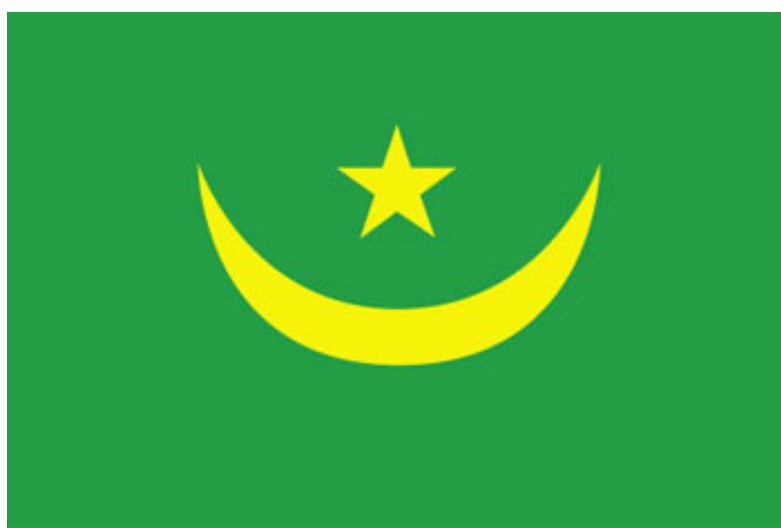


# Country Pasture/Forage Resource Profiles

## MAURITANIA



by  
**Ahmedou Ould Soule**



The designations employed and the presentation of material in this information product do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations (FAO) concerning the legal or development status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. The mention of specific companies or products of manufacturers, whether or not these have been patented, does not imply that these have been endorsed or recommended by FAO in preference to others of a similar nature that are not mentioned.

The views expressed in this information product are those of the author(s) and do not necessarily reflect the views of FAO.

All rights reserved. FAO encourages the reproduction and dissemination of material in this information product. Non-commercial uses will be authorized free of charge, upon request. Reproduction for resale or other commercial purposes, including educational purposes, may incur fees. Applications for permission to reproduce or disseminate FAO copyright materials, and all queries concerning rights and licences, should be addressed by e-mail to [copyright@fao.org](mailto:copyright@fao.org) or to the Chief, Publishing Policy and Support Branch, Office of Knowledge Exchange, Research and Extension, FAO, Viale delle Terme di Caracalla, 00153 Rome, Italy.

---

## CONTENTS

<b>1. INTRODUCTION</b>	<b>5</b>
<b>2. SOILS AND TOPOGRAPHY</b>	<b>5</b>
Topography	5
Soils	5
<b>3. CLIMATE AND AGRO-ECOLOGICAL ZONES</b>	<b>6</b>
Climate	6
Ecological zones	6
Agriculture	7
<b>4. RUMINANT LIVESTOCK PRODUCTION SYSTEMS</b>	<b>8</b>
Livestock production	10
Livestock production systems	11
Animal health	14
<b>5. THE PASTURE RESOURCE</b>	<b>14</b>
The main pasture units	14
Forage resources	18
Pasture potential	18
Fodder crops	19
<b>6. OPPORTUNITIES FOR IMPROVEMENT OF FODDER RESOURCES</b>	<b>20</b>
Constraints	20
Advantages	20
<b>7. RESEARCH AND DEVELOPMENT ORGANIZATIONS AND PERSONNEL</b>	<b>21</b>
Resource persons	21
<b>8. REFERENCES</b>	<b>21</b>
<b>9. CONTACTS</b>	<b>22</b>



## 1. INTRODUCTION

Mauritania is a vast Sahelo-Saharan country, predominantly Saharan, covering 1 030 000 km<sup>2</sup>. It is in the north-west of Africa between 15° and 27°N and 5° and 17° West. In the north it borders with Morocco and Algeria, to the west with Mali, to the south with Senegal, and to the west with the Atlantic Ocean (Figure 1). The latest census found 2 54 157 inhabitants (Ould Ekeïbed, 2001) living on less than forty percent of the country (according to the World Factbook the estimated population of July 2006 was 3 177 388 with a growth rate of 2.88%). Three-quarters of the country is covered by the Sahara desert, the remainder belongs to the Sahelian zone.

The majority of the population are of Arab-Berber origin (White Moors, Black Moors or Haratins) and there are many Negroid Africans: Halpoularen, Sonikés, Wolof and Bambara. The religion is Islam and the official language is Arabic. Mauritania gained its independence on 28 November 1960.

The main national resources come from trade, mining and fisheries. There is also a large potential for stock rearing and, to a lesser degree, crop production.



Figure 1a. Map of Mauritania

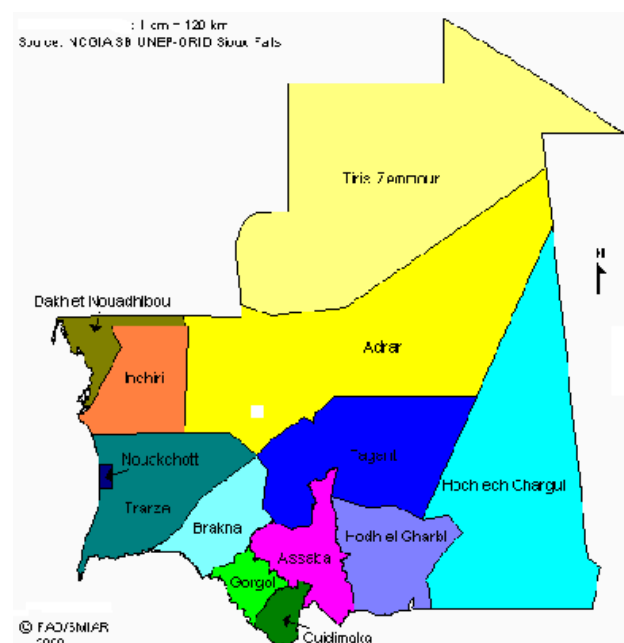


Figure 1b. Administrative map of Mauritania

## 2. SOILS AND TOPOGRAPHY

### Topography

More than half of the country is part of the African Plain, the rest is a combination of vast plains with, scattered here and there, the plateaux of Adrar, Tagant and Affolé the heights of which vary from 200 to 800 m with the highest point at 917 m at Kédia d'Idjil. The lowest altitudes are along the Atlantic Coast at under 50 m. To the east of the littoral are continental dunes between 50 and 100 m. Between the dunes and the Plateaux of Assaba, Tagant and Adrar there are ergs with scattered stony buttes, usually under 100 m. In general the topographic variation affects neither the temperature nor the vegetation.

### Soils

The soils of Mauritania are divided, classically, by climatic regions as follows (Wa Nsanga 1982):

- **Soil Region A.** In the extreme south of the country is the best watered zone and receives over 500 mm. It is the northern limit of the dry savanna. This zone has the best potential for rainfed cropping and pastures.

- **Soil Region B:** takes in those zones with rainfalls between 225 and 500 mm. In order of predominance pastures are on sandy dunes or other wind deposited sands, rocky land, pediments or outcrops in the desert, undifferentiated very high land, coastal dunes, sebkhass (inland areas of salt deposits caused by repeated flooding from the sea) and complex soils. Grazing and agriculture are the main uses of that zone.
- **Soil Region C.** This comprises all the rest of the country where the rainfall is usually under 225 mm. In this region there are three main land forms: the commonest is sand dunes, followed by rocky land then pediments which are rarer.

### 3. CLIMATE AND AGRO-ECOLOGICAL ZONES

#### Climate

The climate of Mauritania is governed by three centres of activity (Diagana, 1998):

- The Azores anticyclone, sited at the southwest of the Azores archipelago, the sea wind from this anticyclone blows north-northwest permanently on the Mauritanian littoral.
- The St Helena anticyclone or monsoon: centred in the south Atlantic, blows south or southwest and is responsible for the summer rains.
- The anticyclones which form in the Sahara in winter, moving northwards and create the Saharan depression. The Harmattan coming from these anticyclones is cool and dry in winter and hot and dry in summer.

The activity of these different air currents gives rise to great annual variability in precipitation. Taking rainfall and its distribution throughout the year, the following are distinguished in Mauritania:

- a dry tropical Sahelo-Sudanese climate characterized by eight months dry in the extreme south of the country (rainfall of 400 mm or above)
- a sub-desert Sahelo-Saharan climate with a great temperature range and between 200 and 400 mm of rain.
- a desert Saharan climate in the centre with under 200 mm of rain annually.

The deterioration of climatic conditions, caused by droughts, have brought about a displacement of the isohyets towards the south and is at the origin of a phenomenon of desertification. All the north of the country (about three-quarters of the national territory) is desert (Figure 2). It is sparsely populated (Table 3). The Sahelian zone extends from west to east over a strip 200 km long.

Overall the Mauritanian climate can be subdivided into three seasons:

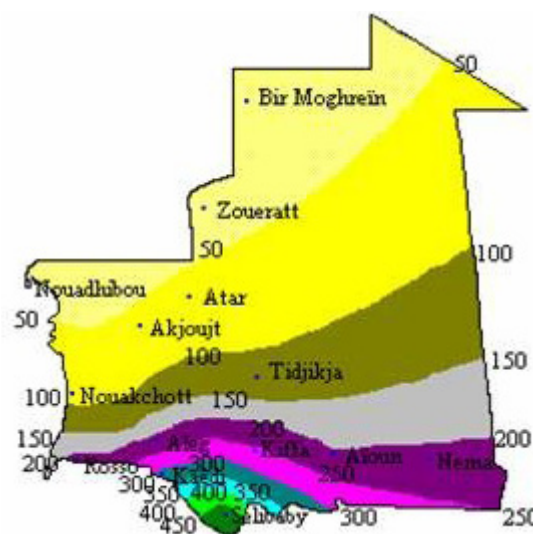
- a rainy season from June to October
- a dry cold season from October to March
- a hot dry season from March to June

The rainy season varies greatly in both time and space. It extends over a period of four months, from June to September/October, along a gradient north-south and west-east from several millimetres to 450 mm annually (Figure 3). The inter-annual instability of rainfall increases as the total rainfall is less (Nations Unies, 2001).

#### Ecological zones

Mauritania can be divided into five ecological zones according to climatic characteristics (Figure 4), the main characteristics of which are shown in Table 1.

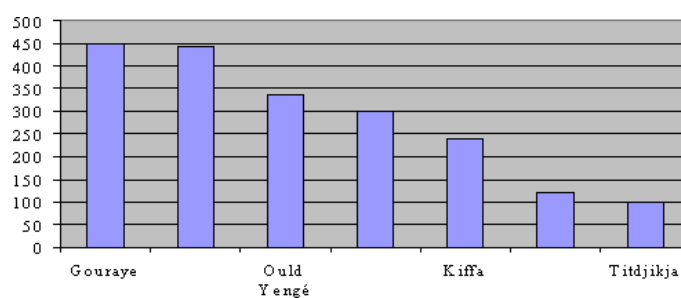
- The arid zone covers all the land below the 150 mm isohyet, excluding the littoral band. It corresponds to the Saharan climate.



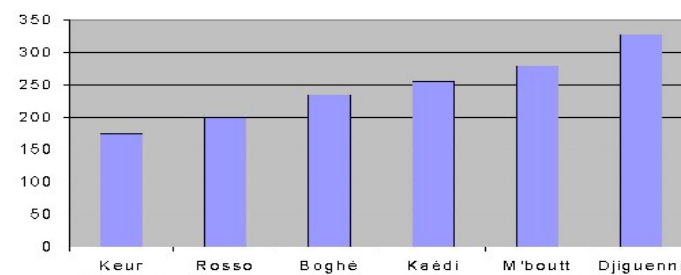
**Figure 2. Isohyets (mm) 1961–1990**  
(Map based on data from AGRYMET/RIM)

- The eastern Sahelian zone comprises the land between the 150 mm isohyet and the border of the two Hodhs and Mali. This zone contains half the sylvopastoral potential of the country.
- The west Sahelian zone is between the 150 mm isohyet and the Senegal river.
- The riverine zone is where most of Mauritania's agriculture is concentrated.
- The seafront is a narrow band of 50 m between Nouadhibou and N'diogo

Within these ecological zones there are wetlands that are transit areas for migrating birds, some of which harbour a rich avifauna. The main wetlands are: The Senegal river; lake Rkiz; lake Mâl, Tamourt N'nâj, The Banc d'Arguin national park and the Diawling National Park.



a. Rainfall gradients N-S (mean rainfall in mm)



b. Rainfall gradients E-W (mean rainfall in mm)

Figure 3. Rainfall gradients north-south and east-west  
(Source: Ministère du Développement Rural et de l'Environnement)

## Agriculture

In Mauritania crop production is greatly influenced by the geographic situation of the country. It is concentrated in the south, along the Senegal river between 18° N and 20° N. There are five cropping systems depending on regions and irrigation potential; these are: rainfed cropping; irrigated cropping; receding flood crops and oases.

It is estimated that the land suitable for agricultural activities is 500 200 ha (Table 2), that is about 0.5% of the country's area (Nations Unies, 2001). The agricultural potential can vary considerably from year to year.

The agricultural potential is unequally distributed; the four southern districts (Trarza, Brakna, Gorgol and Guidimakha), which cover 12% of the country, contain 59% of the arable and almost all the irrigable land.

**Rainfed crops** are closely linked to the rainfall regime and can vary considerably from year to year. The main crops, sorghum, millet and maize, are grown in mixture with cow-



Figure 4. The ecological zones

Table 1. Characteristics of Mauritania's ecological zones

Ecological zones	Territories involved	Area		Population		Density
		km <sup>2</sup>	%	Habitants	%	
Arid	Tiris Zemmour, Adrar, Tagant, Oualata, Magta Lahjar, Boumdeid, Boutilimitt.	810 000	78	300 000	13	0.4
West Sahel	Assaba and parts of Trarza, Brakna, Gorgol and Guidimakha.	75 000	7	440 000	19	6
East Sahel	The two Hodhs less the Department of Oualata.	100 000	10	420 000	18	4
River	Some Departments of Trarza, Brakna, Gorgol and Guidimakha.	22 000	2	450 000	19	20
Sea coast	Littoral from Nouadhibou to Keur Macène.	25 000	3	700 000	31	28

peas, water-melon, ground-nuts, *Hibiscus sabdariffa* etc. Although the main national means of production, rainfed crops only cover, according to the year, 13 to 30% of the country's needs. About 80% of the production is consumed domestically. Their contribution to GDP is insignificant and tending to decrease.

**Irrigated crops.** The rhythm of development of irrigated areas has increased considerably in the river valley in recent years, thanks to a rapid increase in private irrigation development. This spectacular development of irrigated cropping although raising hopes involves the use of modern technology and the use of polluting products: fertilizers and pesticides. The main crop is rice. In addition some off-season crops, (sorghum, maize and horticultural crops) are grown.

**Falling-flood crops.** The system is based on exploiting the floodable areas of the Senegal

River and its tributaries; the zones of water held above dams and bunds; topographic depressions. This form of agriculture is now threatened by water management rules which were imposed after the opening of the hydro-electric plant at Manatali. The main crops thus grown are sorghum and maize, traditionally mixed with water-melon and cowpeas.

**Oases.** The oases are celebrated for their date palms. The palm groves are mainly in the regions of Adrar, Tagant, Assaba and the two Hodhs. The number of date palms is estimated to be 1 870 780 covering 5 500 ha. In the palm groves dates are grown in association with vegetables and fodder crops (mainly lucerne). The main oasis products are: dates, horticultural crops, lucerne and, to a lesser degree, wheat, barley, sorghum and cowpea.

**Table 2. Mauritania's agricultural potential**

Wilaya (administrative unit)	Area (km <sup>2</sup> )	Potential (thousand ha)				TOTAL ('000 ha)
		Rainfed	Décrue	Oasis	Irrigated	
District Nouakchott	120	-	-	-	-	-
Hodh Chargui	182 700	70	8	0	0	78
Hodh Gharbi	53 400	42	16	0.5	0	58.5
Assaba	36 600	15	8.5	1.5	0	25
Gorgol	13 600	25	25	0	38.3	88.3
Brakna	33 000	13	19.1	0	49.7	81.8
Trarza	67 800	0	18	0	47.3	65.3
Adrar	215 300	0	28	2	0	30
Dakhlet Nouadhibou	17 800	-	-	-	-	-
Tagant	95 200	0	12.5	1.5	0	14
Guidimakha	10 300	55	4	0	2.1	61.1
Tiris Zemmour	258 580	-	-	-	-	-
Inchiri	46 300	-	-	-	-	-
TOTAL	1 030 700	220	139.1	5.5	137.4	502

**Table 3. Distribution of agricultural land by wilaya (2000)**

Wilaya	Area (ha)	Average cultivated area (ha)	Potential area (ha)	Cultivated as % of potential
District Nouakchott	12 000	-	-	-
Hodh Chargui	18 270 000	40 205	78 000	54.54
Hodh Gharbi	5 340 000	25 693	58 500	43.92
Assaba	3 660 000	20 426	25 000	81.70
Gorgol	1 360 000	53 030	88 300	60.06
Brakna	3 300 000	14 952	81 800	18.28
Trarza	6 780 000	31 603	65 300	48.40
Adrar	21 530 000	337	30 000	1.12
Dakhlet Nouadhibou	1 780 000	-	-	-
Tagant	9 520 000	3 725	14 000	26.61
Guidimakha	1 030 000	18 516	61 100	30.30
Tiris Zemmour	25 858 000	-	-	-
Inchiri	4 630 000	-	-	-
TOTAL	103 070 000	208 487	502 000	41.53

(Nations Unies, 2001)

## 4. RUMINANT LIVESTOCK PRODUCTION SYSTEMS

Previously animal husbandry was separate from crop production, but there has been an evolution over recent decades and livestock are now found in all agricultural production systems. Thus, in Mauritania, the main production systems are: nomadic pastoral systems; pastoral and agropastoral transhumant; sedentary agropastoral and stock rearing systems associated with cropping; extensive and semi-intensive urban systems.

In Mauritania stock rearing is the main activity of the rural sector. In most cases it is extensive but, for several years, there has been an evolution towards other forms. Despite years of serious drought that reduced fodder and water resources considerably and decimated the livestock during the 1970s and 80s, stock rearing remains an important activity. The official contribution of the sector to the national added value for 2000 is around 68 milliards of Oguiya (1 USD = 258.750 Oguiya (MRO) in 2003), that is about 21% of the GDP (FAO 2001). It is mainly practised in the Sahelian zone which covers the south of the country between 15° and 18° N. The distribution of the livestock is related to the species.

Cattle are essentially limited to that part between the 150 mm isohyet and the south of the country. Small ruminants are found throughout the territory with high densities in the south and southeast. Most of the camels are north of the 400 mm isohyet with greatest densities near the coast since camels are very fond of the salty grazing.

There is a zonal specialization in types of stock rearing: the Sahel Est is the most important zone with 64% of the cattle, 49% of small ruminants and 40% of camels. The Sahel Ouest is the second livestock zone with 33% of the cattle, 44% of small stock and 22% of the camels. The arid zone is the least important with 3% of cattle, 7% of the small stock and 38% of the camels.

There is different information on stock numbers. Figures for 2000 published by the Ministry of Rural Development and the Environment are: cattle 1 657 000; small ruminants 12 555 000; camels 1 247 000; asses and horses 212 000. FAO data on livestock numbers, cattle exports and meat and milk imports are given in Table 4. By 2004 the small ruminant population approached 15 m head and of the milk production of 348 600 tonnes over 200 000 tonnes was from sheep and goats.

Livestock numbers have undergone large variations since 1964 (the first statistics available date from then). The drop in numbers has been caused by various droughts. Small stock and camels have suffered much less from drought than have the cattle (Figure 5). At present herd numbers have been reconstituted and are higher than prior to the cycles of drought which began

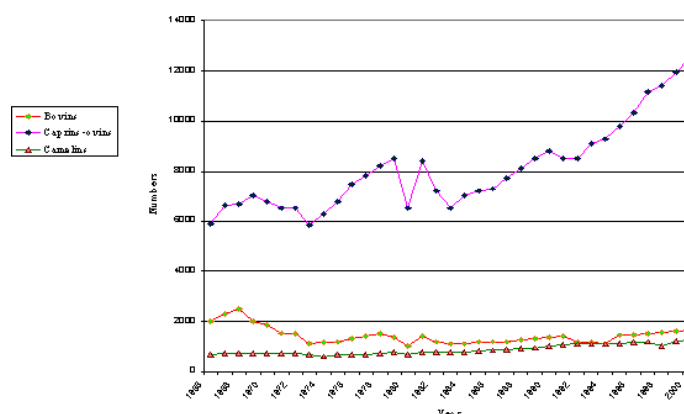


Figure 5: Evolution of stock numbers (thousand head)  
(Source: Direction de l'élevage)

Table 4. Mauritania statistics for livestock numbers, meat and milk production, live animal exports and milk and meat imports for the period 1996–2005

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Cattle nos. (,000,000)	1.12	1.35	1.39	1.48	1.52	1.57	1.56	1.60	1.60	1.60
Camel nos. (,000,000)	1.11	1.16	1.19	1.21	1.25	1.27	1.30	1.30	1.30	1.30
Sheep nos. (,000,000)	6.20	6.30	6.84	7.69	8.04	8.40	8.77	8.80	8.85	8.85
Goat nos. (,000,000)	4.13	4.20	4.56	4.87	5.09	5.32	5.56	5.60	5.60	5.60
Asses nos. (,000)	155.0	155.5	156.0	156.5	157.0	157.5	157.5	158.0	158.0	158.0
Beef and veal prod. (,000 mt.)	10.2	12.5	13.5	14.0	21.0	22.0	22.0	23.0	23.0	23.0
Sheep meat prod. (,000 mt)	15.8	16.5	18.8	20.7	21.8	23.0	24.0	24.0	24.8	24.8
Goat meat prod. (,000 mt.)	9.8	9.9	11.0	11.9	12.5	13.1	13.7	13.8	13.8	13.8
Camel meat prod. (,000)	18.1	18.3	18.3	16.2	19.9	20.9	22.0	22.0	22.0	22.0
Total milk prod. (,000 mt.) [of which cow]	300.9 [106.8]	303.4 [108.5]	314.4 [110.3]	320.4 [113.8]	322.4 [115.5]	322.4 [115.5]	348.3 [120.4]	348.8* [120.8]	348.8* [120.8]	348.8 [120.8]
Live cattle exports nos. (,000)	70	60	50	50	0	0	0	0	0	n.r.
Live camel exports nos. (,000)	25	25	0	0	0	0	0	0	0	n.r.
Live sheep exports nos. (,000)	206	245	195	250	200	250	280	200	300	n.r.
Live goat exports nos. (,000)	120	120	120	120	120	200	100	100	120	n.r.
Milk equiv. imports (,000 mt)	52.78	58.66	41.28	53.43	35.19	71.90	72.99	75.21	85.21	n.r.
Fresh milk imports (,000 mt)	5.50	8.30	6.20	4.02	5.06	12.05	8.37	10.26	13.68	n.r.
Chicken meat imports (,000 mt)	0.1	0.1	0.1	1.2	2.8	2.8	5.5	6.0	4.2	n.r.

Source: FAOSTAT 2006; n.r. no record

\* In 2004 sheep milk production was 96 025 tonnes, goat milk 109 800 tonnes and camel milk 22 000 tonnes

in 1968. The recent evolution of numbers is due to the good rainfall which the country has enjoyed.

The domestic livestock reared in Mauritania belong to the following species (Table 5) (Kane 1995). Cattle – Moorish Zebu and Peulh Zebu; sheep – Moorish sheep both short and long haired, Peulh sheep; goats – Gouéra, dwarf eastern sheep; camels – Brabiche and Rgueïbi; horses – Barb and Arab; asses – local; poultry.

**Cattle** (*Bos indicus*). There are two distinct breeds. The Moorish Zebu accounts for three-quarters of the total. It is a hardy animal that can go as far north as the 150 mm isohyet.

It is very tough and may drink only every second day. The Peulh Zebu is only found in the south of the country (mainly in Gorgol Assaba and Guidimakha).

**Sheep** (*Ovis aries*). There are three breeds. The Moorish short hair (Toubair or Ladem) is greatly appreciated for its meat. The Moorish long-hair is markedly smaller than the preceding breed. Its black hair is long enough to be woven. Peulh sheep or Poulfouli have characteristics similar to the Moorish short-hair. It is only in the south of the country.

**Goats** (*Capra hircus*). The following breeds occur. The Sahel or Spotted goat is met throughout the country; the Saharan, or Spanish or Gouéra goat; the Dwarf Eastern goat or Djouger.

**Camels** (*Camelus dromedarius*). Two breeds occur; the Sahel Camel – Rguebi and the Aftout or Brabiche camel.

**Horses** (*Equus caballus*). Two breeds are present; the Barb and the Arab or Breed of the two Hodhs

**Asses** (*Equus asinus*) the local breed is found throughout the country.

**Poultry**. These are mainly local or exotic breeds of *Gallus gallus*; recent estimates give 3 500 000 local fowls under traditional systems. Traditionally some ducks and Guinea fowl are also reared.

### Livestock production

Animal production, being largely dependent on the forage available from natural pasture, is characterized by short periods of weight gain and increases of milk production during the wet season (3–4 months) followed by long periods of weight loss and falling milk production (8–9 months).

The sale of live animals and livestock products such as milk, meat, butter, hides and skins, wool etc. is the main source of income of the stock rearer. The market price of livestock depends on supply and demand. Transactions are made per head of livestock. The animals sold are generally old males and cull females. Young small ruminants, especially goats, are intensively exploited; the females are usually kept.

**Milk production.** Milk is important in the Mauritanian diet. It is eaten fresh, as curd or as butter. The alternating seasons and feed supply for stock are important factors governing production. In the wet season production is much higher than in the dry season because of forage and water are much more abundant in the rainy season. The variation in the nutritive value of the pastures causes not only variations in milk production but also in milk quality, that of the rainy season being better.

**Table 5. Ruminants kept in Mauritania**

Species	Breed	Weight	Milk production
Cattle	Moorish	Male of 500 kg Female of 250 to 300 kg	600 to 1 000 litres per lactation of 6 to 7 months.
	Peulh	Male of 350 to 450 kg Female of 250 to 300 kg	300 to 500 litres per lactation of 6 to 7 months.
Sheep	Moorish short-hair	40 to 50 kg	50 to 100 litres per lactation of 5 to 6 months.
	Moorish long-hair	Male of 30 to 45 kg Female of 25 to 35 kg	30 to 60 litres per lactation of 5 to 6 months.
	Peulh	Male of 30 to 50 kg Female of 25 to 40 kg	30 to 90 litres per lactation of 5 to 6 months.
Goats	Sahel goat	25 to 35 kg	100 to 300 litres per lactation of 5 to 6 months.
	Sahara (Gouéra)	30 to 40 kg	300 to 400 litres per lactation of 5 to 6 months.
	Dwarf Eastern	15 to 20 kg	200 to 300 litres per lactation of 5 to 7 months.
Camels	Dromedary of l'Aftout	350 to 600 kg	900 to 2000 litres per lactation of 6 to 18 months.
	Sahel Dromedary	350 to 600 kg	900 to 2000 litres per lactation of 6 to 18 months.

(Kane, 1995)

Milk production is estimated at 362 866 tonnes of which 36% is from cattle, 8.5% from small ruminants and 55.5% from camels (according to FAO statistics 2004 milk production was 348 600 tonnes with 34.7% from cattle, 27.5% from sheep, 31.5% from goats and only 6.3% from camels). The average consumption of locally produced milk is 56 litres/inhabitant annually. Despite an annual production equivalent to 150 litres per head of population, Mauritania has to import milk powder and sterilized milk. From Table 4 it is noted that in 2003 fresh milk imports were 10 180 tonnes and total milk equivalent imports were 75 210 tonnes.

The two pasteurization units have organized milk collection from semi-intensive and peri-urban (transhumant or sedentary) producers. These collections are organized with modern methods, pick-ups, tankers etc. With a view to rationalizing and developing milk production the pasteurization units have organized producers, which has allowed, in addition to an increase in production, improved management of herds, which are better fed and cared for.

**Meat production.** Annual meat production is about 75 426 tonnes of which 16 215 are from cattle, 38 745 from small ruminants, 18 046 from camels and 2 420 from poultry (By 2004 total meat production was 89 349 tonnes including 23 000 tonnes of beef and veal, 24 750 tonnes of sheep meat, 13 800 tonnes of goat meat and 22 000 tonnes of camel meat – see Table 4). Mauritania is self sufficient in meat and sells excess production (live animals) to neighbouring countries: Senegal, Mali, Côte d'Ivoire and the countries of the Maghreb Arab Union. Live exports are of the order of 43 300 cattle and 300 000 sheep (However, in 2003 live cattle exports were estimated at 0 head as well as 280 000 sheep, 100 000 goats and 0 camels – Table 4). The exportable surplus has been estimated at 43 300 cattle, 327 600 small ruminants and 31 600 camels, that is 17 100 tonnes of carcass equivalent (Marchés Tropicaux et Méditerranéens, 1998).

**Other livestock products.** The potential exploitable as hides and skins is estimated at 78 000 cattle and 1 800 000 small ruminants. Hides and skins of small ruminants and cattle are used by local artisans but camel hides are not. Export of hides and skins are limited and are mainly sheep skins (according to customs statistics exports are about 20% of controlled slaughter and 2.5% of total slaughter). (Marchés Tropicaux et Méditerranéens, 1998). Collection of raw skins is mainly done at Nouakchott. Hoofs and horns are little exploited. Sheep's wool, greatly appreciated, is used to make tents as is camel wool. Cow dung is used as fuel. It is also used in making mud-brick.

**Animal traction.** In the Saharan and Saharo-Sahelian zones where wells can be tens of metres deep, drawing water is done with the help of camels or less commonly asses. When water is drawn from wells with a delou (a kind of cowhide bucket) its capacity can be over 50 litres. In the valley animal drawn cultivation is used; the most commonly used animals are oxen, horses and asses. Carts pulled by horses or asses are used to carry water and merchandise and sometimes even passengers.

### **Livestock production systems**

Previously stock rearing was separate from agriculture but there has been an evolution in recent decades and livestock are now found in all agricultural production systems. The principal production systems are: nomadic pastoral systems; transhumant pastoral systems; agropastoral and sedentary systems associated with crops; extensive urban systems; semi-extensive urban systems.

#### **Nomadic pastoral systems**

Formerly very important in Mauritanian production systems, nomadism has suffered a serious regression during the past thirty years, principally because of drought. The main animals in this system are goats and camels. This system is characterized by great herd mobility. The herd movements depend on the availability of natural pasture and water points.

During the rainy season the herds go as far north as possible within their territories. During the cool dry season (October–February) the herds move slowly southwards. In the hot dry season (March–July) the nomads are usually camped around water points. In the north the nomads are sometimes obliged to take camel herds very far from water points (sometimes over 30 km) to find grazing. Even if

camels are on pasture well supplied with water they may not drink for weeks, even up to one to three months. Nomadic herds are tended by herders who are often old nomads who have lost their own herds during drought years, or their sons. They generally look after herds, on remuneration, owned by urban proprietors. The herders often have their own small herds of goats.

The livestock travel daily over long distances in search of forage which is mainly trees, shrubs and herbs. Only weak animals may get some supplementary feed of wheat or groundnut cake. The nomads are very familiar with the plants and livestock. Their knowledge allows them to use the pasture of one zone or another at the best time. According to surveys carried out among nomads, they carry out reconnaissance trips on camel-back to assess the forage capacity and spatial distribution of pastures, which allows them to manage their grazing lands. Nomadism has the advantage that it allows livestock to explore zones which are outside the reach of other systems. The diversity of palatable species plays an important role in their health and nutrition. During the dry season goats are watered every two days whereas camels are only watered once every four or five days or even more. The camel herd is given salt two or three times monthly.

Camels' milk is the staple of the nomads' diet and is the main source of water for their bodies. It is under exploited since most of the camels are not milked, which is a serious loss of milk during the whole of the dry season; on the other hand, during the rainy season the milk is made use of since the urban population take advantage of the school holidays to take "cures de lait". As to goats milk (small quantities) it is often reserved for butter making. As in other livestock systems camel meat is only eaten by the herders on important occasions. Goat meat is most frequently eaten, especially at festivals and during visits from strangers.

Camels' wool is used for tent making. Nevertheless it is less well liked than that of sheep. Goat skins are tanned by the women and used for making water-skins, mats and various other uses. Camel hides are not used. Camels are the only kind of transport suited to such an environment and is still used; they are also used for drawing water.

### ***Pastoral and agropastoral transhumant systems***

Transhumant stock rearing is characterized by the herd being in transhumance during seven to eight months. These cyclic movements can take the herders out of the country (to Mali or Senegal) and are characterized by a return to a point of origin where the owner of the herd resides. The herds are sometimes looked after by family herders but are often under hired herders accompanied by at least one family member who is in charge of management. The main stock in this system are cattle, sheep and sometimes goats and camels.

There has been a noticeable reduction in mobility of cattle herds during the past few years. Movements are limited to two or three months during the lean season (May–July). During that time the herds move slowly towards the zone, usually to the south, where water and natural grazing is more plentiful. Sheep rearing is important in the south of the country, especially the two Hodhs. Movements are large in both time and space. The motives for that transhumance are found in the need to put the animals on green pasture to be able to intensify the rhythm of reproduction so as to have two lambings per year. Herds in the southeast use Malian pastures throughout the whole of the dry season and come back north during the wet season to avoid biting insects and stay with or near their owners. Goat rearing is secondary.

Camel rearing by urban owners, which is close to the nomad system from the point of view of mobility, has been developed in recent years. It resembles semi-extensive urban systems in that some females are kept near Nouakchott for milking, at least in the rainy season.

The feeding of transhumant stock is almost entirely based on natural grazing. Nevertheless supplementary feed, usually wheat, is often given to weak or ailing stock during the lean season. Sometimes the herd is accompanied by four wheel drive vehicles which allows: rapid reconnaissance of grazing areas; transport of weak stock; transport of water for domestic use and weak animals; transport of stock feed. Small ruminants are watered daily, cattle every two days and camels once every four or five days.

The food security of the herder and the family which sometimes accompanies him is at least partially assured by the herd which he is in charge of. The urban owners do not get many of the products because the herd is far away. Cow milk is generally reserved for family use or to some poor villagers to whom it

is offered through solidarity networks. In zones where commercial outlets for milk have been developed traditional solidarity mechanisms (loan of cows to poor families “mniha) have suffered greatly. Excess milk is made into butter.

Urban owners only drink the milk of their herds during the rainy season. Owners of herds of camels and cattle go to the country during the school holidays for a “cure du lait” which plays a very important sanitary and nutritional role. This practice has increased considerably in recent years and has encouraged merchants and civil servants to buy herds of cattle or camels which they exploit in the rainy season.

Peulh women traditionally exchange cow milk (fresh, curd or butter) for cereals. Ewe milk is little used by herders, being almost entirely used to feed lambs.

The goats in the herd serve mainly to feed the herder and his family. Sheep production is in a great part aimed at producing rams, which are regularly sent to inland towns or marketed in Senegal and Mali.

### **Sedentary agropastoral systems associated with crop production**

The livestock kept in this system are cattle and small ruminants. The stock stay all the year round on the same territory where they eat crop residues as well as natural pasture. The farmer guards his cattle at night. During the rainy season the stock are left on free grazing all day or herded by a shepherd on the village grazing; on the other hand, at night, they are taken far from the crops until a late hour then shut up. In the dry season they are often left to graze at will.

Sedentary cattle keeping is essentially practiced in the south (valley zone, particularly Gorgol and Guidimakha) whereas small ruminants are principally found in all the zones of the south identified as pockets of poverty. In the valley the traditional household sheep fattening is often done. In the past few years a similar fattening of bullocks has begun.

During the rains the stock have only natural grazing. In the dry season they exploit crop residues, mainly straw and stover left on the field, and natural grazing. The crucial period for feed is during the hot dry season when the natural pasture yields little; its length varies from year to year. Supplementation usually starts in March and stops with the onset of the rains in June. When supplementation begins the natural pastures are not completely exhausted; the livestock can often find half of their needs thereon. The contribution of the pasture diminishes as the rainy season approaches; it can drop to a quarter of daily needs.

From May to July the livestock, at least weak ones and milking dams receive straw, bran (from sorghum, maize, millet and rice), cowpeas and cereals. In irrigated areas the animals graze in paddy fields which are irrigated after harvest to encourage ratoon growth and weeds; they receive complementation – crop residues.

Sheep and bullocks being house-fattened get high quality feed composed of stems of *Cucumis ficifolia*, *Merremia pentaphylla*, *Ipomoea aquatica* etc., stems and seed of cowpea, cereal grain, kitchen waste, groundnut cake etc.

Cow and goat milk play a very important role in the nutrition of the population of these areas whereas ewe milk is little used. Milk yields vary seasonally: cow 1–4 litres daily; goat 0.5–1; ewe 0.25. Agropastoralists often undertake traditional fattening; usually of young lambs which are fattened with a complementary feeding of kitchen waste and agricultural by-products. The main aim of this fattening is consumption or sale for the festival of Tabaski. At the end of the fattening period one ram is sacrificed by the family while the others are sold; this permits the family to buy festive clothes. In the oasis zones complementary feed is crushed date seeds, lucerne, crop residues etc.

### **Extensive urban system**

This system has developed as a corollary of the urbanization brought about by drought; goats are the main livestock. Sheep fattening is often carried on in parallel with goat keeping in town. The main products are goat milk and fattened sheep. This stock rearing is carried out by low-income families and is done by women.

Animals wandering in the streets are characteristic of this system; they feed on urban waste but always receive a high quality complementation of kitchen waste, wheat flour, groundnut cake, lucerne etc. and are watered daily. Goats are kept for milk which is consumed, by preference, as fermented drink “zrig”. Traditional sheep fattening aims at producing fat ewes for Tabaski.

### **Semi-intensive systems**

The livestock in this system are camels and cattle (Maure); it has been developed in the past decade around the big towns (especially Nouakchott) by merchants and civil servants and extends along the main roads. Throughout the dry season the camel herd, comprising only milking females, leaves in the morning in search of grazing around the periphery of the town. They return very early in the afternoon and receive supplementary feed. Milk cattle are kept penned throughout the dry season and are watered every afternoon. In the rainy season the milk herd is transferred to between fifty and a hundred kilometres from Nouakchott, all along the Nouakchott-Rosso road, for grazing. During that period the herd only gets what it can graze on natural pasture.

During the rainy season feeding is almost entirely based on natural pasture. On the other hand in the dry season the camels get a ration in the morning before going to graze in the surroundings of the town; they return soon after midday and get water and a complementation of groundnut cake, and bran of rice and wheat. The cattle are kept tied up indoors throughout the dry season and are fed a concentrate-based ration.

Milk production is better, quantitatively and qualitatively during the rainy season because their feed is balanced. Yields vary according to the stage of lactation between 3–7 litres daily (mean 4.5) for cattle and 3–10 (mean 5) for camels. Evening milk is sold to clients in town whereas morning milk is sold to one of the two pasteurization plants. Excess milk is sold as curd. During the rainy season many families install themselves along the Nouakchott-Rosso road, close to the milch herds in order to take a “cure de lait” – this causes a slight rise in milk prices. Milking females come from the family’s nomadic (or transhumant) herd; after a year of commercial exploitation the females and their offspring are either sold to the butchers of Nouakchott or returned to their original herd. In all cases they are replaced by others.

### **Animal health**

Assistance to the livestock sector in the past three decades has mainly been in the animal health sector. Notable progress has been made in this field, although diseases still constitute a threat to livestock development. At present there is no monitoring of livestock diseases because of lack of funds. Only vaccination campaigns are organized regularly on a national scale to control the major epizootics. (FAO, 2001)

Cattle enjoy a good prophylactic cover, notably by vaccination against Contagious Bovine Peripneumonia botulism, black quarter, anthrax and nodular dermatitis. Veterinary care also involves internal, and external parasites but is usually only done on weak animals or those with obvious signs of parasites. Other diseases which appear from time to time and can be serious include: foot and mouth disease and Rift Valley fever. Rinderpest has been eradicated.

The diseases of small ruminants are less well studied than those of cattle. The main diseases reported are: peste des petits ruminants, sheep pox, gastro-intestinal parasites and enterotoxaemia. Prophylactic treatments are rare. Stock owners have recourse to traditional cures. Sometimes stock are vaccinated against enterotoxaemia or doses against worms.

For camels, veterinary care is essentially aimed at controlling ectoparasites, ticks and mange, and to a lesser degree controlling gastro-intestinal parasites. Trypanosomiasis (*Trypanosoma evansi*) transmitted by biting insects (horse-flies and Stomoxys) affects animals which have ventured into southern zones during the rainy season.

## **5. THE PASTURE RESOURCE**

### **The main pasture units**

Mauritania can be divided into six pastoral units based on rainfall and edaphic conditions (Kane, 1996): the Saharan domain; the sub-desert sahel; the typical sahel; the Sahelo-Sudanian border; the valley of the river and pastures of the salty soils.

### **The Saharan domain**

This corresponds to the arid zone north of the 150 mm isohyet and covers two thirds of the country. The structure of the desert vegetation is often a discontinuous layer of small shrubs belonging to various

genera and one or more strata of grasses and other herbs. In all cases the vegetation is not homogenous and is characterized by a low plant density.

**The sandy ergs.** Psammophyllic vegetation is largely represented since the ergs occupy a non-negligible part of the national territory. They are characterized by a pseudo-steppe dominated by *Stipagrostis pungens*. The principal species associated with it are: *Calligonum comosum*, *Cornulaca monacantha*, *Farsetia stylosa* and *Cyperus conglomeratus*. The barkedans, practically bare of vegetation provide no grazing.

The stony ergs are characterized by a very diffuse group dominated by: *Acacia tortilis subsp. raddiana* and *Hammada scoparia* (Mint Soueidatt Fatimetou, 1988). Their main associate is *Pergularia tomentosa*.

**The sandy regs:** are characterized by a steppe of *Aerva javanica* and *Fagonia oliveri*. The grass stratum is dominated by Aristideae notably *Aristida mutabilis*.

**The clayey-sandy regs:** are characterized by a steppe of *Nucularia perrini* by far the most important formation; it is often accompanied by *Salsola baryosma*. The herb layer is dominated by *Stipagrostis acutiflora*. This pasture is greatly liked by camels.

**The depressions and wadi beds:** are vast expanses of reg the conformation of which allows the collection of the runoff after light rain. These environments harbour shrubby steppes formed by one or more of the following species: *Acacia ehrenbergiana*, *Acacia tortilis*, *Maerua crassifolia*, *Balanites aegyptiaca*, *Capparis decidua*, *Boscia senegalensis*, *Calligonum comosum*, *Panicum turgidum* and *Cymbopogon schoenanthus*.

**The beaches and littoral dunes:** carry a pasture with few pastoral resources composed of: *Tamarix sp.*, *Nitraria retusa*, *Atriplex halimus*, *Sporobolus spicatus*, *Polycarpea nivea*, and *Sesuvium portulacastrum*.

Overall the productivity of these pastures is low.

### **The sub-desert Sahel**

This unit is between the isohyets of 150 and 200 mm and corresponds to a narrow band from Nouakchott in the west to Tidjikja in the centre. The southern limit of that zone in the west is around 170 and rises to 180 in the centre. (FAO 2001). It is characterized by a very short period of pasture growth.

**On the red dunes with active crests,** are found: *Balanites aegyptiaca*, *Commiphora africana*, *Farsetia stylosa*, *Cyperus conglomeratus* and *Panicum turgidum*. This pasture is much liked by the herders and remains in good state until the onset of the hot season.

**In the calcareous inter-dune depressions** are found: *Maerua crassifolia*, *Capparis decidua*, *Leptadenia pyrotechnica*, *Fagonia oliveri*, *Panicum turgidum*, *Farsetia stylosa* and *Cyperus conglomeratus*.

**On the coastal dunes** a steppe develops of *Euphorbia balsamifera*, *Commiphora africana*, *Acacia tortilis*, *Panicum turgidum*, *Cenchrus biflorus* and *Tribulus terrestris*. This formation has little value in the dry season

**Shallow aeolian sands** over sandstone are colonized by a pasture of difficult access of *Euphorbia balsamifera*, *Boscia senegalensis*, *Aristida adscensionis* and *Tetrapogon cenchroides*.

**On undulant regs with sand covered bottom land** are found *Boscia senegalensis*, *Capparis decidua*, *Panicum turgidum*, and *Farsetia stylosa*. These regs have scattered loamy-clay depressions where most of the forage is found.

Overall the productivity of these pastures is very low, especially on sandy dunes, but is a bit better on sandy-loam peneplains.

### **The typical Sahel**

This is between the 200 and 400 mm isohyets and extends from West to East in a strip 200 km wide. The Northern limit of this unit is roughly on the line Kaédi, south of Kiffa and Adel Bagrou to the east (FAO 2001). The productivity of these pastures varies according to the soil. The percentage of grass in the herbaceous layer on fixed sandy dunes is 40 whereas it is 25 on skeletal soils more or less covered with a sandy layer.

**On the fixed dunes we find:** *Balanites aegyptiaca*, *Acacia senegal*, *Leptadenia pyrotechnica*, *Cenchrus biflorus*, and *Alysicarpus ovalifolius*. It is excellent grazing in the rainy season and the start of the dry season.

**On sandy soils** sometimes slightly loamy a pasture of good quality during the rainy season and the start of the dry season is found composed essentially of: *Acacia senegal*, *Balanites aegyptiaca*, *Cenchrus biflorus*, *Aristida mutabilis* and *Heliotropium bacciferum*.

**In depressions** between dunes with a sandy-loam substrate a herbaceous steppe develops in the rainy season of: *Panicum turgidum*, *Aristida mutabilis*, *Cyperus conglomeratus*, *Euphorbia cordifolia*, *Farsetia stylosa*, *Aerva javanica*, *Fagonia oliveri*, *Pergularia tomentosa*, *Schoenefeldia gracilis*, *Aristida funiculata*, *Aristida mutabilis*, *Aristida adscensionis*, and *Cenchrus biflorus*. The woody vegetation includes *Boscia senegalensis*, *Maerua crassifolia*, *Balanites aegyptiaca* etc.

**The coastal dunes** carry a steppe of *Acacia tortilis*, *Salvadora persica*, *Commiphora africana*, *Chloris prieurii* and *Aristida mutabilis*. In the inter-dunes are found *Salvadora persica*, *Maytenus senegalensis*, *Borassus flabellifer*, *Cenchrus biflorus*, *Schoenefeldia gracilis* and *Aristida funiculata*. This pasture can be used throughout the year.

**In the low salty areas** a steppe of sub-shrubs occurs: *Arthrocnemum macrostachyum*, *Salsola baryosma*, *Salsola vermiculata*, *Zygophyllum fontanesii*.

**In the main beds of wadis** with clay or sandy-clay substrates where runoff accumulates temporary pastures mainly based on annuals develop. The herb layer is composed of *Panicum laetum*, *Cassia tora*, *Eragrostis tremula*, *Pennisetum violaceum* etc. The woody layer comprises *Ziziphus mauritiana*, *Acacia ehrenbergiana*, *Acacia seyal* etc.

**On clay and clay-loam soils** a luxuriant vegetation develops in the main beds of wadis dominated by *Acacia scorpioides*, *Acacia seyal*, *Echinochloa colona* and *Aeschynomene indica*. After overgrazing species of low palatability like *Indigofera oblongifolia*, *Cassia tora*, *Spermacoce vermiculata* proliferate while the plants liked by livestock like grasses and legumes tend to disappear.

**The sterile Sahel regs** with *Acacia ehrenbergiana*, *Balanites aegyptiaca*, *Acacia senegal* and *Schoenefeldia gracilis* are of little use and are mediocre in the dry season.

### **The Sahelo-Sudanian border**

This has a dry tropical climate of the Sahelo-Sudanian type with a rainfall rising from 400 mm in the north to 500 – 600 in the south. It corresponds to the whole zone south of the 400 mm isohyet and particularly south of Guidimakha. The association of *Combretum glutinosum* dominates this zone associated with *Acacia senegal* and *Adansonia digitata*. The grass layer is a dense sward of *Schoenefeldia gracilis*, *Eragrostis tremula* and *Andropogon gayanus*. The productivity of these pastures depends on the soil and their position on the slope.

**On fixed dunes** a pasture develops of *Balanites aegyptiaca*, *Acacia senegal*, *Aristida mutabilis*, *Cenchrus biflorus*, *Dactyloctenium aegyptium*, and *Sesamum alatum*. It has a low carrying capacity, especially in the dry season.

**On sandy soils** sited at the base of plateaux are found: *Combretum glutinosum*, *Acacia senegal*, *Sclerocarya birrea*, *Balanites aegyptiaca*, *Cenchrus bifloris*, *Aristida mutabilis*, and *Indigofera aspera*. This is useful grazing throughout the year but with a reduced carrying capacity in the hot, dry season.

**On sandy loams:** *Balanites aegyptiaca*, *Adansonia digitata*, *Combretum glutinosum*, *Aristida mutabilis*, *Eragrostis tremula*, *Indigofera senegalensis*, *Schoenefeldia gracilis* and *Zornia glochidiata*. This is useful grazing throughout the year but with a reduced carrying capacity in the hot, dry season.

**On regs with stony and gravelly soils** we find *Acacia seyal*, *Adansonia digitata*, *Schoenefeldia gracilis*, and *Aristida mutabilis*. This pasture is of little importance in the dry season.

**On the flanks of plateaux with stony soils** with small wadis there is an extraordinary but inaccessible pasture composed essentially of *Commiphora africana*, *Pterocarpus lucens*, *Combretum glutinosum*, *Blepharis linearifolius*, *Aristida adscensionis*, *Andropogon gayanus* and *Tetrapogon cenchriformis*.

**On clays and clay loams** forests of *Acacia seyal*, *Maytenus senegalensis*, *Andropogon gayanus*, *Pennisetum pedicellatum* and *Indigofera astragalina* occur. This is an excellent dry season pasture.

### **The river valley**

**Zones of prolonged inundation** are populated with a monospecific group of *Acacia scorpioides* which can withstand the total immersion of its roots over several months; these forests are disappearing because of their intensive use for charcoal making. These zones carry here and there aquatic pastures of *Oryza barthii* (Barry, 1988); after clearing these are colonized by *Vetiveria nigricans*.

**On clay soils that are flooded** by the Senegal river and its tributaries we find *Acacia scorpioides*, *Acacia seyal*, *Faidherbia albida*, *Mimosa pigra*, *Ziziphus amphibia*, *Echinochloa colona*, *Aeschynomene indica*, *Sphenoclea zeylanica*, *Alternanthera nodiflora*, *Lotus glinoides*, *Chrozophora senegalensis*, *Ipomoea aquatica* etc. Once the waters start to retreat (September) an uninterrupted band of cultivated fields develops for kilometres that makes the rich intercalated pastures inaccessible; these are later used by sedentary herds after harvest. This is an excellent dry season pasture. These pastures are far fewer in Mauritania than on the Senegal bank.

**The coastal dunes** carry very diverse woody vegetation containing, among others, *Euphorbia balsamifera*, *Maytenus senegalensis*, *Tamarix sp.*, *Nitraria retusa*, *Commiphora africana* etc.

**On coastal sands** are found *Ipomoea pes-caprae*, *Sesuvium portulacastrum*, *Alternanthera maritima*, *Cyperus maritimus* etc.

### **Saline soil pastures**

These are mainly at the coast, principally in Aftout es Sahli where the climate is tempered by the sea breeze and the rainfall is between 120 mm in the north and 300 mm in the south. On saline clay soils a halophyte vegetation develops the composition of which is strongly influenced by the degree of salinity of the soil.

**The delta of the Senegal** river supports great areas, mostly inundated during floods, which carry often monospecific populations of one of the following: *Typha australis*, *Phragmites sp.*, *Cyperus sp.*, *Sporobolus sp.* and in addition *Cressa cretica*, *Echinochloa colona* and *Paspalum vaginatum*. Here and there the flowers of *Nymphaea lotus* can be seen. There are relic mangroves of *Rhizophora sp.* and *Avicenna africana*.

**In the sebkhas** where soils are very saline a population of *Tamarix* and-or *Arthrocnemum macrostachyum* is found

**On the edges of flooded areas and on the periphery of sebkhas** *Arthrocnemum macrostachyum*, *Salsola baryosma*, *Salsola vermiculata* *Suaeda mollis*, *Cressa cretica* etc. are found.

In saline depressions in the interior *Nucularia perrini* and *Salsola baryosma* are met with; this is excellent dry season grazing. Nevertheless it can only be tolerated by livestock for twenty days because of its salinity. Overall these pastures, greatly liked by camels, are of low productivity.

### Forage resources

The country's overall forage resources are variable over time and discontinuous spatially. It is thanks to the complementarity of the country's different zones that the herds graze if weather conditions are favourable. The natural pastures are the basis of ruminant nutrition and stock depend on them throughout the year. A characteristic of these pastures is their seasonal variation in quantity and quality; fodder quality varies from one species to another and within a species according to season and stage of development.

During the rains livestock energy and protein requirements are well met which explains the good condition of the herds and a satisfactory milk production. In the dry season the situation is reversed and all pastures provide forage deficient in both energy and protein, to such an extent that stock living off these pastures will become emaciated and may die (Boudet and Duverger, 1961).

Palatability of plants is a relative characteristic. The same species can be sought after or left alone according to the season, the age of the plants, the floristic composition of the pasture in which they are found and the species of grazing animal, (Annex 1, Ould Soulé A. 1995, 1998). Thus, following overgrazing, unpalatable or undesirable species proliferate. (UNESCO, 1961).

Forage resources are composed mainly by the shrub and tree layers. In fact during the dry season and particularly before the rains (the critical period) the green parts and fruits of woody vegetation provide the main if not the only source of protein essential to a balanced diet. The trees or shrubs which remain green throughout the year or are in leaf at the critical period (*Combretum glutinosum*, *Balanites aegyptiaca*, *Faidherbia albida*, *Salvadora persica*, *Piliostigma reticulatum*, *Piliostigma rufescens*, *Indigofera oblongifolia* etc.), the weedy lianas (*Cocculus pendulus*, *Leptadenia hastata*, *Leptadenia arborea*, *Ephedra sp.* etc.) and epiphytes like *Tapinanthus* spp. provide a nutritious contribution while the annual herbs only provide roughage of mediocre nutritive value. As for the perennial herbs (*Panicum turgidum*, *Andropogon gayanus*, *Aristida pungens*, *Vetiveria nigriflora* etc.), they also provide quality feed.

The variable forage resources depend on the summer rains which are irregular and unreliable. The herbaceous pastures depend closely on the amount and distribution over time of the rainfall. Rain has to fall regularly, without big gaps, to allow herbs to complete their growth cycle from germination through flowering to seed maturity. The variable forage resources show the nature of the precipitation precisely. Scarcity, insufficiency and poor distribution limit forage production. The exploitation of pastures by herds of different compositions behaving in different ways vis à vis the forages: cattle graze the herbage to a certain height, sheep clip it to ground level whereas goats prefer to browse shrubs and camels feed on the leaves of trees and bushes, allowing a better valorization of the grazing land.

Water resources, to which the grazing of the stock is closely tied, like the forage resources are also variable in time and discontinuous spatially. The permanent water sources are the Senegal river, the lakes Rhiz and Mâl and the deep water tables which feed the wells and bore-holes. These are the permanent element and the ultimate supply in the dry season. The variable water resources also depend on the summer rains; they are surface water (ponds, wadis etc.) and the shallow ground water recharged annually by infiltration of rain water and feed shallow wells which are often dry by the end of the dry season (May–June).

Where the stock graze is determined by the availability of matoral forage and of water; in the rainy season these resources are generally satisfactory, in contrast in the dry season the grazing land is often limited by the lack of one or both of the two resources.

The installation of bores and wells in recent decades has brought about a profound modification in pastoral conditions. Herds stay longer on grazing areas, thus removing a quantity of vegetation largely exceeding the annual growth. Thus concentric rings are created around some boreholes and wells starting from a denuded area. The denudation of the soil is because of overgrazing and trampling and soil compaction.

### Pasture potential

The sylvopastoral potential (Table 6) is great (almost 14 000 000 ha or about 14% of the country) but is handicapped by pastoral overstocking due to non-accessibility of some zones where water supplies have not been installed.

Incomplete statistics indicate that 13 848 000 ha of pasture produce 6.3 milliards of Fodder Units (UF) corresponding to 2 500 000 tropical livestock units (UBT) on the basis of 2 500 UF/UBT/year; now the national herd is 3 500 000 UBT which indicates that the carrying capacity of the pastoral ecosystem is largely exceeded. (Nations Unies, 2001). This calculation does not take account of the forage from trees and shrubs (aerial pastures). To avoid the destruction of that ecosystem, rational pasture management is necessary. That management should assure proper nutrition of the livestock while allowing both annual and perennial plants to regenerate.

Phytomass production on Mauritanian pastures is very dependent on the weather; it varies from one wilaya to another according to the rainfall and the area of the wilaya. From estimates of phytomass and calculations of carrying capacity/wilaya it seems that the fodder balance is positive overall with an excess of about 3.8% over the total needs of ruminants. Nevertheless the balance is negative in six wilayas (Table 7). The Wilayas of the two Hodhs, Assaba and Adrar produce three-quarters of the national forage potential.

### Fodder crops

In Mauritania ruminant feed is essentially from natural pastures. If during the rainy season these pastures provide a very satisfactory forage, in the dry season the dried vegetation of low feeding value cannot meet the maintenance needs of the livestock.

In the north where conditions are difficult the agropastoralists who have understood well the need to provide a complementary feed (especially to goats) in lean periods cultivate fodder (mainly lucerne *Medicago sativa*) between the date palms. In contrast, in the south where conditions are better, fodder crops are still in an embryonic state in irrigated areas. Private and public trials have given encouraging results; several forages have been

tried over many years. The most promising are: cowpea ISRA 66-35; *Lablab purpureus* or *Dolichos lablab*; Pigeon pea *Cajanus cajan*; lucerne *Medicago sativa* and fodder sorghum. Others have been tried: *Clitoria ternatea*, *Macroptilium lathyroides*, *Crotalaria juncea*, *Pennisetum* sp., *Stylosanthes* sp.

These forages are potentially usable for diversification of fodder crop production; most are from humid regions; so it is desirable to target zones analogous with our conditions. But why have local forages not been tested? Some of them produce forage of excellent quality. Stock rearers know well *Blepharis linearifolius*, *Astragalus vogelii*, *Neurada procumbens*, *Crotalaria saharae*, *Tribulus terrestris*, *Opuntia* sp. etc.

**Table 6. Sylvopastoral potential of Mauritania**

Wilaya	Area (km <sup>2</sup> )	Potential ('000 ha)		TOTAL ('000 ha)
		Sylvopastoral	Classified forest	
District Nouakchott	120	-	-	-
Hodh Chargui	182 700	3 500	0	3 500
Hodh Gharbi	53 400	3 000	1.5	3 001.5
Assaba	36 600	2 500	16	2 516
Gorgol	13 600	1 100	4.5	1 104.5
Brakna	33 000	1 300	9	1 309
Trarza	67 800	1 000	8.5	1 008.5
Adrar	215 300	-	-	-
Dakhlet Nouadhibou	17 800	-	-	-
Tagant	95 200	700	6	706
Guidimakha	10 300	700	2.5	702.5
Tiris Zemmour	258 580	-	-	-
Inchiri	46 300	-	-	-
TOTAL	1 030 700	13 800	48	13 848

(Nations Unies, 2001)

**Table 7. Fodder balance of Mauritanian livestock**

Wilaya	Rain-fall (mm)	Edible phytomass (T/DM)			Dry Matter – Tonnes	
		Herbaceous	Aerial	Total	Needs	Balance
D. Nouakchott		-	-	-	-	-
Hodh Chargui	242	2 174 040	549 000	2 723 040	1 750 517.4	972 522.6
Hodh Gharbi	204	1 268 784	320 400	1 589 184	1 324 992.5	264 191.5
Assaba	216	923 967	233 3258	1 157 292	1 011 510.9	145 781.1
Gorgol	240	383 724	96 900	480 624	663 364.9	-182 740.9
Brakna	220	343 035	111 375	454 410	740 700.3	-286 290.3
Trarza	225	548 163	177 975	726 138	7016 755	9 363
Adrar	132	852 588	484 425	1 337 013	526 594.8	810 418.8
D. Nouadhibou	22	528.7	401	929.2	-	929.2
Tagant	154	60 588	34 425	95 013	500 837.9	-405 824.9
Guidimakha	321	333 102	75 705	408 807	785 329	-376 522.0
Tiris Zemmour	64	7 722.4	5 850	13 572.8	165 010.6	-151 437.8
Inchiri	88	125 433	71 269	196 701.8	288 947	-92 245.3
TOTAL		7 021 675	2 161 050	9 182 725	8 474 580.5	708 144.2

(FAO, 2001)

## 6. OPPORTUNITIES FOR IMPROVEMENT OF FODDER RESOURCES

### Constraints

In general, despite a positive evolution thanks to support given by the state to individual initiatives, animal husbandry faces serious constraints that hamper its production and economic development. These include:

- the difficulty of knowing the real pastoral situation;
- the seasonal fluctuation of forage resources;
- the lack of water points which sometimes prevents the exploitation of good grazing land;
- the June-July crisis and the long daily travel of livestock to water and grazing damages the vigour and productivity of herds;
- destruction of crop residues by trampling;
- uncontrolled cattle in the countryside often causes disputes between stock-owners and farmers. At the same time this exposes stock to predator attack (especially small ruminants);
- difficulty of access to veterinary care;
- desertification of peri-urban pastures.

### Advantages

Nevertheless, technically, the livestock production systems of Mauritania have several advantages.

- the abundance of pasture in the rainy season;
- the good knowledge of livestock and their environment allows herders (nomadic and transhumant) to maintain their stock in good condition and react to weather conditions and grazing capacities;
- nomadism and transhumance favour rotational grazing as well as avoiding dietary deficiencies and parasite build-up;
- the preparation of a pastoral code based on rules and practices of free access to pastoral resources. It ought to reduce conflicts between sedentary farmers and herders and rationalize pasture use.

The main problems which livestock production faces in Mauritania concern, essentially, the management of pastoral resources. To contribute to an improvement of these resources, the following measures could be implemented.

- Improvement of natural pasture by planting or sowing shrubs or herbaceous forages, indigenous or introduced, of high fodder value;
- Improvement of the nutrition of livestock, especially in the dry season when the protein and/or energy content of natural pastures is generally very mediocre. In that context the following actions could be undertaken:
  - Haymaking at an opportune time and silage making are techniques which should be popularized because they greatly increase the value of the fodder produced. In fact the abundance of forage in the rainy season is under-used because mowing and conserving grass is not done at the correct season. Education of stock keepers is needed;
  - The introduction of irrigated forages favours the availability of quality fodder in the dry season;
  - The use of supplementary feeds (wheat, groundnut cake etc.);
  - Protection of grazing land against uncontrolled burning and the abuse of woody vegetation should be reinforced;
  - Grazing control to better distribute grazing pressure and the making available of new grazing areas through increasing the number of water points so as to allow a better exploitation of existing resources. In this case it will be necessary to create an organization which will be responsible for managing the herders' pastures.

The improvement of pasture resources must be through the rational management of these resources and herd mobility. In order to improve pasture management it would be necessary to set up an Observatoire Nationale des Ressources Pastorales which would be responsible for drawing up a consensual plan of pasture management which would favour the implementation of the Code Pastorale.

## 7. RESEARCH AND DEVELOPMENT ORGANIZATIONS AND PERSONNEL

- Le Centre National de Recherches Agronomiques et de Développement Agricole (CNRADA) :  
Siège : Kaédi  
B P : 22  
Tel : (00222) 5335377; E-mail : cnrada@mauritel.mr  
Contacts : Cheikh Ould Dih, Directeur  
Messouda Mint Baham, Chef du Programme Culture Périurbaine, Nouakchott
- La Direction de la Recherche, de la Formation et de la Vulgarisation (DRFV)  
Siège : Nouakchott  
Contact : Diarra Mamoudou, Directeur
- Le Centre National d'Élevage et de Recherches Vétérinaires (CNERV)  
Siège : Nouakchott  
B P : 167  
FAX : (00222) 5252803; Tel : (00222) 5252765; E-mail : cnerv@opt.mr  
Contacts : Diallo Boubacar Ciré Directeur du CNERV
- L'École Nationale de Formation et de Vulgarisation de Kaédi (ENFVA)  
Siège : Kaédi  
Tel : (00222) 5335399  
Contacts : Ahmed Ould Dah, Directeur
- La Direction de l'Environnement et de l'Aménagement Rural (DEAR)  
Siège : Nouakchott  
B P : 171  
FAX : (00222) 5250741; Tel : (00222) 5290115  
Contacts : El Hadrami Ould Bah Nina, Directeur
- La Direction de l'Agriculture (DA)  
Siège : Nouakchott  
Tel : (00222) 5257879  
Contacts : Mohamed Ould El Ghoth, Directeur

### Resource persons

- Chouaïb Ould Abdellahi, Enseignant-Chercheur à l'École Normale Supérieure de Nouakchott
- Abdellahi Ould Mohamedou, Enseignant-Chercheur à la Faculté des Sciences et Techniques de Nouakchott
- Dia Amadou Tidjane, Chef du Département Zootechnie CNERV
- Kane Mamoudou, Chef de division Recherches Vétérinaires et Zootechniques (DRV)
- Sarr Abdoul Oumar, Chef du Programme Cultures Irriguées/ Cultures Fourragères (CNRADA)

## 8. REFERENCES

- Banque Africaine de Développement** 1997 Profil environnemental de la Mauritanie. Geco-Conseils, Nouakchott, 66 pages.
- Barry J.P.** 1988 Approche Ecologique des Régions Arides de l'Afrique. Université de Nice/ ISS de Nouakchott. 107 pages.
- Barry J.P. & Celles J.C.** 1991 Flore de la Mauritanie. Université de Nice/ ISS de Nouakchott. Tomes 1 et 2.
- Boudet G. & Duverger E.** 1961 Etude des pâturages naturels sahéliens. Le hodh (Mauritanie). I.E.M.V.T., Maisons Alfort. 160 pages.
- Diagana M.Y.** 1998 Contribution à l'étude de la dégradation du milieu naturel en Mauritanie et l'opportunité de reboisement à base d'espèces exotiques (*Prosopis* sp.) par rapport à une espèce locale (*Acacia* sp.).

- Mémoire de fin d'études pour l'obtention du diplôme de Postgrado. Université de Nouakchott/Université de Barcelone. 36 pages.
- FAO** 2001 Etude sectorielle de l'élevage 2001- Propositions pour une stratégie nationale et un plan cadre d'actions pour l'amélioration de la croissance de l'économie nationale et la réduction de la pauvreté. Rapport de préparation - version provisoire. Volume I de III Texte principal.
- Kane M.** 1995 Les races d'animaux élevés en Mauritanie. Bulletin d'information sur les ressources génétiques animales N° 15 FAO (UNEP) pp 3–25.
- Kane M.** 1996 Consultation : Information sur le bétail, les pâturages et les marchés à bétail. Projet informations rurales (MAU/94/009/DRAP/MDRE-FAO/PNUD.
- Marchés Tropicaux et Méditerranéens** 1998 La Mauritanie. Numéro hors série. 52 pages.
- Mint Soueïdatt F.** 1988 Contribution à l'analyse biogéographique de la Mauritanie. La végétation : analyse et diversité. Université de Nice/ ISS de Nouakchott. 35 pages.
- Nations Unies** 2001 Bilan commun de pays. Développement rural et sécurité alimentaire. Habitat, Eau et Environnement
- Ould Ahmed Amou M. et al.** 1996 Commercialisation du bétail et de la viande en Mauritanie. Mémoire de fin d'études pour l'obtention du diplôme de Postgrado. Ecole Normale Supérieure de Nouakchott/ Université de Barcelone. 48 pages.
- Ould Ekeïbed M.A.** 2001 Eléments de démographie. 10 pages.
- Ould Soulé A.** 1995 Utilisation de la flore de la Mauritanie. Cours de Postgrado Université de Nouakchott/ Université de Barcelone.
- Ould Soulé A.** 1998 Noms vernaculaires de plantes de Mauritanie 12 Pages.
- UNESCO** 1961 Recherches sur la zone aride. Echanges hydriques des plantes en milieu aride ou semi-aride. Compte rendu de recherches. 250 pages.
- Wa Nsanga** 1982 Inventaire des ressources du sud-ouest mauritanien. USAID (contrat : AID/AAFR-C-1619) 391 pages.

## 9. CONTACTS

This profile was drafted by Ahmedou Ould Soule, lecturer and researcher at the Ecole Normale Supérieure de Nouakchott in March 2002 (and finalized in 2003), who will update it as necessary.

Ahmedou Ould SOULE  
Enseignant-chercheur à l'Ecole Normale  
Supérieure de Nouakchott Mauritanie  
B P 990  
FAX: (+222) 5253172  
Tel: (+222) 5253184 (B)  
(+222) 6412834 (M)  
E-mail: soule@univ-nkc.mr ou aideorg@yahoo.fr

[Translation of the profile from the French original was done by J. M. Suttie and final editing was undertaken by J.M. Suttie and S.G. Reynolds in September 2003. Livestock data were updated in August 2006 by S.G. Reynolds.]