1715	509	828	2,687
1988	220	1757	999	853	2,833
1989	253	1799	1,041	879	2,995
1990	270	1842	1,083	907	3,173
1991	237	1886	805	913	3,063
1992	236	1931	731	914	2,880
1993	244	1978	1,034	937	2,977
1994	240	2025	881	948	2,910
1995	266	2074	1,061	970	3,001
1996	292	2124	1,092	994	3,099
1997	308	2175	1,117	1,018	3,198
1998	282	2227	861	1,023	2,036
1999	281	2280	772	1,022	2,786
2000	308	2336	1,013	1,038	2,762

Table X-9
Mauritania: Forecast of Goat Production.

Scenario C
(in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Herd
1980	192	1453	589	727	2,513
1981	230	1488	930	752	2,691
1982	236	1524	931	780	2,842
1983	244	1560	988	802	2,982
1984	240	1598	791	814	2,959
1985	266	1636	1,062	844	3,177
1986	292	1675	1,138	878	3,437
1987	308	1715	1,220	916	3,740
1988	282	1759	893	929	3,705
1989	281	1799	849	938	3,616
1990	308	1842	1,295	978	3,933
1991	322	1886	1,393	1,022	4,305
1992	310	1931	1,108	1,043	4,369
1993	295	1978	1,008	1,057	4,320
1994	275	2025	945	1,065	4,200
1995	254	2074	873	1,069	4,004
1996	238	2124	840	1,070	3,775
1997	224	2175	818	1,070	3,523
1998	216	2227	800	1,069	3,254
1999	230	2280	1,158	1,093	3,318
2000	244	2336	1,179	1,118	3,380

Table X -10
 Mauritania: Forecast of Camel Production
 Scenario A
 (in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Herd
1980	192	1453	11	63	656
1981	230	1488	83	64	675
1982	256	1524	85	64	695
1983	241	1560	51	64	681
1984	267	1598	85	65	702
1985	256	1636	58	65	695
1986	241	1675	62	65	691
1987	253	1715	86	66	710
1988	277	1757	89	66	733
1989	259	1799	51	67	717
1990	244	1842	54	67	714
1991	280	1886	90	67	736
1992	271	1931	64	68	733
1993	244	1978	56	68	722
1994	232	2025	66	68	720
1995	252	2074	90	69	741
1996	224	2124	31	69	703
1997	182	2175	35	69	669
1998	220	2227	85	69	685
1999	253	2280	86	70	701
2000	270	2336	87	70	718

Table X-11
 Mauritania: Forecast of Camel Production
 Scenario B
 (in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Herd
1980	192	1453	11	63	656
1981	230	1488	83	64	675
1982	271	1524	86	64	700
1983	244	1560	34	63	671
1984	232	1598	61	63	669
1985	252	1636	83	64	689
1986	244	1675	29	63	655
1987	182	1715	32	62	625
1988	220	1757	80	63	642
1989	253	1799	81	64	660
1990	270	1842	82	64	678
1991	237	1886	24	63	638
1992	236	1931	66	63	641
1993	244	1978	79	64	656
1994	240	2025	63	64	655
1995	266	2074	82	65	672
1996	292	2124	84	66	690
1997	308	2175	86	67	709
1998	282	2227	40	66	683
1999	281	2280	72	67	688
2000	308	2336	86	67	706

Table X -12
 Mauritania: Forecast of Camel Production
 Scenario C
 (in thousands)

Year	Average Rainfall mm	Human Popula- tion	Gross Product- ion	Offtake	End of Year Herd
1980	192	1453	11	63	656
1981	230	1488	83	64	675
1982	236	1524	83	64	684
1983	244	1560	84	65	704
1984	240	1598	58	65	697
1985	266	1636	87	66	719
1986	292	1675	90	67	741
1987	308	1715	92	68	765
1988	282	1757	34	67	732
1989	281	1799	66	67	731
1990	308	1842	91	68	754
1991	322	1886	93	70	777
1992	310	1931	55	69	763
1993	295	1978	60	69	754
1994	275	2025	58	69	743
1995	254	2074	57	68	732
1996	238	2124	56	68	720
1997	224	2175	55	67	708
1998	216	2227	54	67	695
1999	230	2280	85	69	711
2000	244	2336	87	70	728

Table X - 13

Mauritania: Forecast of Poultry and Egg Production
Scenario A (2.5%)
(in thousands of birds and metric tons)

Year	Human Popula- tion	National Flock (000)	Eggs for Consumpt- ion MT	Meat Produced MT
1980	1453	3075	1950	2429
1981	1488	3152	1983	2490
1982	1524	3231	2048	2553
1983	1560	3311	2099	2616
1984	1598	3394	2152	2681
1985	1636	3479	2206	2748
1986	1675	3566	2261	2817
1987	1715	3655	2317	2887
1988	1757	3747	2376	2960
1989	1799	3840	2435	3034
1990	1842	3936	2495	3109
1991	1886	4035	2558	3188
1992	1931	4136	2622	3267
1993	1978	4239	2688	3349
1994	2025	4345	2755	3433
1995	2074	4454	2824	3519
1996	2124	4565	2894	3606
1997	2175	4679	2667	3696
1998	2227	4796	3041	3789
1999	2280	4916	3117	3884
2000	2336	5039	3195	3981

Table X -14

Mauritania: Forecast of Poultry and Egg Production

Scenario B (2%)

(in thousands of birds and metric tons)

Year	Human Population (000)	National Flock (000)	Eggs For Consumption MT	Meat Produced MT
1980	1453	3060	1940	2417
1981	1488	3121	1979	2466
1982	1524	3184	2019	2515
1983	1560	3247	2059	2565
1984	1598	3312	2100	2616
1985	1636	3378	2142	2669
1986	1675	3446	2185	2722
1987	1715	3515	2229	2777
1988	1757	3585	2279	2832
1989	1799	3657	2319	2889
1990	1842	3730	2365	2947
1991	1886	3805	2412	3006
1992	1931	3881	2461	3066
1993	1978	3958	2509	3127
1994	2025	4038	2560	3190
1995	2074	4118	2611	3253
1996	2124	4201	2663	3319
1997	2175	4285	2717	3385
1998	2227	4370	2771	3452
1999	2280	4450	2821	3516
2000	2336	4547	2883	3592

Table X -15

Mauritania: Forecast of Poultry and Egg Production
Scenario C (3%)

(in thousands of birds and metric tons)

Year Year	Human Population (000)	National Flock (000)	Eggs for Consumption MT	Meat Production MT
1980	1453	3090	1959	2441
1981	1488	3183	2018	2515
1982	1524	3278	2078	2590
1983	1560	3377	2141	2668
1984	1598	3478	2205	2748
1985	1636	3584	2272	2831
1986	1675	3690	2340	2915
1987	1715	3800	2409	3002
1988	1757	3914	2482	3092
1989	1799	4032	2556	3185
1990	1842	4153	2633	3281
1991	1886	4277	2712	3379
1992	1931	4406	2793	3481
1993	1978	4538	2877	3585
1994	2025	4674	2963	3692
1995	2074	4814	3052	3803
1996	2124	4959	3144	3918
1997	2175	5107	3238	4035
1998	2227	5261	3336	4156
1999	2280	5418	3435	4280
2000	2336	5581	3538	4409

Mauritania: UBT Forecast All Species
Scenario A
(in thousands)

Year	Cattle	Sheep	Goats	Camels	Total
1980	795	395	377	656	2,223
1981	820	437	404	675	2,336
1982	856	484	434	695	2,469
1983	814	481	429	681	2,405
1984	852	537	462	702	2,553
1985	826	546	462	695	2,529
1986	774	509	449	691	2,423
1987	816	562	481	710	2,569
1988	862	631	520	733	2,746
1989	838	639	518	717	2,712
1990	788	591	503	714	2,596
1991	832	666	544	736	2,778
1992	832	688	546	733	2,799
1993	784	632	527	722	2,665
1994	731	561	450	720	2,462
1995	777	612	529	741	2,659
1996	746	580	504	703	2,533
1997	628	433	438	669	2,168
1998	657	448	447	685	2,237
1999	694	461	455	701	2,311
2000	742	470	460	718	2,390

Table X-17
Mauritania: UBT Forecast All Species
Scenario B
(in thousands)

Year	Cattle	Sheep	Goats	Camels	Total
1980	795	395	377	656	2,223
1981	820	437	404	675	2,336
1982	852	501	447	700	2,500
1983	788	485	445	671	2,389
1984	706	457	428	669	2,260
1985	735	508	458	689	2,390
1986	676	484	451	655	2,266
1987	542	394	403	625	1,964
1988	548	428	425	642	2,043
1989	559	466	449	660	2,134
1990	575	508	476	678	2,237
1991	523	469	459	638	2,089
1992	471	429	432	641	1,973
1993	480	452	447	656	2,035
1994	463	436	436	655	1,990
1995	470	450	450	672	2,042
1996	480	487	465	690	2,122
1997	494	518	480	709	2,201
1998	464	479	455	683	2,081
1999	434	436	418	688	1,976
2000	442	447	414	706	2,009

Mauritania: UBT Forecast all Species
 Scenario C
 (in thousands)

Year	Cattle	Sheep	Goats	Camels	Total
1980	795	395	377	656	2,223
1981	820	437	404	675	2,336
1982	860	456	426	684	2,426
1983	904	502	447	704	2,557
1984	888	496	444	697	2,525
1985	934	554	477	719	2,684
1986	989	625	516	741	2,871
1987	1,056	710	561	765	3,092
1988	1,017	688	556	732	2,993
1989	975	660	542	731	2,908
1990	1,044	752	599	754	3,149
1991	1,124	862	646	777	3,409
1992	1,132	870	655	763	3,420
1993	1,112	847	648	754	3,361
1994	1,074	799	630	743	3,246
1995	1,021	728	601	732	3,082
1996	974	653	566	720	2,913
1997	938	579	528	708	2,753
1998	920	508	488	695	2,611
1999	993	530	498	711	2,732
2000	1,069	556	507	728	2,860

Annex A RAMS Rainfall Model

The rainfall model developed by RAMS is based on of take ratio, human population, reproducing female ratio in the herd and calculated rainfall. The rainfall calculations are weighted 20% for year before last, 40% for last year and 40% for the current year. The calculations are tested for up or down trends. If it is down, they are then tested to see if the downward movement occurred two years in row. The rainfall average for the current year is then divided by either last year's average or the previous average. This ratio was then applied to the base year herd (1966). The ending year herd is then adjusted by the rainfall factor. This adjustment has the advantage over other models in that herd reductions are shown whereas, with most other models, there is a constant trend upward and this is clearly not always the case. To obtain the gross production, a livebirth ratio of .35 (35%) was applied against the number of reproducing females in the herd (cattle .41 - .55). The reason for the increase in reproducing females was a governmental ban on slaughter of these animals in an attempt to increase herd size after the drought.

Calculated off-take becomes a function of domestic consumption based on available data and live animal exports (.0385 of the net herd). The resulting figure subtracted from gross production then gives the net growth.

Calculations for the other species of livestock are done in the same manner with appropriate changes in the various ratios utilized. Annexes 5, 6, 7 and 8 show the RAMS calculations derived from the FAO computer print-out. As stated in Chapter II, the other Annexes have been included to provide a comparison.

In the RAMS model, sheep and goats have been separated because:

1. Sheep graze animals and goats are browse animals, and
2. The sheep and goat populations have undergone a rather dramatic proportional change between 1967 and 1979, a change which is not often recognized.

Cattle Production - Mauritania
(in thousands)

Annex A - 1

Cattle	1973	1974	1975	1976	1977	1978
Numbers at Beginning of Year	<u>1500</u>	<u>1115</u>	<u>1103</u>	<u>2246</u>	<u>1192</u>	<u>1183</u>
Gross Rate of Annual Increase	4.7%	2.90%	7.86%	8.90%	2.23%	3.29%
Gross Production	71	32	87	93	26	39
Percentage Off-Take	20.96%	4.0%	4.0%	4.0%	3.0%	3.0%
Off-Take Number	314	45	44	46	36	36
Annual Variation (Numbers)	385	13	43	47	-9	3
Numbers at End of Year	<u>1115</u>	<u>1103</u>	<u>1146</u>	<u>1192</u>	<u>1183</u>	<u>1186</u>
Average Numbers for the Year	1307	1109	1124	1169	1188	1185
Percentage of Females	35%	35%	35%	35%	35%	35%
Number of Females	458	388	393	409	416	414
Average Milk Production (Tons)	0.19	0.20	0.21	0.21	0.20	0.20
Total Milk Production (Tons)	87	78	83	86	33	83

Source: Central Bank of Mauritania (BCM)

Sheep and Goat Production - Mauritania
(in thousands)

Annex A-2

Sheep and Goats	1973	1974	1975	1976	1977	1978
Numbers at Beginning of Year	<u>6500</u>	<u>5850</u>	<u>6137</u>	<u>6631</u>	<u>6973</u>	<u>7209</u>
Gross Rate of Annual Increase	10.40%	16.90%	21.06%	21.25%	16.30%	17.20%
Gross Production	676	998	1292	1409	1133	1240
Percentage Off-Take	20.4%	12.0%	13.0%	16.0%	13.0%	13.0%
Off-Take Number	1326	702	798	1061	907,3	937
Annual Variation (Numbers)	-650	287	494,6	348	230	303
Numbers at End of Year	<u>5850</u>	<u>6137</u>	<u>6631</u>	<u>6979</u>	<u>7209</u>	<u>7512</u>
Average Numbers for the Year	5175	5993	6383	6805	7094	7360
Percentage of Females	45%	45%	45%	45%	45%	45%
Number of Females	2775	2697	2873	3062	3192	3313
Average Milk Production (Tons)	0,030	0,035	0,040	0,040	0,035	0,030
Total Milk Production (Tons)	83	94	115	123	112	99

Source: Central Bank of Mauritania (BCM)

Camel Production-Mauritania

Annex A-3

(In thousands)

Camel	1973	1974	1975	1976	1977	1978
Numbers at Beginning of Year	<u>700</u>	<u>670</u>	<u>700</u>	<u>707</u>	<u>714</u>	<u>721</u>
Gross Rate of Annual Increase	3.9%	5.39%	6.69%	6.76%	5.23%	5.48%
Gross Production	27	36	46.8	48	37	39.5
Percentage Off-Take	5.39%	0.91%	5.69%	5.75%	4.23%	4.48%
Off-Take Number	38	6	40	41	30	32
Annual Variation (Numbers)	-30	+30	7	7	7	7
Numbers at End of Year	<u>670</u>	<u>700</u>	<u>707</u>	<u>714</u>	<u>721</u>	<u>728</u>
Average Numbers for the Year	685	685	703	710	718	724
Percentage of Females	25%	25%	25%	25%	25%	25%
Number of Females	171	171	175	178	179	181
Average Milk Production (Tons)	0.23	0.25	0.25	0.25	0.23	0.23
Total Milk Production (Tons)	39	43	44	44	41	42

Source: Central Bank of Mauritania (BCM)

Mauritanian Estimated Animal Populations 1969 - 1979
(in 1,000 Heads)

Year:	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
<u>Animal</u>											
Cattle	2,000	1,900	1,550	1,500	1,115	1,150	1,300	1,400	1,550	1,700	1,900
Sheep and Goats	7,000	6,750	6,500	6,600	6,000	6,300	7,000	7,500	7,500	8,000	8,500
Camels	720	710	705	700	670	680	700	700	700	700	700

Source: Livestock Bureau Estimates

Mauritania : Cattle Production and Off-Take

Year	Average Rainfall mm	Gross Production (.....in thousands.....)	Off-Take	Year End- ing Herd	UBT ^v
1967	340	314	197	2 507	1 880
68	298	-31	190	2 286	1 715
69	313	314	197	2 403	1 802
1970	301	100	193	2 310	1 733
71	265	-61	182	2 067	1 550
72	192	-369	154	1 544	1 158
73	177	-231	140	1 173	880
74	217	168	143	1 198	899
1975	268	173	146	1 225	919
76	274	200	150	1 275	956
77	224	-29	144	1 102	827
78	224	194	146	1 150	863
79	227	200	148	1 202	902

Source: Derived from FAO 06/28/80, computer print-out.

Mauritania : Sheep Production and Off-Take

Year	Average Rainfall mm.	Gross Production (.....in thousands.....)	Off-Take	Year End- ing Herd	URT's
1967	340	1 418	1 055	4 663	699
68	298	685	1 059	4 289	643
69	313	1 403	1 091	4 602	690
1970	301	980	1 106	4 476	671
71	265	548	990	4 034	605
72	192	-286	843	2 905	436
73	177	- 51	705	2 149	322
74	217	723	597	2 275	341
1975	268	763	614	2 424	364
76	274	892	636	2 680	402
77	224	339	637	2 382	357
78	224	886	659	2 609	391
79	227	964	684	2 889	433

Source: Derived from FAO 06/28/80, computer print-out.

Annex A-7

Mauritania : Goat Production and Off-Take

Year	Average Rainfall mm	Gross Production (.....in thousands.....)	Off-Take	Year End- ing Herd	UBT's
1967	340	853	763	2 790	419
68	298	785	778	2 797	420
69	313	877	795	2 879	432
1970	301	907	815	2 971	446
71	265	800	714	2 056	458
72	192	62	644	2 475	371
73	177	140	577	2 038	306
74	217	632	589	2 081	312
1975	268	656	603	2 134	320
76	274	753	620	2 077	340
77	224	659	633	2 993	344
78	224	817	653	2 456	368
79	227	870	675	2 650	398

Source: Derived from FAO 06/28/80, computer print-out.

Annex A-8Mauritania : Camel Production and Off-Take

Year	Average Rainfall mm	Gross Production (.....in thousands.....)	Off-Take	Year End- ing Herd	UBT's
1967	340	72	49	673	673
68	298	56	50	679	679
69	313	75	52	702	702
1970	301	76	52	726	726
71	265	53	53	726	726
72	192	0	54	672	672
73	177	10	55	627	627
74	217	70	56	641	641
1975	268	72	57	656	656
76	274	79	58	677	677
77	224	50	59	668	668
78	224	81	61	698	688
79	227	83	63	708	708

Source: Derived from FAO 06/28/80, computer print-out.