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ASSESSMENT OF AGRICULTURAL
RESEARCH RESOURCES
IN THE SAHEL

VOLUME III
NATIONAL REPORT: MAURITANIA

by

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PREFACE

ASSESSMENT OF AGRICULTURAL RESEARCH RESOURCES IN THE SAHEL

This document has been prepared by DEVRES, Inc. and the Sahel Institute (INSAH) in accordance with the terms of a contract with the U.S. Agency for International Development.

The national agricultural research resources assessments which provide the necessary background information for this document were conducted by national agricultural research scientists from Sahelian countries under the guidance of DEVRES and INSAH with financial support from the U.S. Agency for International Development (under Contract No. AFR-0435-C-00-2084-00 and Project No. 698-0435 entitled Strengthening African Agricultural Research) on behalf of the member countries of the Cooperation for Development in Africa (CDA).

The results of the assessment are contained in the following reports:

Volume I - Regional Analysis and Strategy

Volume II - Summaries of National Reports

Volume III - National Reports:¹

Cape Verde
Chad
The Gambia
Mali
Mauritania
Niger
Senegal
Upper Volta²

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¹Each national report is printed separately.

²As this report was going to the printers in August 1984, the change of name of "Upper Volta" to "Burkina Faso" was announced. While Upper Volta was the correct name of the country as of the date of the inventory (December 1983), readers should take note of this recent change.

LIST OF ACRONYMS AND ABBREVIATIONS

Agents PV	Pre-extension agents
CCCE	Central Bank for Economic Cooperation (France)
CEAO	West African Economic Community
CMSN	Military Committee for National Welfare
CNRADA	National Center for Agronomic Research and Agricultural Development
CNROP	National Center for Oceanographic Research and for Fisheries
CSA	Food Safety Board
ENFVA	National School for Agricultural Training and Extension
FAO	United Nations Food and Agriculture Organization
FLN	World Lutheran Federation
ILN	National Languages Institute
IRAT	Institute for Research in Tropical Agronomy
MDR	Ministry of Rural Development
MPAT	Ministry of Planning and Land Management
NGO	Non-Governmental Organization
OMVS	Senegal River Basin Commission
PPR	Small Ruminant Plague
RAMS	Rural Assessment Manpower Survey
RIM	Islamic Republic of Mauritania
SOMALIDA	Mauritanian and Libyan Agricultural Development Company
SOMECOB	Mauritanian Livestock Marketing Company
SONADER	National Rural Development Company
SONIMEX	National Import-Export Company
UBT	Tropical Cattle Unit
UM	Monetary Unit (Ouguiya)

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INTRODUCTION

A. Background

The Agricultural Research Resources inventory and assessment for Mauritania was also conducted in the remaining seven countries of the Sahel (Cape Verde, Chad, Mali, Niger, Senegal, The Gambia and Upper Volta), all of which are member countries of the CILSS, the Permanent Interstate Committee for Drought Control in the Sahel. The eight national reports taken together comprise Volume III of this report. They are bound separately and are available from the United States Agency for International Development in Washington.¹

The inventory and assessment was carried out within the framework of the high priority accorded by the member countries of the CDA (Cooperation for Development in Africa) and the CILSS to the need to develop and strengthen agricultural research capability in the region. As the World Bank noted in its September 1983 report entitled "Sub-Saharan Africa: Progress Report on Development Prospects and Programs"²:

"Even within the present state of technical knowledge, improved incentives and marketing arrangements would permit very large increases in agricultural output [in Africa]. However, for the longer term, increased output will depend on the development of effective technical packages, pest and disease control and developments in animal husbandry... In a situation of budgetary stringency and of immediate crises, expenditure on research having a possible, but uncertain payoff, ten years or more in the future is frequently seen as dispensable. This danger is increased when research programs are manifestly weak and unfocused. It is, therefore, essential that these programs be formulated and implemented in ways which will enable them to contribute more effectively to the process of development..."

The CDA is an informal association of donors including Belgium, Canada, France, Italy, West Germany, the United Kingdom and the United States. The United States, assisted by other CDA donors, was assigned

¹Volume II, Summary of Agricultural Research in the Sahel, contains summaries of each of the eight countries' national reports. Volume I is a "Regional Analysis of Agricultural Research Resources in the Sahel". Both may be obtained from AID as well.

²World Bank, Sub-Saharan Africa: Progress Report on Development Prospects and Programs, Washington, D.C., World Bank, (September 1983, pp. 30-31.

the specific responsibility for coordinating the development of CDA-supported agricultural research programs in the Sahelian and Southern African regions.

This CDA initiative responds to initiatives already undertaken by many national governments and regional entities (such as the OAU, and CILSS) to emphasize the development of a strong capability in the Sahel to increase agricultural productivity. The donors, therefore, joined with African regional agencies such as INSAH in the Sahel and the Southern Africa Development Coordination Conference (SADCC) in Southern Africa to develop country-specific, regionally-sensitive analyses of existing resources and to identify medium- to long-term needs and opportunities in support of agricultural research that will lead to increased agricultural productivity.

The assessment and preparation of this report were financed by the U.S. Agency for International Development (AID) and carried out by DEVRES, Inc., a U.S.-based private contractor located in Washington, D.C. engaged by AID. DEVRES was assisted by two sub-contractors, the Institut du Sahel (INSAH) and the Midwest Universities Consortium for International Activities (MUCIA). INSAH was established in 1976 and given prime responsibility by CILSS for the collection, analysis and dissemination of research results; for the promotion and coordination of research; for the training of researchers and technicians; and for the adaptation and transfer of technology. The MUCIA consists of seven universities, with administrative headquarters at Ohio State University. Michigan State University was identified by MUCIA as its lead institution for this assessment due to its experience in Africa.

The CDA mandate for the assessment and this report preparation was to consider programs up to 20 years in duration. Few specific project ideas were developed with this timeframe in mind. However, in developing proposals for future programs, this long term emphasis maximized flexibility to focus on the needs of agricultural research regardless of the timeframe involved. Ultimately, the research priorities and activities were set out as needed, while remaining sensitive and responsive to the severe budgetary constraints in the Sahelian countries.

B. Methodology

Sahelian participation in the process of carrying out the inventory and assessment--the collection of data, the preparation of national reports, and the subsequent regional assessment--has been a central aspect of the design and implementation of this study. In May 1983, INSAH, cooperating with DEVRES, invited agricultural researchers from Mauritania and other Sahelian countries to INSAH headquarters in Bamako, Mali to discuss the study and examine the first draft of a series of questionnaires intended to inventory the resources (both

physical and human) available for agricultural research in the region. The questionnaires were then revised in light of the researchers' knowledge of the technical areas and local conditions.

Senior researchers from each of the Sahelian countries were hired by INSAH as National Coordinators and placed in charge of obtaining the answers to the questionnaires and preparing the national reports for their respective countries. National Coordinators in turn hired experienced researchers for short periods of time in their respective countries to help with the completion of the questionnaires in specific subject matter areas such as export and food crops, livestock, agro-forestry, fisheries, and farming systems. The questionnaires included not just the research institutions in these fields, but also the training institutions, and the extension institutions which provide the link between the research and the farmers who utilize the research results.

DEVRES fielded a team of experienced agricultural researchers and development specialists to assist the National Coordinators and their staffs, help with the establishment of a data bank at INSAH on research resources, and develop the regional program. The DEVRES staff consisted of a team leader, a regional coordinator, a technical consultant, one sub-regional coordinator for Cape Verde, The Gambia, Mauritania and Senegal, and another for Chad, Niger, and Upper Volta. Mali was assisted by the technical consultant stationed in Bamako. In addition, INSAH made available two of its senior staff--the Director of its Research Department and the Coordinator of the Research and Documentation network (RESADOC)--who were responsible for coordination between the DEVRES staff and the National Coordinators. MUCIA participated in the design of the questionnaire, furnished country background data for the survey and the sub-regional coordinator for the Eastern Sahel.

INSAH, because of its regional responsibilities for coordination of agricultural research and dissemination of the results, became the repository of the results of the questionnaires in the form of a data bank located at INSAH headquarters. The data collected from the study has been organized using a standard software package--"dBase II"--and can be accessed on the microcomputers available at INSAH headquarters.

More information on potential uses of the data bank can be found in Volume I. The survey has been an important first step in creating a data bank which (when combined with other information available at INSAH) will provide a foundation of practical, useful data that can be updated and refined. It will be a valuable tool for those designing programs and projects in agricultural research in the Sahel and it will also be a source of providing information for researchers in the Sahel and in other neighboring countries.

The inventory and assessment were carried out from May 1983 to April 1984. The bulk of the data collection and the writing of the national reports were carried out from September to December 1983 by the National Coordinators and their consultants in cooperation with the DEVRES/INSAH staff. The national reports are essentially the product of the work of the National Coordinators, assisted by their consultants, based on the responses to the questionnaires. The regional analysis and research strategy were developed by the DEVRES staff in consultation with INSAH in light of the national reports, the questionnaire, and contacts with international research organizations, bilateral and multilateral donors and development organizations (such as the Club du Sahel, the various UN agencies, and the World Bank) and other written information available to the team. The DEVRES/INSAH staff collaboratively designed the proposed regional projects and activities to carry out the strategy elements.

In carrying out the inventory and analysis and in preparing recommendations for programs and projects in this report, the national Coordinators team made special efforts to take into account research work already carried out, underway or proposed. This is consonant with one of the principal objectives of the assessment--to seek ways to strengthen existing national and regional research activities. Further, specific recommendations are placed in a wide context, involving not only the research institutions, but also the training of researchers and the dissemination of research results to the farmers.

II. GENERAL INFORMATION ON MAURITANIA

A. Notes on Geography and Ecology

Mauritania is located between the latitudes 16° and 17° N and covers an area of 1,030,000 km². This large country is handicapped by a scattered population and precarious ecological conditions caused by the harsh climate.

1. Topography

Part of North-West Africa, Mauritania is generally very flat. Most of the country is covered with relatively recent continental formations, such as sandhills or ridges of less than 500 meters in altitude. A large proportion of the surface is occupied by sandstone plateaus marked by erosion. Most are 200-400 m high. A few are over 500 m high (Zemmour and Kejiet oj jill measure 915 m). The country can be divided into six geographical regions:

- o The northern and northeastern plateaus;
- o The very flat Saharan plains which span from the eastern to the west-central part of the country;
- o The Trab el Hajra (stone country), which includes the plateaus in Adrar, Trogart and Assaba;
- o The great sandy erg, east of Adrar and Trogart;
- o The Hodh, the immense southeastern basin; and
- o The coastal region, running from north of Cap Blanc to the sandy area south of Cap Timiris. Between these two capes the continental plateau is very vast.

2. Borders

Mauritania is bordered by the Atlantic Ocean to the west, Western Sahara (Morocco since the agreement of April 14, 1978) to the northwest, Algeria to the north, Mali to the east and southeast, and Senegal to the south (the Senegal river serves as a natural boundary).

3. Climate

a. Types

Mauritania has two different types of climate - the Sahelian and the Saharan.

The Sahelian climate is found in the southern part of the two Hodhs and Assaba regions, as well as in the regions of Guidimaka, Gorgol, Brakna and Trarza, where the average annual rainfall is less

than 450 mm. The zone's northern limit is located near the 150 mm isoyhet, beyond which rainfed agriculture becomes very difficult.

The Saharan climate covers two-thirds of the country. Precipitation is low or almost non-existent -- under 150 mm a year. The only prosperous areas are found in the cases where some cereals and vegetables are cultivated under date trees.

b. Seasons

The year is divided into three seasons varying from three to five months each. The rainy season comprises July, August and September. This period is characterized by low-volume torrential rainfalls. The distribution of rainfall is as important a constraint as its low volume. (See Figure 1.) The cool dry season runs from October to February, and the hot dry season begins in March and lasts until June.

The highest daytime temperatures are recorded in May (48° C) and the lowest nighttime temperatures are in January (about 0° C) in the Saharan zone. Annual evaporation exceeds 3,000 mm, with the greatest percentage occurring from March to May.

c. Winds

The dominant wind is the harmattan, a dry and hot wind which blows from the east to the northeast during the dry season, except on the coast where the counter-trade wind prevails. Dry winds increase evaporation and carry large quantities of mineral particles which trigger sandstorms and dry fog.

In the rainy season, the monsoon prevails, a cool and humid wind which blows from the south and southwest, bringing rain. It is characterized by sudden gusting winds of 30 m per second or more.

4. Hydrography

a. Waterways

Mauritania has only one major waterway: the Senegal River, which constitutes the southern border with Senegal from Bakel to the Atlantic Ocean. The lower river is navigable during part of the year, beginning in September when there is flooding. Two large dams are under construction on the Senegal River; one of them, Diama, is located partly in Mauritania.

Three principal tributaries the Karakoro, Garfa and Gorgol rivers, flow into the right side of the Senegal River. The three tributaries are oueds which only flow intermittently.

The average flow of the Senegal river is 773 m³ per second but this figure varies widely according to year and season. At its lowest level it can be crossed by foot in many places. When the river is this low, its flow at high tide is reduced to almost nothing.

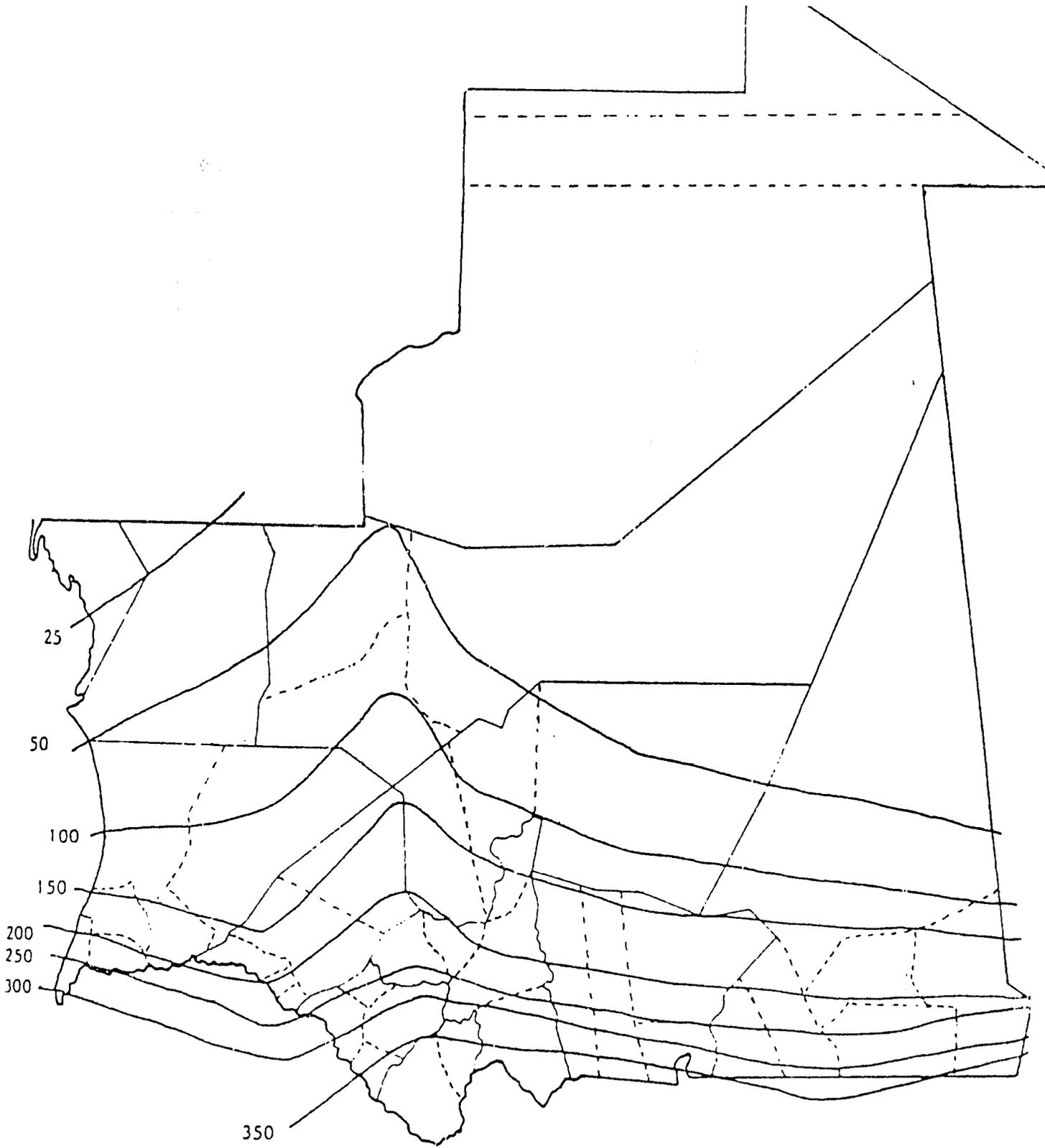


Figure 1: Isohyets (Period Before 1977)

Source: RAMS

North of the river region Mauritania's hydrography is characterized by occasional rainfall in the plains. In this region surface water always originates from rainfall.

b. Underground water

Mauritania possesses underground reservoirs of water that are of considerable value in a country where low precipitation is coupled with high evaporation (3,000 mm on average). There are four layers of underground water, the most important being the Trarza layer which supplies the city of Nouakchott.

5. Soil

The amount of cultivable land in Mauritania has been estimated at 500,000 hectares (ha)¹, located mostly in the south in the Senegal River Valley. The Mauritanian bank of the river, which has been the object of thorough pedological studies, includes 300,000 ha of irrigable land, mostly heavily-textured waio vertisols, suitable for rice cultivation, as well as alluvia. Since the areas of cultivation which receive rain vary according to rainfall, it is necessary to use caution when interpreting data in this area.

6. Vegetation

The extent and variety of vegetation depends on the climate and its influence on various species. However, the severity of the drought, the requirements of intensive livestock production and, at times, the thoughtless actions of man have caused such a systematic destruction of the vegetation layer that desertification has become a major problem.

In many areas, trees have almost disappeared. Isolated trees from the more resistant species (Combretum sp. Callotropis procera) still remain, as well as a few dense pockets dominated by the Acacia nilotica, which can be found in favorable and protected riverbank areas.

The herbaceous layer can no longer grow continuously because of the unpredictable rainfall. Among the annual grains, the Cenchrus biflorus predominates in the Sahel area, while the Aristida pungens (sbatt in Moorish) is more common in the desert area.

In the forests, vegetation is threatened to the point that 80 percent of the forest area existing in 1960 has since disappeared. Only a few selected forests, covering an estimated 126,625.9 ha, have been spared.

¹ Planning Mission for a Rural Development Strategy and Program Activities, 1982-86 UNDP/FAO/ROME 1981.

7. Principal ecological zones

There are three principal ecological zones:

a. Senegal River zone

This area consists of a narrow strip of land along the riverbeds where irrigation is possible during part of the year (the walo). Normal precipitation was 300 mm before 1970, but since then the annual total has almost always been inferior to this level. The soil is sandy and clayey-sandy.

b. Sahelian zone

This zone is defined as the area which receives more than 100 mm of rain annually. According to "normal" rainfall statistics, this definition of the zone includes Nouakchott and the area on the same parallel with it, approximately one third of the country. The soil is mostly deep sand. This area is the domain of cattlemen, who move their herd through the Sahel from one natural pasture to another. Annual grasses (Aristida, Schoenefeldia, Cenchrus) and scattered thorny bushes (Acacia) grow in these grazing areas.

c. Saharan zone

This is a desert region which represents two-thirds of the national territory and receives less than 100 mm of rain annually or no rain at all. Because of the irregular rain patterns, vegetation is concentrated in a few fertile pockets, which are often very poor and far apart. Apart from nomads who raise dromedaries, almost no one lives in these regions.

8. Transportation and telecommunications

A large share of investments has been allotted to construction or modernization of infrastructure over the last few years because the country has had almost none until the beginning of the 1960's.

a. Roads

In 1933 the national road network totalled 4,782 km. One third of the roads (1,572 km) are paved, 450 km are improved dirt roads and the rest (2,760 km) are classified as unimproved dirt roads or paths, as shown in Table 1.

b. Maritime facilities

These include the port of Nouakchott (wharf), the autonomous port of Nouadhibou and the projected deep-water port of Nouakchott, now under construction.

Table 1: Technical Characteristics of National Roads

<u>Characteristics</u>	<u>Name</u>	<u>Length (km)</u>
Asphalted Roads	Nouakchott-Rosso	204
	Nouakchott-Akjoujt	256
	Nouakchott-Kiffa-Afoun	817
	Afoun-Timbedra	170
	NDB-Zte road network	46
	NKT-coast road network	27
	Aleg-Boghe (constructed in 1983)	<u>62</u>
	Subtotal	1,572
Improved Dirt Roads	Akjoujt-Atar	180
	Boghe-Kaedi	100
	Atar-Choum	120
	Kiffa-El Moudere	<u>50</u>
		Subtotal
Unimproved Dirt Roads and Paths	All other roads	<u>2,760</u>
	Total	<u><u>4,782</u></u>

The V'arf's present facilities include a 142 m x 26 m platform linked to the shore by a 250 m double gangway; and a second 56 m x 21 m platform linked to the first by a 56 m gangway, where 5,000-ton ships can dock in calm weather.

The autonomous port of Nouadhibou includes a trading dock, 22 m wide and 128 m long on one side and 108 m on the other, linked to the shore by a 150 m platform, as well as two docks for barges, one 80 m long, the other 160 m long, one of which is served by a double railroad track. There is also a fishing dock.

c. Air transportation

Mauritania has 25 airports, most of which were built during the colonial era. Only the airports of Nouakchott and Nouadhibou are international and can accommodate large carrier traffic. It should be noted that only ten of the 25 airports are served by scheduled airlines.

d. Telecommunications

Sixty post offices are located throughout the country, as well as some telecommunications equipment, including nine automatic telephone exchanges, a Rosso-Nouakchott-Akjoujt coaxial cable, two Telex exchanges, a Hertzian terminal, and high-frequency radio-electrical material.

B. Demography

1. Population

a. Structure

The population of Mauritania was estimated in 1982 at 1,605,000 inhabitants.² It is a very young country; people under 15 years of age make up 44 percent of the population, adults 50 percent and the elderly 6 percent. With an estimated 2.5 percent birth rate, the population should double within 25-30 years. Mauritania is predominantly rural: in 1980 the rural population made up 75 percent and the urban population 25 percent of the total. The number of nomads decreased from 65 percent of the population in 1965 to 36 percent in 1977. The sedentary rural population grew from 25 percent to 42 percent and urban dwellers from 10 percent to 22 percent of the total during the same period. (See Table 2).

If the present trend continues, the sedentary rural population will continue to increase (51 percent by 1990) over the nomadic (18 percent by 1990). At the same time, the urban population should reach

² Department of Statistics and Public Accounting, 1983.

Table 2: Different Population Components
(percentage)

<u>Population</u>	<u>1965</u>	<u>1977</u>	<u>1980</u>	<u>1985</u>	<u>1990</u>
Urban	10	22	25	28	31
Rural, sedentary	25	42	47	50	51
Rural, nomadic	65	36	28	22	18

Source: Fourth Plan, MPAT (Ministry of Planning), 1981.

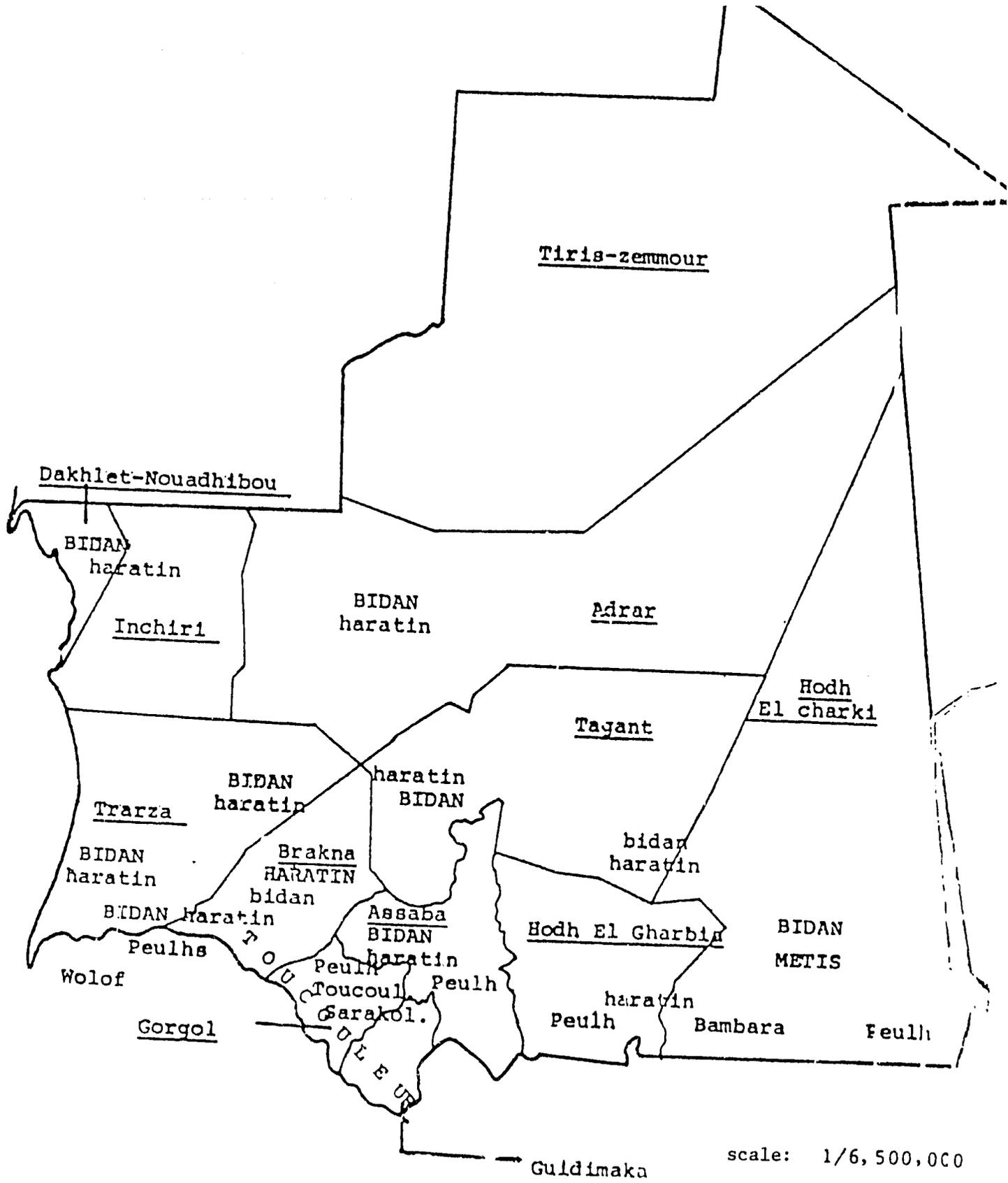


Figure 2: Geopolitical Distribution of Ethnic Groups

31 percent of the total by 1990. In 1977 non-Mauritanians numbered 45,954 out of a total population of 1,338,800, or 3.4 percent, as shown by Table 3.

b. Emigration

Some Mauritanians (mostly Moors) have emigrated to member countries of the West African Economic Community (CEAO) where they engage in trade. Most of these emigrants are living in Senegal, the Ivory Coast and Mali. Further, since the beginning of the 1960's, and in some cases earlier, Soninké people from Guidimaka have been emigrating to France. The persistence of the drought has accelerated this trend. Today, emigration affects all the southwestern regions (Gorgol, Brakna, Trarza), where much of the active labor force goes to Gabon, Libya, etc., in search of work.

c. Employment

According to the Fourth Plan (1981-85), 413,000 people out of 482,000 who offered their services were employed in 1980. Thus, 69,000 or 14 percent did not find a job. This situation is a cause for concern, as job-training is rare and the drought which began in the 1970's has forced farmers to give up farming and migrate to urban centers in search of work. This has caused unemployment rates to climb and widened the economic gap between urban and rural areas.

Based on a presumed annual population increase of 2.5 percent, it is evident that there will be a large increase in available manpower and that the unemployment problem will become more acute. (See Table 4.)

2. Regional population distribution

Mauritania is divided into 13 regions of various sizes, the largest ones being the most desertic. This system tends to induce socio-economic balance between regions. (See Table 5.)

C. Educational System

Mauritania's school attendance rate averages from 24 to 28 percent but varies widely from one region to another. (See Table 6.) It is 14.2 percent in Hodh Charqui and 57.4 percent in Dakhlet-Nouadhibou. In the densely-populated and exclusively rural regions such as the Hodhs, Assaba, Guidimaka, Tagant, and Gorgol, the rate is below the national average; it is usually above average in the industrial and port regions such as the Nouakchott district, dakhlet-Nouadhibou, Zouérate and Atar (commercial town).

In 1980, basic education was offered in 543 schools with 1,613 classes to 85,150 students (62 percent boys, 38 percent girls). In 1950-51 2,300 students were enrolled in grade schools. Eighty-one percent were boys and 19.9 percent were girls. A total of 17,647 students were attending high school in 1980, while vocational training and higher education remained very weak. Functional literacy programs

Table 3: Population According to Sex and National Origin, 1977

<u>Sex</u>				
<u>Nationality</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>	<u>Percentage</u>
Total	658,012	680,817	1,338,830	100
-Mauritanians	641,426	669,074	1,310,500	97.88
-Other Nationalities				
Arabs	549	304	853	0.07
-Africans				
Non-Arabs	13,500	9,718	23,298	1.75
Including Senegalese	9,913	7,711	17,524	1.32
-Europeans	2,061	1,578	3,639	0.27
-Other Nationalities	396	144	540	0.04

Source : Department of Statistics and Public Accounting, 1980.

Table 4: Labor Force and Employment Rate

	<u>1973</u>	<u>1974</u>	<u>1975</u>
Labor Force	625,675	637,110	648,755
Employed	259,500	263,000	267,000
Modern Sector	42,500	44,400	46,500
Traditional Sector	217,200	218,900	220,500
Non-employed	336,175	373,810	381,775
Proportion of Non-employed	58.5	58.7	58.8

Source : Third Plan, MPAT, 1976-80.

Table 5: Population By Region

Region	Surface (km ²)	Population				Total
		Urban	Rural			
			Sedentary	Nomad		
Nouakchott	1	134,700	0	0	134,700	
Hodh Charqui	182,700	13,200	57,800	85,700	156,700	
Hodh Gharbi	59,400	8,500	51,700	64,000	124,200	
Assaba	36,600	10,300	75,500	43,400	129,200	
Gorgol	13,600	20,700	112,300	16,400	149,400	
Brakna	33,000	13,100	87,600	50,600	151,300	
Trarza	67,800	23,800	86,100	106,100	216,000	
Adrar	215,900	16,200	21,500	17,700	55,400	
Nouadhibou	17,800	21,900	1,600	0	29,500	
Tagant	95,200	7,900	24,600	42,500	75,000	
Guidimaka	10,300	6,000	68,100	9,100	83,000	
Tiris zemmour	252,900	19,500	2,400	700	22,600	
Inchiri	46,800	8,000	9,600	1,800	17,600	

Table 6: School Attendance Rate Per Region

<u>Region</u>	<u>Population To Be Educated</u>	<u>Educated Population</u>	<u>School Attendance</u>
Hodh Chargui	39,343	5,600	14.23
Hodh Gharbi	31,233	5,309	16.99
Assaba	32,400	4,674	14.42
Guidimaka	20,966	3,744	17.85
Tagant	18,708	3,781	20.21
Brakna	38,004	8,877	23.35
Gorgol	38,719	8,135	24.01
Trarza	54,133	13,035	24.07
Inchiri	4,290	1,550	36.13
Adrar	13,548	4,898	36.15
Tiris Zemmour	6,350	2,844	44.78
Dakhlet-Ndbou	6,680	3,839	57.47
Nouakchott	<u>46,311</u>	<u>18,865</u>	<u>40.73</u>
Total	350,683 =====	85,151 =====	24.28 =====

Source : Department of Education, 1980.

have been implemented only recently and the illiteracy rate remains extremely high (81.8 percent in 1977). The creation of the Institute for Native Languages in 1979 will help make it possible to introduce the Soninko, Wolof and Pular languages into the elementary schools and be used more often in public life to fight effectively against the serious illiteracy problem (74 percent in 1980).

D. Brief Description of the Government Structure

1. Principal Ministries

The economic sector is comprised of the following ministries:

- o Ministry of Finance and Commerce;
- o Ministry of Planning;
- o Ministry of Rural Development; and
- o Ministry of Fisheries and Maritime Economy.

The socio-cultural sector is comprised of the following ministries:

- o Ministry of Education;
- o Ministry of Health and Social Welfare; and
- o Higher Education, Management Training and Civil Service.

2. Public finances

Austerity measures have been adopted to reduce the growing government deficit. Public expenses had increased to four billion ouguiya (UM - monetary unit) in 1980. This austerity policy is meant to reallocate public funds to more productive sectors and exert tighter control over government finances.

Table 7 shows the evolution of public expenses and state revenues.

3. Agricultural policy

The Military Committee for National Welfare (CMSN - Comité militaire de salut national) has clearly defined the country's agricultural policy based on three fundamental goals:

- o Self-sufficiency in food production;
- o Restoration of the environment; and
- o Maintaining and returning people to the land.

Table 7: Public Expenses and Revenues
(in millions of UM)

	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>
Revenues	2,787	3,886	3,924	4,991	4,620	5,928	6,009	5,511
Expenses	2,942	3,683	4,588	8,289	9,017	11,833	10,381	10,169
Surplus and Deficit	- 155	+ 203	- 664	-3,398	-4,397	-5,905	-4,381	-4,658

Source : IMF Report, April 1980, from 1973 to 1977; MEF from 1978 to 1980.

To reach these goals, the government has given budgetary priority to the rural sector which includes 75 percent of the population. The current plan calls for allocating 29.1 percent of public investments or UM 19,345,000 to the rural sector, which constitutes the largest investment (excluding the Guelbs project).

The Fourth Plan recommends an investment policy which favors productive sectors such as agriculture, animal production and fisheries, and promotion of low-cost job-creating projects.

Mauritania is a member of the Senegal River Development Organization (OMVS - Organization de mise en valeur du fleuve Sénégal). Its goal is to develop land in the Senegal Valley for food self-sufficiency. Hydro-agricultural surfaces such as the Gorgol project, the Boghé and M'Pourié Plains, the Fom Gleita and Tagant projects are being, or will be, developed in the near future.

4. Membership in international organizations

Mauritania is a member of the following international and regional organizations: the United Nations and its specialized organizations: UNDP, FAO, ACP, CILSS, CEAO, CEDEAO, Arab League, Arab Economic Council.

E. Economic Background

1. General trends

According to the Fourth Plan for Economic and Social Development (1981-85), the base of the Mauritanian economy has passed from the primary sector to the tertiary sector. This trend started in the beginning of the 1960's and accelerated between 1970 and 1980. (See Table 8).

In general, the real Gross Domestic Product (GDP) has grown by an average of 4.75 percent between 1973 and 1981. However, this average conceals important disparities. For example, the GDP decreased both in 1976-77 and in 1977-78. Growth was moderate (0.2 percent) in 1979 and good in 1980 and 1981 when the growth rate reached 13.5 percent. This increase originated primarily in the animal production and fishing sectors. Indeed, the added value of the latter more than doubled between 1980 and 1981, passing from UM 708 million to UM 1,671 million.

One notices in Table 9 that the rural share of GDP is almost equal to that of industry, despite fluctuations caused by the climate and the small amount of investments (about 14 percent) allotted to agriculture in the previous plan (1976-80).

One also notices a net decrease in the mining sector's contribution to GDP which, until recently, accounted for the bulk of industrial value added. This is largely due to the growing importance of the fish processing industry. However, the tertiary sector

Table 8: Evolution of the GDP (1973 Prices)
(10⁶ UM)

	<u>1973</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
<u>Rural Sector</u>	2,916	3,803	3,270	3,577	3,576	3,329	3,723
Agriculture	273	323	257	228	328	367	381
Animal Production	1,823	2,545	2,472	2,514	3,248	2,962	3,342
Fisheries	771	428	489	491	NA	NA	NA
<u>Industry</u>	<u>3,776</u>	<u>3,395</u>	<u>3,239</u>	<u>2,450</u>	<u>3,433</u>	<u>3,629</u>	<u>5,006</u>
Mining	3,140	2,623	2,377	1,546	1,810	1,904	1,919
Manufacturing	636	772	862	902	1,623	1,725	3,087
BAT and TP	569	983	971	674	1,037	1,151	1,070
Services	2,881	3,688	3,704	3,677	3,354	3,667	3,905
Administration	<u>1,706</u>	<u>3,177</u>	<u>3,630</u>	<u>3,629</u>	<u>2,413</u>	<u>3,358</u>	<u>3,468</u>
Fixed Cost GDP	11,848	15,048	14,814	13,777	13,813	15,134	17,172

Source: 1973-80: Statistical Guide, 1980, Department of Statistics and Public Accounting;
1979-81: Annual Report of the BCM, 1981.

Table 9: GDP Growth
(percentage)

	<u>1973</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Rural Sector	24.6	25.3	22	23.8	25.9	22	21.7
Industrial Sector	31.8	22.6	21.8	17.8	24.8	24	29.1
Services Sector	43.6	52.1	56.2	58.4	49.3	54	49.2
Fixed Cost GDP	100	100	100	100	100	100	100

Source : National Report on the Progress of the Agrarian Reform and Development, MDR/FAO, 1983.

continues to dominate the economy (nearly half of GDP and, at times, even more).

The contribution of sub-sectors to rural GDP generally fluctuates. One notes a marked variation in the importance of the different subsectors of the rural economy in Table 10. This table clearly shows that animal production is by far the most important rural activity (75 percent to 90 percent of the rural value added) while agriculture represents less than 10 percent.

2. International trade

Table 11 presents a breakdown of imports and exports. Foreign trade is essential to Mauritania. Exports represented 65 percent of GNP in 1981. Nevertheless, the balance of payments remains largely negative (UM 56,400 million in 1981, or 18 percent of GNP) because the balance of goods and services are both negative.

Iron sales totalled UM 72,800 million in 1982, representing more than 77 percent of goods exported. This explains why Mauritania is interested in maintaining the world price for this mineral at its current level.

3. Currency and credit

Credit has expanded since the introduction of a national currency - the ouguiya (UM) - in 1973. The banks have distributed UM 8.7 billion and collected UM 3.2 billion in deposits as of December 1979 (Source: ECM/Ministry of Planning, 1981). Unfortunately, some loans have not been repaid. The value of the national currency has been one ouguiya equaling FCFA 5 in 1981, FCFA 6.25 in 1982 and FCFA 7.27 in 1983.

The distribution of credits to the economy between 1975 and 1979 is shown in Table 12.

4. The Fourth Plan for economic and social development

The strategy for the Fourth Plan rests upon the following goals:

- o Restoration of the country's financial balance in order to reduce the public deficit and maintain an acceptable level of debt;
- o Creation of structures to stimulate economic recovery; and
- o Recovery measures for state corporations.

Investments for the current five-year plan (1981-85) are set at UM 89,205 million.

Table 10: Contribution of the Sub-Sectors to the Rural GDP

	<u>1973</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>
Agriculture	9.4	8.5	7.8	6.9	9.2	11	10.3
Animal Production	62.5	77.4	75.6	76.5	90.8	89	89.7
Fishing	26.4	11.3	15	15	-	-	-

Source : National Report on the Progress of the Agrarian Reform and Development, MDR/FAO, 1983.

Table 11: International Trade

<u>Exports and Imports of Goods and Services and Transfers</u>	<u>Foreign Trade in Mauritania</u> (in billions of dollars)	
	<u>1980</u>	<u>1981</u>
Exported Goods FOB	+ 0.19	+ 0.27
Exported Services	+ 0.19	+ 0.18
Total Exports	+ 0.38	+ 0.45
Imported Goods FOB	- 0.32	- 0.38
Imported Services	- 0.19	- 0.20
Total Imports	- 0.51	- 0.58
Balance of Payments	- 0.13	- 0.13
Foreign Debt	0.71	0.82

Source: Monthly Newsletters of the IMF and the UN.

Table 12: Distribution of Credits

<u>Categories</u>	<u>1975</u>	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>
Trade	35.4	33.2	40.8	35.6	38.0
Including SONIMEX	(5.0)	(1.2)	(4.3)	(3.6)	(2.4)
Petroleum Distribution	1.7	0.7	0.4	0.4	0.2
Fishing	4.7	1.9	1.9	2.5	2.8
Mining	32.5	32.9	24.5	21.6	18.0
Public Services	2.1	1.9	2.6	2.3	1.8
Construction	9.0	10.5	8.6	9.0	9.7
Housing	2.0	2.9	2.5	3.2	3.2
Other Sectors	12.6	16.0	18.7	25.4	26.3
Total	100	100	100	100	100
	=====	=====	=====	=====	=====

5. Food aid

Food aid to cover Mauritania's needs cannot be neglected in an overall food strategy. Mauritania receives international aid to help offset a continuous decrease in cereal production since the beginning of the drought in the region. Mauritania has received the following amounts of aid:

- o Between 50,000 and 62,000 tons of wheat and sorghum in 1978;
- o Between 23,000 and 49,000 tons in 1979; and
- o Between 62,000 and 86,000 tons in 1980.

Mauritania imports between 75 and 80 percent of its needs in cereals and the totality of foodstuffs such as tea, sugar and oil. These imports amounted to UM 6,111 million in 1980 and imposed a heavy burden of Mauritania's balance of payments. Imports provide 65 percent of the caloric intake and 40 percent of the proteins of the average national diet (Study of a Food Strategy, Department of Rural Development, 1982).

Food availability in kilo-calories is sufficient for national needs, but some regions such as the Hodhs, Assaba, Trarza and Inchiri have insufficient rations (1,500 kilo-calories). Poor and unemployed people suffer from serious nutritional and health problems. People on low incomes (UM 4,000 or less a year) cannot afford the food required for a healthy diet.

However, the situation is improving for children because of the work by the Infant Recovery Centers and the Centers for the Protection of Mothers and Children. This improvement has been more marked in urban than rural areas.

6. Dietary habits

Cereal imports and international aid have altered the dietary habits of the Mauritanians. The introduction of new products such as wheat, olive oil, tea, etc., on the market have changed traditional habits. Wheat and wheat flour have replaced souna millet or sorghum, which in good years used to be abundant in the Nouakchott and regional marketplaces.

Despite the priority given by the government to rural areas the crisis is worsening and the growing dependence on imports is discouraging local producers. Mauritania could become totally dependent on the outside world if special care is not taken.

7. Food balance

National cereal production essentially occurs in the southern part of the country which profits from the Sahelian climate. In 1981, cereal production was estimated to be 41,000 tons of a predicted need of 173,000 tons based on a consumption rate of 120 kg per person/per year. Table 13 gives the distribution of the yield.

F. Rural Sector

1. Agro-ecological zones

Mauritania can be divided into four agro-ecological zones. The agricultural potential of each one varies according to rainfall and the availability, of surface or underground water.

a. The alluvial zone of the Senegal River or Chamama

The surface area of this region is estimated at 127,041 ha (Fourth Plan 1981-85). Rainfall averages 350 mm (M'Bout station).

Three types of farming can be found: rainfed farming on the sandy soils of the Diéri; flood recession farming on muddy-clayey soils (hydromorphic soil); and irrigated farming, using water from the Senegal river on "established" and hollalde (heavy-textured vertisol adapted to rice growing) soils.

b. Rainfed and flood-recession farming zones

With a northern limit at the 350 mm isoyhet, this area includes the two Hodh regions, Assaba, Guidimaka and the Brakna, Gorgol and Adrar ridges. It is the privileged area for traditional cultivation of cereals (millet, sorghum) and legumes (cowpeas).

Flood-recession farming traps the receding water of the water streams and is a long-standing practice in the area. Villagers have always fought the harshness of nature by relying on their traditional resourcesfulness; building hill dams and flood-recession dams, for example. Villagers build small earth dikes on streams and rivers flowing down hills and mountains to capture water from annual floodings, and then inundate fields upriver. As the water recedes, farmers cultivate the moistened soil. In 1979 the amount of land under flood recession farming was estimated at 3,000 ha.

In 1979 the area under cultivation farmed with dams increased to 3,000 ha. Without access to reliable agricultural statistics, the Fourth Plan estimated that, in a year of normal rainfall, the amount of land under cultivation reaches 182,000 ha, divided as follows:

- o Flood-recession crops (Walo), 48,000 ha; and
- o Rainfed crops and lowland areas and those farmed through the use of dams, 134,000 ha.

It is estimated that this area could be increased by 96,000 ha of flood-recession farming, depending in the Senegal river to reach a total of 278,000 ha.

c. Palm tree zone

This area consists of a vast crescent which includes the highlands of Adrar, Tagant and a part of the Assaba and Affolé.

d. Pasture zone

Pastures are estimated at 55 million ha, allowing a load of 3.4 to 3.6 million TLU (Tropical Livestock Unit) per year.

2. Agricultural land

Despite the fact that 80 percent of the population is engaged in agriculture, it cannot feed itself. Cultivable land covers only one percent of the territory, and almost all of it is located in the south along the Senegal River. The principal crops are millet and sorghum, which are best suited to the climate. However, they normally give low yields which can vary widely depending on rainfall.

3. Land ownership patterns

A land reform law was adopted in June 1983. It stipulates that land belongs to the state, but private property can be maintained in accordance with the Islamic Sharia. By-laws regulating the organization of the reform are still under preparation.

Meanwhile, traditional land ownership systems still prevail. For example, in the Senegal valley the land ownership system involves a complex relationship between the Hapulaar landowner (Dyom leydi) and the tenant farmer (samba remooru). It recognizes the right to farm and the right of the land master.

The right to farm is the right to sow and harvest a plot of land. It is granted to the first person to farm that land and it is transferable to his descendents. It is called the diéyugol (right to inhabit) or lenré (right of the hatchet). The bearer of this right is called Dyom diéyugol or Dyom leydi.

The right to farm can take different forms;

- o A loan with yearly interest (assakal);
- o A sharecropping contract, half-half rempétien; and
- o A rental agreement with a payment at the beginning of cultivation, followed by payment of the assakal yearly (thiougou).

The land master is the manager of all the plots. He receives payment from the bearers of the right to farm.

4. Principal crops

a. General information

Yields from rainfed farming are generally low. Table 13 shows that traditional crops (millet, sorghum) have yields averaging between 212 and 382 kg per ha with farming on lowlands and around dams producing slightly higher yields. This is the same yield as corn in rainfed agriculture.

Despite its recent introduction, irrigated farming has made remarkable progress. Irrigated corn yields 2,600 kg per ha while rice fields yield between 3 and 3.5 tons of paddy per ha (1,800 kg per ha of processed rice). In villages where water is carefully managed and agricultural techniques well executed (hydrolic wheel, careful transplantaion, etc.) yields are high (five to seven tons of paddy per year).

b. Date production

Date production was estimated in 1980 at 12,000 tons on a surface of 4,500 ha. According to the RAMS (Rural Assessment Manpower Survey, MPAT, 1981) there are 1,024,000 date palm trees.

c. Cereal production

Cereal production in 1981 is shown in Table 14. In relation to the estimated norm of 66,000 tons, production in 1981 represented only 62 percent. The share of sorghum and millet was 75 percent of the total, corn 10.7 percent and rice 13.7 percent. In relation to their respective norms, production of sorghum and millet reached 46.9 percent while corn production was above the average.

d. Market gardening

The persistent drought created and even intensified the development of market gardening, with home gardens and garden plots in some cities. As a result, vegetables are now an important addition to the Mauritania diet. (See Table 15.)

5. Animal production

The Livestock Production Department estimates the composition of the Mauritanian herd in 1981 as follows:

- o Cattle: 1,400,000 head;
- o Camels: 770,000 head;
- o Sheep and goats: 8,300,000 head; and
- o Horses and donkeys: 285,000 head.

Table 13: Crops and Yields

Type	Crops and Yields (ha) 1980-81	Average Yield kg/ha	Production (in tons) 1980-81
<u>Sorghum-Millet</u>			
Rainfed Farming	61,270	212	13,000
Dams and Low Lands	11,500	340	3,900
Dryland Farming	37,000	382	14,100
<u>Irrigated Rice</u> (processed)	3,127	1,800	5,600
<u>Corn (grain)</u>			
Rainfed	7,000	340	2,400
Irrigated	763	2,600	2,000
<u>Wheat, Barley</u>			
	Pm	-	-
Total	120,760 =====	339 =====	41,000 =====

Source : Fourth Plan, 1981-85 - MPAT.

Table 14: Cereal Production

Crops	Production (in tons)	
	1981	Estimated Norm
Sorghum-Millet	31,000	62,000
Flood-Recession	14,000	28,000
Low Land	3,900	14,000
Rainfed	13,000	20,000
Corn	4,400	4,000
Irrigated	2,000	-
Rainfed	2,400	4,000
Processed Rice	45,600	66,000
Total	41,000 =====	66,000 =====

Source: Fourth Plan, 1981-85 - MPAT.

Table 15: Principal Market-Gardening Production, 1981
(t)

<u>Types</u>	<u>Potatoes</u>	<u>Onions</u>	<u>Carrots</u>	<u>Cabbage</u>	<u>Tomatoes</u>	<u>Turnips</u>
Total	87.4	44,676.85	362.05	1,394.8	1,169.09	3,750
	=====	=====	=====	=====	=====	=====

Source: National Report on the Agrarian Reform and Rural Development, MRD, 1983.

However, the number of livestock has varied widely over the years as shown in Table 16.

This table shows that cattle have decreased from 2,050,000 head in 1969 to 1,115,000 head in 1973. This decrease was caused by the drought, which started in 1969. The number of cattle reached its lowest level in 1973 while other species were less affected. It should be noted that camels, sheep and goats are more robust animals and better equipped to fight the drought.

a. Regional distribution of livestock

Table 17 shows the two principal animal production regions in Mauritania: the Southeast (the two Hodhs, Assaba, Guidimaka) and the Southwest (Brakna, Gorgol and Trarza). Sixty-five percent of the country's cattle stock, nearly 50 percent of sheep and goats and 33 percent of the camels are concentrated in the Southeast. The Southwest is home to 25 percent of all cattle, 30 percent of the sheep and goats and 25 percent of the camels.

Natural pastures available for grazing total 55 million ha, but forage capacity varies widely from one year to another and from one region to another. The actual load in Tropical Livestock Units (one head of cattle equals 0.75 TLU; one camel equals one TLU; one goat equals one sheep equals 0.15 TLU) varies from one TLU every 75 ha in the north to one TLU for every four ha in the best areas near the river.

b. Composition of the herd

According to a recent study, the composition of bovine herds has been estimated as shown in Table 18.

Rational management is necessary for herd improvement. Among Moorish herdsmen, there is a tendency toward a more careful herd management with commerce as a goal, sometimes to the extent of over exploitation, while Peulh herdsmen are still operating traditionally among extended families. The money economy and the precarious weather have not served to change their traditional production patterns. The offtake rate is estimated at 10.5 percent for cattle, 30 percent for sheep and goats and 7 percent for camels. It should be noted that animal production accounts for 20 to 25 percent of the GDP (while only 0.5 percent of the budget is earmarked for it).

c. Meat production

Based on the cattle offtake rate of 10.5 percent, the average weight of the carcass and offal is 160 kg for a live animal weighing 270 kg. The average weight of the carcass and offal is estimated at 15 kg for sheep and goats (30 percent offtake rate) and at 180 kg for camels (7 percent offtake rate), as shown in Table 19.

Table 16: Evolution of the Mauritanian Herd, 1969-1981
(000 heads)

<u>Years</u>	<u>Cattle</u>	<u>Sheep/Goats</u>	<u>Camels</u>	<u>Horses</u>
1969	2,050	7,000	780	220
1970	1,920	6,750	720	220
1971	1,550	6,500	705	200
1972	1,500	6,500	700	200
1973	1,115	6,500	670	200
1974	1,150	6,300	680	200
1975	1,293.5	6,840	700	180
1976	1,350	7,500	700	190
1977	-	7,500	700	190
1978	-	8,500	750	200
1979	-	8,500	720	200
1980	1,200	7,000	770	200
1981	1,400	8,300	770	200

Source: Department of Animal Production, MRD, 1981.

Table 17: Estimates of Heads Per Region
(000 heads)

Regions	Cattle			Sheep/Goats			Camels		
	1969	1975	1981	1969	1975	1981	1969	1975	1981
Hodh El Charghi	400	260	380	1,820	1,820	1,600	79.2	77	100
Hodh El Bharbi	320	208	270	1,400	1,500	1,500	72.2	70	85
Assaba	320	208	250	700	700	1,000	43.2	42	70
Guidimakha	160	104	100	350	350	500	-	-	-
Tagant	120	78	50	350	350	400	57.6	56	80
Gorgol	280	143	145	490	490	1,100	7.2	7	10
Brakna	280	182	120	980	980	1,300	86.4	84	45
Trarza	160	104	85	560	560	700	79.2	77	140
Inchiri	10	5.5	-	70	70	150	108.0	105	60
Adrar				280	280	50	187	182	180
Total	2,050	1,293.5	1,400	7,000	7,000	8,300	720	700	770

Table 18: Composition of the Herd
(percentage)

	<u>Males</u>	<u>Females</u>
Calves	8.5	10.5
Young (1-3 years)	12	19.5
Adults	8	41.5

Table 19: Meat Production, 1977

<u>Species</u>	<u>Live Weight</u> (kg)	<u>Carcass Weight</u> (kg)	<u>Offals</u> (percent) (kg)		<u>Total Weight</u>
Cattle	270	130	23	30	160
Sheep/Goats	25 - 30	13	15	2	15
Camels	300 - 325	150	20	30	180

The calving rate is estimated at 56 percent for cattle, 95 percent for sheep and 115 percent for goats, according to the above-mentioned study. The mortality rate is estimated at 10.7 percent for cattle, 13.5 percent for sheep and 14.8 percent for goats.

d. Meat consumption

According to Georgely's estimates, the annual meat consumption per capita was 32 kg in 1977. However, this average varied widely. The city of Nouakchott consumed an average of 31 kg per capita, while a regional town like Kaedi consumed 20 kg per capita. (See Table 20.)

6. Ground cover

Among the countries of the Sahel, Mauritania is the one most threatened by desertification. Indeed, the consequences of the drought coupled with uncontrolled actions by man have seriously reduced the country's vegetation potential since the beginning of the 1970's, to the point that of the 15 million ha of vegetation that existed in 1960, 80 percent have completely disappeared.

Protected forests, which theoretically cover 126,625.9 ha have not been spared by this phenomenon. (See Table 21.)

7. Fisheries

a. Freshwater fishing

Fishermen or subalbés used to fish in the Senegal River and its major tributaries. Freshwater fish was a significant caloric supplement for the coastal population of the Senegal River and these fishermen thus played an important role. However, fishing has lost much of its economic vitality because of the drought. In 1968, fish production reached approximately 10,400 tons; by 1980 it had dropped to a little over 800 tons.

At the same time, the number of fishermen decreased to the point of almost disappearing. Some found employment in the newly-created maritime fishing industry while others emigrated to the industrial centers of Nouadhibou and Zouérate.

With the harnessing of the Senegal River by the Senegal River Development Organization, plans have been elaborated to reconstitute the fish stock with fish reserves in some areas of the river.

b. Ocean fishing

The role of ocean fishing has become more important since the onset of drought reduced the yields of freshwater fishing. The estimated size of the Atlantic catch totalled 35,000 tons in 1980.

Table 20: Per Capita Meat Consumption, 1977

	<u>Cattle</u>	<u>Sheep/Goats</u>	<u>Camels</u>	<u>Total</u>
National Average				
kg	7	19	6	32
Percentage	21	60	19	100
Nouakchott				
kg	8	16	7	31
Percentage	26	29	23	100
Kaédi				
kg	13	6	1	20
Percentage	66	29	5	100

Source : Georgely - FAO 1977.

Table 21: Protected Forests in Mauritania
(in ha)

<u>Regions</u> (number of forests)	<u>Protected Surface</u>	<u>Unprotected Surface</u>
Trarza 14	84,797	400
Brakna 11	12,920	2,200
Gorgol 5	4,452.9	2,800
Assaba 2	16,105	-
Hodh El Gharbi 1	1,650	-
Tagant 3	5,995	-
Guidimakha 1	706	
Total 37	126,625.9	5,400
==	=====	=====

Reforestation Areas (ha)

Trarza : 2 areas	121.21
Brakna : 1 forest and pasture reserve	1.992

Source : Protection of Nature, MRD, 1980.

8. Marketing systems

a. Cereals

Unlike other CILSS countries, Mauritania does not have actively traded cash crops. Most of the cereals produced are consumed by peasants themselves. The excess is only sold when there are unusually good harvests.

The price of cereals was fixed for the 1982-83 crop as follows:

- o One kg of paddy, UM 12.5;
- o One kg of millet or sorghum, UM 13; and
- o One kg of corn, UM 13.

These prices serve as incentives for producers but agricultural input is more and more costly to the point that the state has had to subsidize farmers to keep them on the land.

Weekly farmers' markets, where all types of produce and animals are sold, are common in the southeastern part of the country. This type of activity takes place on the peasants' day off in the villages bordering Mali. Products are either bartered (millet for corn) or sold in cash, generally in Malian francs or in ouguiya.

In the large Senegal river towns such as Kaedi, Boghé, Rosso, etc., market days are generally on Thursday and Friday. Friday is the Muslim day of prayers.

In order to exert some control over the market, the State has intervened by setting up structures such as the Food Security Board (CSA--Commissariat a la sécurité alimentaire) and the National Import-Export Corporation (SONIMEX)--Société nationale d'importation et exportation). CSA manages cereals provided to Mauritania by the international community and intervenes in the market to maintain production prices and prevent periodic price increases. It took over the latter role from the now-defunct Mauritania Cereal Board, disbanded in 1982.

SONIMEX is a state and private corporation which has the monopoly on importation of rice, sugar and tea. These imports are shared by the corporation's 15 regional offices. These agencies distribute quotas allotted to accredited retailers, who then sell these products to consumers for profit.

b. Livestock

Extensive animal production is practiced throughout the territory because it is well-suited to the climate and ecology. This production has always caused herdsmen to migrate regularly from north to south in search of rain. But, since the great drought, another

migration, from west to east, has been adopted because water often runs out in the Guidimaka and Gorgol pastures.

Cattle are traded at the various fairs throughout the territory, especially in the regional and county seats. However, the Nouakchott cattle market is still the most important because of the large number of animals sold. The meat trade is conducted by many middlemen such as brokers, wholesalers and butchers, whose participation causes an increase in retail prices.

Regulating bodies also exist in this area. The Mauritanian Livestock Marketing Corporation (SOMECOB--Société mauritanienne délevage et de commercialisation du bétail) manages the Kaédi slaughterhouse and markets meat in the external and domestic markets. Another such institution is the Mauritanian-Libyan Corporation for Agricultural Development (SOMALIDA--Société mauritano-lybienne pour le développement agricole. Despite these structures, a black market cattle trade between Mali and Senegal still exists. Georgely estimates that 90,000 cattle and 300,000 sheep and goats were exported clandestinely in 1977. This lucrative activity provides foreign currency for the "luxury trade."

9. Agricultural labor

Migration from the countryside to the cities used to be a seasonal phenomenon. During the off-season, agricultural laborers travelled to urban areas to work and earn money for essential products (sugar, tea, fabrics, etc.). When the rainy season approached, these workers would go back to their villages to prepare their fields for cultivation. However, since the onset of the drought, migration has become more and more permanent. Farmers who have given up the hope of working in the village have moved to makeshift houses, called kebba, in the outlying areas of large cities to look for work.

Since it is mostly men who have migrated to the cities the women who have remained in the villages have become more active in agriculture. Fulaar, Soninké, Wolof and Haratine women play an essential role in production of cereals (plowing of cowpea and millet fields) and vegetables. In Guidimaka where emigration is strong, cultivation is mostly done by Soninké women.

The role of women is also important in animal production. They tend the sheep and goat herds, milk the livestock and sell the milk. The development of market gardening has increased the size of female farm labor (approximately 3-4 percent of manpower).

10. Agricultural credit

Agricultural credit was made available in 1980 with the creation of a National Development Fund. However, the fund has not yet played the role expected of it, that is, to provide rural areas with grants before each harvest in order to improve production.

The National Society for Rural Development (SONADER--Société nationale pour le développement rural) manages on an experimental basis, a plan based on a line of credit from the World Bank. Despite these shortcomings, this plan enables farmers working in areas under the jurisdiction of SONADER to have access to means of production which they then repay after each harvest.

ii. Agricultural research institutions

The institutions engaged in agricultural research are:

- o National Center for Agronomic Research and Agricultural Development (CNRADA--Centre nationale de recherche agronomique et de développement agricole) in Kaédi;
- o National Center for Livestock and Veterinary Research (CNERV--Centre nationale élevage et des recherches vétérinaires) in Nouakchott; and the
- o National Research Center for Oceanography and Fisheries (CNROP--Centre nationale de recherche océanographique et des pêches) in Nouadhibou.

There is no need to explain the operation and necessity of these institutes. However, they are facing problems in securing funding for research and in finding native researchers. Senior native researchers are in such short supply that these institutes almost always rely on international technical assistance.

III. AGRICULTURAL RESEARCH INSTITUTIONS

A. National Center for Livestock and Veterinary Research

1. Structure

In 1982 CNERV entered in a new stage of development. Activities have been reinforced and diversified because of a more complete and better structured research team. Its responsibilities in Nouakchott and in the regions have increased with the number of sample and diagnostic missions in different animal production zones and projects concerning the development of a national herd. (See Figure 3.)

The Center's sponsor is the Ministry of Rural Development. The CNERV's objectives are to: increase animal production by decreasing the mortality rate through better control of sanitary and animal husbandry conditions; selection of more productive animal races; and better integration of agriculture and animal production. CNERV is comprised of a center in Nouakchott and a branch office in Kaedi.

2. List of programs

a. Bacteriology Department

(1) Diagnostic

The Bacteriology Department is charged with:

- o Analyzing samples to isolate and identify bacteria affecting different animal species. Emphasis is placed on germs from the respiratory tract (collaboration is projected with the Virology Department on respiratory diseases);
- o Diagnosing poultry diseases in collaboration with the Virology Department;
- o Etiology of the Soussa syndrome in collaboration with other departments; and
- o Study of some bacteriological and physico-chemical aspects of camel's milk.

(2) Research

Efforts will be concentrated on mammitis in large and small ruminants. General objectives include:

- o Extension of the territory of study of infectious mammitis; and

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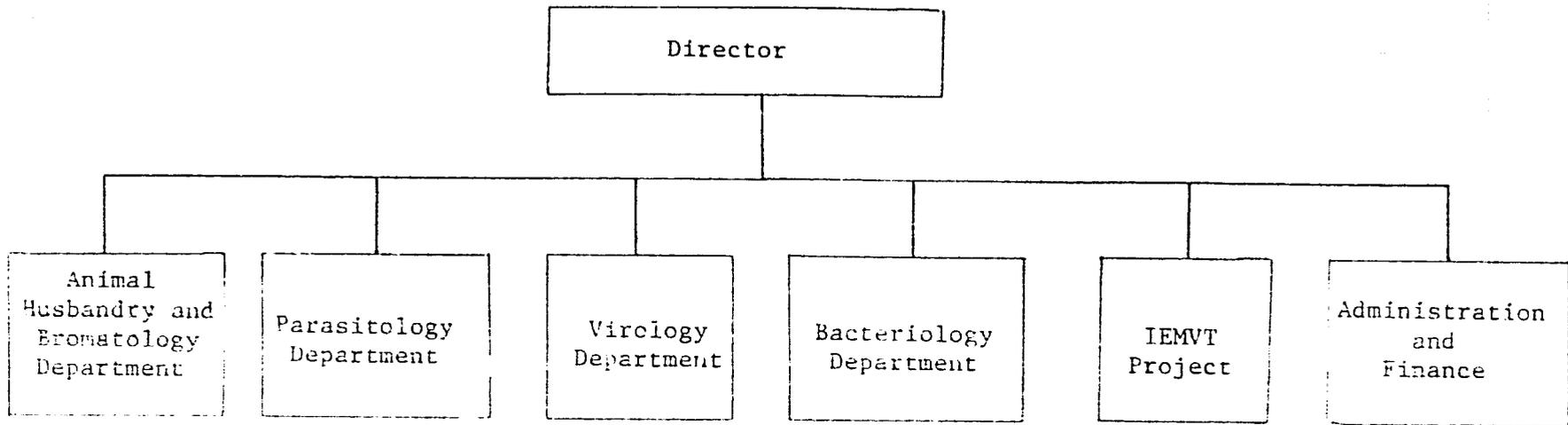


Figure 3 : Organization Chart of the National Center for Animal Production and Veterinary Research (CNERV)

- o Inquiry on mineral and trace element deficiencies in small ruminants as a cause of predisposition to mammitis (in collaboration with the Bromatology Department).

More specific goals include:

- o Testing of a vaccine to prevent staphylococcal mammitis among small ruminants;
- o Preparation of a staphylococcal toxoid from local bacterial sources; and
- o Study of lysotype, serotype, antibiotype and the causes of their presence, of staphylococci, streptococci and colibacilli present in mammitis.

(3) Staff Training

The different operations required by these activities will be used systematically to train new staff on medical bacteriology techniques. As much as possible, study and handling of some collected germ sources will be involved.

b. Virology Department

(1) Diagnosis

This phase will involve:

- o Specific study of the area of origin of enzootic disease upon request from the Livestock Department;
- o Laboratory diagnoses, analysis of samples provided; and
- o Diagnosis activities will be intimately linked to the evolution of programs, as they require adaptation and elaboration of new tests that will increase the number of diagnoses that the Center will be able to practice routinely.

(2) Applied research

(a) Respiratory diseases of small ruminants

(i) Survey in the river region

Herds in the river region have been studied since January 1983 in order to:

- o Evaluate the incidence of respiratory diseases in the cool season and their clinical evolution;
- o Attempt to isolate viruses from diseases; and

- o Through the presence of antibodies in the serum and nasal mucus, search for incidence of respiratory tropism viruses: small ruminants plague (PPR - peste des petits ruminants), P13, reovirus and adenovirus.

Viral epidemiology: the frequency of infection by these viruses in Mauritanian livestock will be evaluated by an analysis of serum (Nouakchott slaughterhouse and in the regions).

(ii) Testing of Vaccinations

An evaluation of preventive treatments is planned by the end of the next rainy season in collaboration with the team from the Project "Training of Gorgol Herdsmen". Also planned are vaccinations against small ruminant plague and, eventually, testing of an inactivated vaccine in oily adjuvant.

(b) Small ruminant plague

The Respiratory Diseases Program will evaluate the frequency of antibodies against this disease in Mauritanian livestock and the efficiency of vaccination. In regards to the early diagnosis of PPR, the presence of antibodies in nasal mucus may be a sign of infection by the PPR virus (unlike seric antibodies that can be injected by vaccination). This hypothesis will be tested in order to establish a rapid and sure method to diagnose natural infection by the PPR virus.

(c) Pathology of the dromedary

The lack of basic data on this species and the difficulty in obtaining such information and field samples dictates the following approach:

- o Study upon request in area of origin of enzootic disease and attempts to isolate the virus; and
- o Study of the dromedary's immune functions.

Diagana Elimane is working on finding the normal blood formula of the dromedary and devising a simple test to measure its immune functions. This way, we hope to acquire quantifiable parameters to study syndromes of unknown etiology.

(d) Bird diseases

A support mission (Project Fleury) is planned for the end of the year. Samples on migratory birds at the Arguin sandbank will be taken in order to conduct an epidemiological study of infection by the Yucaipa virus and to carry out research on infections transmissible by these birds to livestock.

This will be the starting point for adapting a routine test to diagnose main bird viruses.

(e) Abortive diseases

The Serology laboratory will, upon request, conduct routine analyses of chlamydiosis, rickettsiosis and IBR/IPV within the framework of programs conducted by the IEMVT team.

(3) Staff Training

Training will continue to occupy a special place in the operation of these different programs.

c. Parasitology Department

(1) Routine activities

These shall include analysis of samples upon request from other departments or individuals, diagnosis of parasites upon request from other departments or individuals, and diagnosis of parasitic diseases on animals brought for consultation.

These activities, routine as they may seem, are conducted in order to obtain data for our research activities.

(2) Research activities

(a) Inventory of external and internal parasites

Inventories of external and internal parasites among different animal species are conducted, emphasizing camels, small ruminants, and poultry.

In the case of internal parasites and particularly helminthes, autopsies will be necessary to gather adult worms, this being the only possible way to make a positive identification.

(b) Diagnosis of external and internal parasitoses

This will accompany the inventory of parasites. The animal species mentioned above will be the focus of attention.

We will study in particular the following parasitoses: trypanosomiasis, helminthoses, myiasis cavitaires and parasitic dermatoses.

In our report we noted the difficulty of identifying flagellates. Concerning parasitic dermatoses, we also noted that within the context of the Mauritanian climate and extensive animal production an outbreak of scabies or ringworm is not expected.

Mass samples of high quality at the appropriate times will be the prime guarantee of efficiency.

(c) Attendant epidemiologic surveys and therapeutic experiments

These will comprise part of the accompanying investigations whenever possible. Within the context of epidemiologic surveys, we shall pursue the study of cetodoses in dogs which are the origin of hydatidoses in animals and humans. Note that autopsies have been performed on 500 dogs for this purpose.

(d) Support to outside projects

The Parasitology Department will support any animal production or animal health project upon request from the CNERV directorate. A draft list of experiments has been given to the Livestock Department in the form of proposals on the Gorgol Project.

(e) Training work

This will involve permanent training of an assistant and of a laboratory aide assigned to the Parasitology Department. There will also be training for interns upon request.

d. Animal Husbandry Department

This department is involved in:

- o Bromatological analysis;
- o Control of imported meat;
- o Follow-up on poultry farming;
- o Establishment of a new laboratory;
- o Follow-up on laboratory animals; and
- o Mineral and trace element deficiencies in small ruminants (in collaboration with the Bacteriology Department).

3. IEMVT Project on dromedaries and small ruminants

a. Dromedaries

(1) Pathology

This project will involve study into the causes of death (above all among the young), carried out through observation, autopsies and samples-gathering. There will be systematic sample taking at the Nouakchott slaughterhouse for the Bacteriology and Virology Departments of the CNERV.

Epidemiological investigations and serological studies will be carried out on brucellosis, rickettsiosis, chlamydiosis, and Para II, as well as investigations of the "Soussa" syndrome.

(2) Economics of animal production

This side of the project will involve the study of milk production in the Nouakchott area and in the interior, as well as surveys of the various regions with the IEMVT questionnaire. The objectives of the survey are to determine state of the herd, composition, reproductive life of females, pathology, practices in the slaughterhouses, and caravans. There will also be a continuation on the study of herds in Trarza.

b. Small ruminants

As regards small ruminants, the study will involve research on the causes of death, carried out through observation, autopsies and sample-gathering.

There will be systematic sample-taking at the Nouakchott slaughterhouse for the Bacteriology and Virology Departments of the CNERV.

The production of small ruminants is very important in the southern part of Mauritania. Numerous projects are located in this zone which specialize in small ruminants: The Southeast Mauritania Project (EDF), the Southwest Mauritania Project (World Bank) and the DRIG Project (Sélibaby - USAID).

Support missions to these projects have been set up, particularly in the Southeast. Epidemiologic investigations are conducted (Brucellosis, small ruminant plague, rickettsiosis, chlamydiosis, para II). Controls will be implemented to assure the profitability of anthelmintic treatments.

c. Miscellaneous

An investigation into the presence of antiseptic antibodies in Mauritanian cattle will be conducted in conjunction with the IEMVT of Bamako.

4. Analysis

As in all countries of the Sahel, livestock production is extensive and predominately transhumant. However, near large urban areas a sedentary type has appeared. Animals graze near these cities during the day and receive a complementary ration of concentrated foods back at the farms in the evening.

Natural pastures made up of vast spaces where grasses, leguminous plants and shrubs predominate will continue to serve as the principal source of food for livestock for the foreseeable future.

As in every type of extensive or intensive animal production, production is usually linked to constraints that can interfere with its rational development if these are not removed. The constraints in Mauritania can be summarized as follows:

- o The very low rainfall levels limit the availability of fodder so that supplies vary widely from year to year;
- o The distance between watering areas (in general, pastures are far from the water) forces animals to travel long distances. The energy lost diminishes the livestock's production potential;
- o The persistence of the drought has spurred the evolution of a new pathology, unknown until recently;
- o Traditional habits exert a large degree of influence on production patterns. Current forms of herd management have only one goal in mind--increase in the number of livestock -- rather than rational development of the herd. Too often there is an overabundance of males or old females in the herds; and
- o Transportation, above all by camel, remains a constraint (which should, in certain conditions, be reevaluated).

Since Mauritania is a pastoral country, meat and milk are largely present in human food consumption. Meat production is currently estimated at 71,592 tons while milk totals 1,740,000 hl. To improve meat and milk production it is necessary to conduct some research in order to overcome the above-mentioned constraints.

Interdisciplinary research in these realms would have many complementary and overlapping aspects. In regards to conditions of production and the environment, studies would involve the grass and tree cover in relation to the environment and the evolution of its composition and production. In regards to the herd, areas of interest would include numbers, composition and the economics of animal production.

In terms of production methods (improvement of management, etc.), rehabilitation of the notion of pastoral space is required. It is also necessary to bring a sense of responsibility for the pastures and their conservation among the herdsmen. Also important are the development of techniques to improve management of herds of different species, including goats, sheep, cattle and camels.

In other areas, study of the new animal pathology that arose during these years of drought and training and retraining of men (department officers and herdsmen) are also key objectives.

Finally, we must focus on the training of men and cultivation of leadership. Agricultural development in the Sahel will rest upon these fundamental elements.

B. National Center for Agronomic Research And Agricultural Development - CNRADA

1. Structure and Objectives

Agronomic research in Mauritania started in 1949 with research on date palm trees by the IFAC. Another research institute (IRAT) conducted research all along the valley on flood-recession sorghum farming, and rain-fed cultivation of millet, cowpeas and corn before independence. The succession of dry years since the 1970's put an end to research by these two institutes.

On November 7, 1974, Decision 74,208 established the CNRADA with the mandate to conduct applied field research on the country's main crops.

As shown in Figure 4 CNRADA is divided between the general directorate and the technical directorate by services and divisions. However, not all services and divisions are fully operational due to lack of funds and qualified specialists. Outside of the administrative services, the Extension and Rural Economics Service, the Fruit and Vegetable Service, the Rice Division and the Food Crop Division are operational. The Seed Service became operational after January 1984. The laboratories will not open until after the CNRADA headquarters is built (bids are now being taken).

CNRADA is sponsored by the Ministry of Rural Development.

The National Center for Agronomic Research and Agricultural Development organizes and conducts research and distributes their reports on any subject involving agriculture and promotion of agriculture. It carries out experimental work in the following fields: plant selection, seed improvement, methods and systems of cultivation, study of basic conditions affecting production, association between vegetable and animal production, soil and water conservation, crop protection, and farm machinery and equipment.

The CNRADA is also charged with the introduction of new species and crops, preliminary popularization studies in rural areas on application of research conclusions, in-the-field adaptation of farming systems and techniques and methods of land improvement.

Other activities include the study of techniques and methods that assure a rational use of natural resources (pastures, water, forests). Finally, more generally, CNRADA is involved with any studies or work investigations that are concerned with the technical and economic evolution of agriculture as well as the practical application to agriculture of discoveries in biological, physical, chemical and social sciences. It dispenses advice and information on the promotion of agriculture and preparation of any documentation required by the extension services. It also organizes information and training sessions for agricultural technicians and provides any information

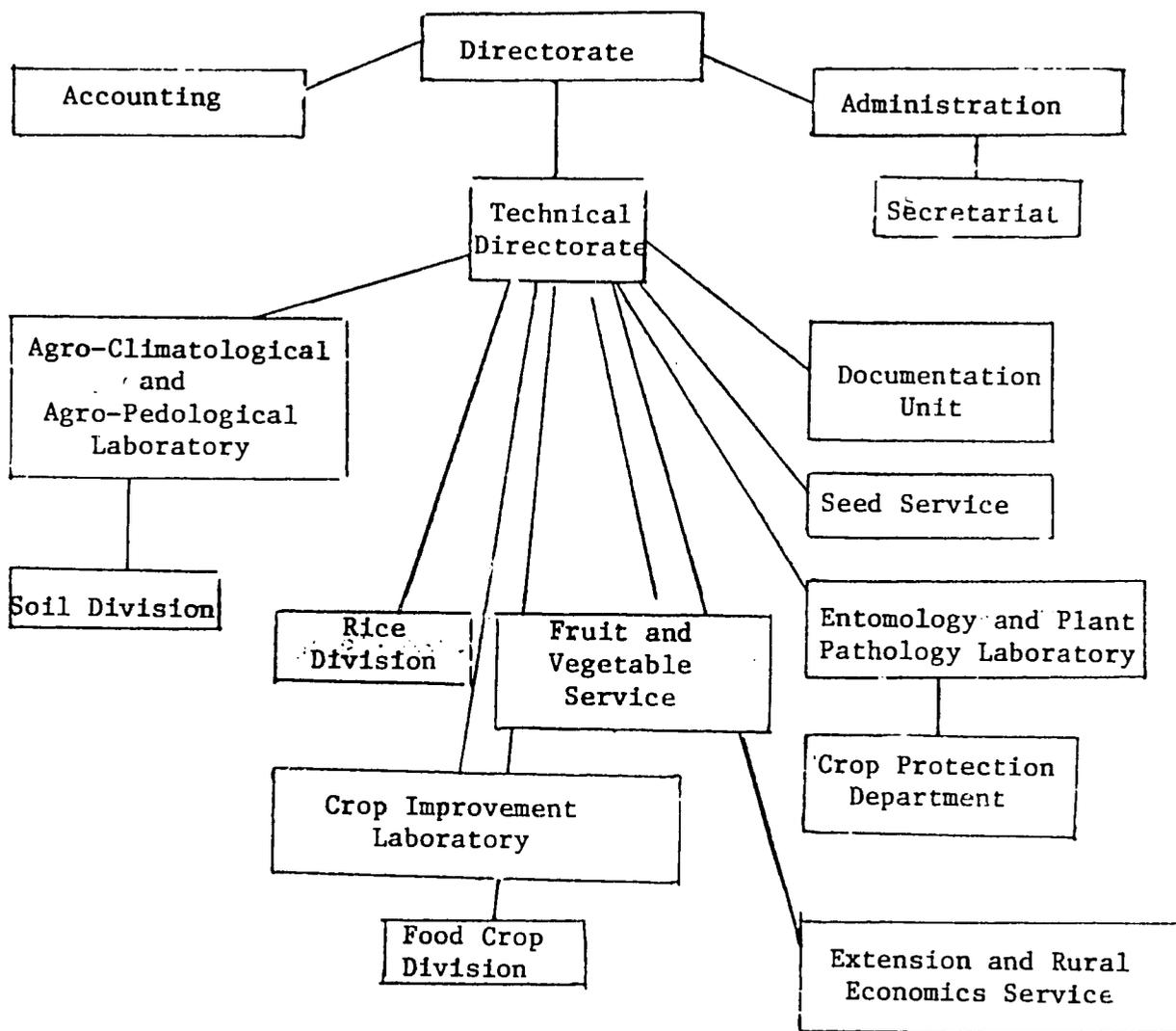


Figure 4 : Organizational Chart of the National Research Center for Agronomic Research and Agricultural Development (CNRADA)

necessary for the preparation of national plans on agricultural development.

The Center will direct its studies and work according to these objectives and within a general strategy for rural development, striving for balanced national development.

2. Research stations

Apart from numerous projects in every region, CNRADA has the following facilities:

- o A research station of 50 ha at Bélinabé;
- o An experimental farm area of 23 ha at Bélinabé II;
- o An experimental farm area for fruit and vegetable growing in Rindiaw (ten ha);
- o A seed laboratory in Rindiaw; and
- o A seed center of 50 ha under preparation.

Funding has been acquired to start projects by the CILSS-EDF for experiments in Kaédi, Barkéol and Sélibaby (rainfed crops) and by the CEAO for production of onion seeds.

3. Programs and projects by sector of activity

a. Research program

This program has been set up in order to lift constraints which burden rural areas. It is directed towards every sector of agriculture and requires a good knowledge of the milieu and conditions which affect climate, soil and human behavior. The program is designed to be a concrete application of wider national principles in research and rural development in the fields listed below.

(1) Agro-pedology

This field involves the study of climatic constraints (temperature, sunshine, pluviometry, etc.), the analysis of climatic risks through the periodical study of drought periods and normal seasons, water needs of the different crops and adaptation to the availability of water, and the study of the hydrodynamic characteristics of soils, their variability under cultivation and the dynamics of irrigated soil.

(2) Fertilization

In this area, activities include the development of methods for sampling and analyzing soil fertility and for estimating the nitrogen and potash content in soil; the study of soil's physical and chemical characteristics; the study of the soil's

pH variability in different ecological zones; the development of optimal doses of mineral fertilizer and research on organic manure; soil improvement with the use of green fertilizer and leguminous plants; and the use of nitrogen-fixing algae (azolla) in rice-fields.

(3) Farming techniques

Here studies will involve density, sowing dates, fertilizer spreading methods and plowing methods.

(4) Selection and genetics

This includes crossbreeding and hybridation.

(5) Entomology and plant pathology

These fields involve the inventory of predators and harmful insects, the inventory of main plant diseases, and the development of efficient methods to fight against them.

b. Food crops

(1) Rice

The project includes research into varieties resistant to cold from October to February, heat from March to June (over 45°), extremely dry air from April to June, and usual diseases and insects. Researchers will also attempt to develop high-yielding (seven to ten tons per ha) and short-cycle (90-110 days) varieties, as well as post-harvest techniques (processing, conservation, technology). Other objectives include development of farming techniques for a two-crop year, seed production (foundation seeds, Geno), multi-site experiments, crop rotation, and chemical defoliation.

(2) Millet and sorghum

In this area, the project will involve research on high-yielding, short-cycle varieties resistant to disease and insects, research on nutritious and organoleptic varieties acceptable to consumers, perfection of farming techniques and multi-site experiments.

(3) Wheat

Research will be conducted on varieties adapted to Mauritania's different agro-ecological zones (valley, oases, walo), as well as research into high-yielding varieties resistant to disease and insects. Attempts will be made to develop farming techniques with a strict sowing schedule and post-harvest techniques and technology.

(4) Corn

New varieties will be researched, introducing composites and hybrids and investigating farming techniques, crop and conservation techniques, crop rotation, and the economics of corn cultivation. There will be multi-site experiments.

(5) Cowpeas

The project involves research on new varieties, farming techniques, conservation, insect control, and multi-site experiments.

c. Fruit production

In terms of fruit, activities will include introduction of high-yielding varieties adapted to the different ecological zones, research on new varieties, farming techniques, research on windbreakers, and needs in water and fertilization. Also important will be research into control of the blooming process, the fight against harmful elements, the economics of fruit growing, fruit growing in conjunction with vegetable growing, and development of technology. The species to be studied are the banana, citrus, mango, guava, papaya, and the pomegranate.

d. Market gardening

The program consists of research on new varieties, an inventory of local varieties, the introduction and development of new varieties and the search for new high-yielding varieties resistant to disease and harmful elements. Other objectives include the development of farming techniques, research into water needs for vegetable growing, the development of vegetable conservation techniques and the economics of vegetable growing.

Local species are the gumbo, diakhatou, watermelon, green pepper and sweet potato. Imported species include the tomato, melon, carrot, onion, turnip, eggplant, lettuce, cabbage, cucumber, squash and potato.

e. Industrial agriculture

(1) Sugar cane

The program is geared toward research on new varieties of sugar cane.

(2) Cotton

The program will consist of research on new varieties and the role of cotton growing in agricultural systems.

(3) Date palm tree

The project goals are the biological control of the cochineal insect (*pariatorea blanchardi targ*), the renovation of the Adrar palm tree areas (divided in three sections) and improvement of existing wells and construction of new hydraulic facilities. Other important objectives are the improvement of farming with modern techniques, creation of a processing plant for a better use of produce, and the creation of socio-economic units and co-operatives. Finally, the program involves study of the development of the date palm tree, study of vegetal reproduction material and of blooming and artificial pollinization.

4. Experiments and application of research findings

The program involves full-size testing of agronomic research results. Specifically, it seeks to increase experimentation locations, organize and supervise the farmers who produce seeds, create national and regional tree and seedling nurseries, and publish farm periodicals accessible to farmers and employees of the extension service. Finally, it will involve the training of supervisors.

5. Human resources and training policies

The staff of the research center consists of:

- o Two doctors (senior engineers in rural economy);
- o One rural economy engineer;
- o Eight research associates (instructors in rural economy) who have attended six to nine month internships in specialized international institutions (WARDA, ICRISAT-SAFGRAD);
- o Seven research assistants (aides trained by the National School of Agriculture); and other
- o Assistants, observers and skilled labor plus approximately 20 auxiliary research personnel trained by the Center according to the needs of its divisions.

Other interns are scheduled to start working in 1984 and 1985 and are currently being trained, including one entomologist, one specialist in azolla, one fruit growing specialist, one food crop specialist and one market gardening specialist.

In 1983 and 1984, interns have been trained in the following specialties: fruit growing, three month internship in Ivory Coast; professional documentation, twelve month intership; and general research management, twelve month intership.

6. Financial Resources

The lack of adequate government funding condemns agronomic research to stagnation and threatens medium-range results and the development of agricultural production. There have also been recurrent cuts in funding of specific projects in agronomic research by international institutions and allied countries. The delays in obtaining outside funding, along with inflation and frequent setbacks, can only increase the risk of failure in meeting our goals and threaten short-term results.

7. Scientific and technical information resources

The Center's role is to survey, study and work on any problem that arises from the technical and economic evolution of agriculture, as well as apply to agriculture new findings from biological, physical, chemical and social sciences. It also provides advice and information on agricultural promotion and prepares any necessary documentation for extension services.

8. Analysis of problems

The priorities in agronomic research are:

- o To assure food security for the population through national production;
- o To reduce and curb the rural exodus through rural development; and
- o To control desertification through applied research in integrated models that can be controlled and popularized by the development sectors.

The first major difficulty of CNRADA is finding enough funding for its agronomic research work. The national budget is not sufficient. This hampers agronomic research, causing it to stagnate, and threatening medium-range results and the development of agricultural production. Funding of specific projects by international institutions and allied countries has been repeatedly cut. The delays in getting outside funding, along with inflation and frequent setbacks, can only increase the risk of failure in meeting our goals and threaten short-term results.

The second major difficulty is that research work is often confused with improvised actions in extension and development services. In their wish to innovate, extension personnel often look for new techniques and researchers must then concern themselves with extension efforts as well. The mutual waste of skills and duplication of effort, along with the budget difficulties, threaten present and future work.

A third area of difficulty involves selection of priorities. Contrary to prevalent opinion, our priorities - research and development - can be shared by everyone.

C. National Center for Oceanography Research and Fisheries (CNROP)

1. Mission

CNROP is charged with ecological and biological studies of marine species, hydrologic studies, and studies relative to abundance and distribution of species in Mauritanian waters. Other responsibilities include evaluation of the potential biomass of Mauritanian waters, estimation of the halieutic stock, follow-up on the evolution of fishing in order to establish the fishing rate of each species. Further, it is concerned with the study of the conservation processes of fishery products, sanitary control of fishery products and processing plants, study of the profitability of fishing vessels in Mauritanian waters and with the impact of fishing on the Mauritanian economy. Also, CNROP is to set quotas and propose planning programs for Mauritanian fisheries and collect data on prices of exported fish, fishing vessels and equipment.

2. Structure

CNROP is divided into seven departments:

- o Oceanographic research and marine biology;
- o Economic data and biological statistics;
- o Technology of fishery products;
- o Technology of fishing vessels;
- o Information and documentation;
- o Administration and finance; and a
- o Nouakchott Branch Office.

a. Oceanographic Research and Marine Biology Department

(1) Mission

This department is charged with ecological and biological studies of freshwater and saltwater species, the inventory of fish stocks, harvesting index of stocks, and follow-up on stock harvesting. It is also involved with the estimation of primary production and the determination of reproduction, growth and development areas of various species.

(2) Structure

(a) Hydrology and Primary Production laboratory

This laboratory is involved in hydrological observation, analysis of hydrological data and estimation of primary production.

(b) Dynamics of Harvested Species, Laboratory for the No. 1

This laboratory works with pelagic species, the structure of harvested pelagic species, the estimation of pelagic stocks and the determination of harvesting indexes of such stocks.

(c) Dynamics of Harvested Species, Laboratory for the No. 2 (Demersal Species)

Here, studies involve the structure of main harvested species, the estimation of demersal stocks, the estimation of harvesting indexes and the ecological and biological studies of main demersal species.

(d) Zooplankton Laboratory

This laboratory identifies hatching and growth areas and studies the composition of zooplankton. It also is charged with the identification of fish larvae.

(e) Freshwater Hydrology Laboratory

This laboratory conducts biological and ecological studies of freshwater species, estimates the quantities freshwater fish stocks and identifies hatching areas and fish production areas. It also studies the impact of harnessing the river on freshwater species.

b. Economic Data and Biological Statistics Department

The Department consists of three sections. First, there is a laboratory which gathers and analyzes statistical data, and centralizes all economic, biological and hydrological data. The fisheries division keeps files on fishing fleets, collecting data on the lengths of trips, fishing periods, times of inactivity and operating expenses. Finally, the production and marketing division surveys the production per corporation, situation of exports and fishing rights, and does follow-up work on prices for export and at disembarkation.

c. Technology of Fishery Products Service

This service also has three divisions. The bacteriology laboratory conducts bacteriological analysis of products, and identifies the causes of food poisoning from fishery products.

The biochemistry laboratory analyzes humidity, alkalinity, mercury content, etc. Finally, the third division is in charge of experimentation and extension of conservation processes and techniques, such as:

- o The study of conservation techniques;
- o The improvement of traditional processes;
- o Dispensing advice on packing fishery products;
- o Sanitary control;
- o Inspection of fish processing plants; and
- o The extension of processing and conservation techniques.

d. Fishing Vessel Technology Service

Here there are two divisions. The Fishing Vessels Division studies the performance of fishing vessels, the efficiency of various fishing techniques and experiments with different fishing vessels in an attempt to improve fishing processes and techniques. The Initiation and Extension Division, in collaboration with other departments, will train fishermen and fleet owners on any new fishing technique already tested by the Center.

e. Information and Documentation Service

This service distributes the Center's newsletters and manages the center's library.

f. Administration and Finances

This service is charged with the recruitment of new personnel, decisions on promotion, leave and disciplinary actions, and centralization of all by-laws pertaining to the Center's employees. Other functions include accounting and centralization of the by-laws regulating public accounting.

g. Nouakchott Branch Office

The office is charged with administration of the Nouakchott Center, data collection on fisheries, sanitary control, and gathering of hydrological data in Nouakchott.

The present organizational structure will take effect once approval is secured from the Ministry of Fisheries and Maritime Economy.

IV. TRAINING INSTITUTIONS

A. The National School of Agricultural Training and Extension (ENFVA - Ecole Nationale de Formation et de Vulgarisation Agricole)

ENFVA in Kaedi is the only institution in the country which provides training in agriculture. Established in 1964, it specializes in training rural works foremen in the areas of agriculture, animal husbandry and environmental protection, as well as training rural extension instructors. The foremen (Cycle B), who are recruited in their last or second to last year of secondary school, receive three years of training. The instructors (Cycle C) who enter the school in their third year of secondary school (at the BEPC level) also take a three year program. When the training is over, they are assigned to various rural development services where they work as middle level cadres. Rural foremen are thus transferred to rural sectors, rural extension services (such as the M'Pourié Farm in Rosso), SONADER regional sectors, or else to agricultural projects, etc.

The animal husbandry assistants, for their part, are assigned to veterinary services (Department of Animal Husbandry, regional livestock inspection stations, livestock projects). The forest-rangers work in the inspection stations and local outlets of the Environmental Protection Services.

ENFVA in Kaedi received financial and technical assistance from the FAO and UNDP up until 1981. This assistance consisted of management of student training, as well as of the local trainers. Today, all these classes are taught by national instructors and the school budget is financed entirely by the State.

However, given the increasing needs for supervisors in rural areas, training institutions are becoming too limited. This is why the school is being expanded. Saudi Arabia is providing UM 100 million in funds for the enlargement of the school, which could then offer higher-level training (for engineers). An international bid has already been issued, and the project is well along.

The school owns a very large estate which spreads over 112 ha of which 32 are used for crops (demonstrations by the trainees, experimental plots of rice, millet and vegetable crops). The remaining land is used as pasture for the farm's cattle and as forestry areas.

There is a fairly good library but many scientific books are lacking. There are few periodicals or newsletters on research and extension. Thus, information on new techniques which is circulated through this kind of publication are lost to the students.

B. Human Resources

Presently, the school has 12 instructors assigned to various subjects, eight training assistants and two contractors. They are all nationals. It should be stressed, however, that some subjects (such as rural engineering) are not taught for lack of staff and technical means. Efforts will be made in the future to make up for these inadequacies.

Moreover, as soon as the next school year starts, a training program in Arabic will be introduced in an effort to achieve a better integration of the school in the environment.

C. Principal Problems

One of the major problems for the school is the lack of ongoing training of local instructors, without which all efforts are meaningless. The pedagogical training of instructors is indispensable if the education level is to be constantly upgraded. This is why short-term training during vacations and scientific conferences are necessary to provide refresher training and inform the instructors about the techniques newly implemented in the area of rural extension.

The second problem is the lack of collaboration between research activities, extension services and the school. The ties between research activities and the school must be improved in order to enable the training institution to benefit from research discoveries. This is why it is necessary to let the students know the results of research work and thus establish a permanent link between these two services.

V. EXTENSION INSTITUTIONS

It would be superfluous to speak of extension institutions, since they do not exist in the strict sense of the term. But there are extension centers and units at different levels:

- o Extension service of the Directorate of Agriculture within the Ministry of Rural Development;
- o Extension service of the CNRADA.

These two services are not presently operational.

The extension divisions of the SONADER and the ENFVA, the cooperative training center of Boghe and the various projects financed by non-governmental organizations all provide extension services, but they are not coordinated. Only a few of them have established relations with one another. A conference on extension services attended by reserchers, trainers and producers was recently held in Nouakchott to find solutions to this problem which does a disservice to the rural society.

The themes which are generally extended are:

- o The stages of the agricultural cycle (the cultivation cycle);
- o Cultivation techniques (soil preparation, sowing, planting out of rice seeds, weeding, etc.) ;
- o Maintenance of irrigated plots and water management;
- o Organization and management of pre-cooperatives and cooperatives;
- o Crop protection;
- o Fertilization techniques;
- o Environmental protection;
- o Herd management; and
- o Other specific themes.

A. National Society for Rural Development (SONADER - Société nationale de développement rural

The SONADER was created in 1975 by decree 76,036 of February 12, 1974 and 78,133 of June 22, 1978.

It is the principal agency responsible for implementation of the hydro-agricultural development policy and the rural development program set forth by the Ministry of Rural Development.

It is the national level development division with supervision and extension services, credits and agricultural inputs which is most specifically responsible for rural extension services.

SONADER has assumed the extension services of the Ministry of Rural Development and the CNRADA, which are no longer operational.

At the regional level, there are four sectors: Rosso, Boghe, Kaedi and Gouraye. Kaedi and Boghe are SONADER's regional directorates. The extension service, which includes a manager, an extension agent, a workshop director, a credit director and field extension workers, is in charge of extension for farmers working on irrigated plots.

SONADER is an industrial and commercial State enterprise sponsored by the Ministry of Rural Development.

It has an administrative advisorship, the president of which is the secretary general of the Ministry for Rural Development.

B. National School for Agricultural Training and Extension (ENFVA)

This school is financed by RIM and FAO.

The school's principal activities are in the field of food and market-garden crops, livestock, counseling on castration, parasite control, disinfection, fodder utilization and conservation, and the production of market garden crops through the school cooperative.

The target zones are in the Gorgol areas (in the close vicinity of Kaedi) in the Sahelian zone.

The school organizes training seminars for the Gorgol area farmers, which consist of field demonstrations, slide shows on market-garden crops and orientation sessions for women on cultivation techniques of market-garden crops. Students participate in the training of local farmers.

The following are problems faced by the school: an inadequate budget for the purchase and distribution of seeds, agricultural equipment and production inputs to the farmers.

There is no investment budget and operational costs of the extension services are included in the overall budget, which is itself largely inadequate. No training of extension workers has been planned although there is a pressing need for it. On the other hand, the school benefits from relatively good access to the limited research facilities and good collaboration with field technicians. There is little collaboration at the managerial level.

The attitudes of the farmers toward the school vary. Those farmers who have already acquired some experience are usually receptive, as are the farmers living nearby. First contacts are often difficult with other farmers.

C. Boghe Center for Cooperative Training (Centre de formation coopérative de Boghé)

1. Financing

Financing is provided by the Ecumenical Council of Churches, UM 5,132,586. The total cost of the project is 8.6 million (1979-80). A two year extension has been granted starting in December 1983, along with a three year extension (1984-86) by an agreement of October 31, 1983. The Center recently received a grant in the amount of FCFA 25,000,000. The project received UM 890,000 in matching Mauritanian funds in 1982.

2. Objectives

Training farmers to participate in the cooperative activity, "accounting techniques and economic management."

3. Accomplishments

The school has organized numerous internships, cooperatives and pre-cooperative associations, and provided training in internships for sector managers and pre-extension agents.

D. List of Institutions Having Extension Functions

1. Barkéol Integrated Rural Development Project (FLM - Federation luthérienne mondiale)

a. Objectives

The Project's objectives are:

- o Reforestation;
- o Animal traction;
- o Cultivation techniques;
- o Development of new varieties;
- o Construction of dams;
- o Development of market gardening; and
- o Establishment of vegetable and forage crop production test plots.

b. Financing

Funding is determined each year by the FLM as a function of actual needs. In 1979 the total was UM 7,559,010; in 1980 UM 10,639,125; in 1981, UM 11,130,840; in 1982, UM 12,368,835; and in 1983, UM 10,125,000.

2. Rosso Integrated Rural Development Project

a. Financing

Funding is provided through a RIM and COSOC (Wipe) agreement ratified by ordinance 79,321 of November 20, 1979. The project began on January 1, 1980 and was completed on December 31, 1983. The total cost is UM 64,402,086.

Fifty-one percent of the financing came from foreign sources. The EEC provided FF 318,950; Belgium, FF 500,346; and Wipe, FF 390,000. The farmers provide another 42 percent and RIM covers the remaining 7 percent (personnel).

The 1983 Budget No. 764 was UM 13,300,000; the BMCD account No. 764 of Sept. 21, 1983, UM 1,087,369.48.

b. Objectives

The project objectives involve: agriculture, rice cultivation, market gardening (four plots of 20 ha); reforestation (20 ha); the promotion of health (medicine); education of women; and providing classroom materials to four villages.

c. Accomplishments

The objectives were attained.

3. Gorgol Integrated Rural Development Project

a. Financing

Financing was arranged in two phases. The first phase involved the agreement signed on April 12, 1980, based on an ordinance of October 21, 1970, which consisted of a grant from Caritas of UM 7,533,600. The first stage was completed in April 1983.

The second phase consisted of an agreement signed on October 15, 1983, which consisted of a Caritas grant of UM 46,574,000, and matching funds totalling UM 5,704,000 from RIM. The project will be completed on March 31, 1986.

b. Objectives

The objectives include integrated development in four villages of the Gorgol region (Tufunde, Cive, Paliba, Dao, Taga) in the following areas: rice cultivation, market gardening, reforestation, health, training and rural promotion.

c. Accomplishments

The project is a success. In addition to numerous training and extension activities, 60 ha of irrigated plots were developed as well as new facilities (pharmacy, dispensary, wells, etc).

4. Dryland Farming Development Project in the Assaba and Guidimaka Areas

a. Financing

Funding was secured through FAC Convention No. 282/C/DOF/79 of September 19, 1979. The sum total was FF 1,500,000, of which 20 percent was a grant and 80 percent a loan. RIM supplied UM 1,100,000 in matching funds for personnel costs.

The project was completed after December 31, 1982. It is now planned that the project will be re-directed towards the Guidimakha area by drawing on the following funds: the balance of the CCCE/FAC budget; the proceeds from the sale of equipment; and the proceeds from the sale of food provided by France in 1982, equivalent to UM 1,056,200, available on July 1, 1983.

b. Objectives

The project's objectives were to increase grain production and area planted to grain and to improve cultivation techniques through the introduction and distribution of animal traction equipment.

c. Accomplishments

The objectives were not achieved. The lack of interest on the part of the agricultural sector personnel has had the following consequences:

- o Weak extension (except when it was part of another project);
- o Very little animal traction equipment was sold (with the exception of plows); and
- o Difficulties in collecting the amounts owed for the credits tied to the sale of equipment.

5. Training and Rural Improvement Project in the Karakoro Area (GRDR)

a. Financing

Funding has been provided from the French Cooperative Mission, (CCCE - Comité français contre la faim - French committee against hunger) provided FF 852,992. RIM provided FF 94,735 in matching funds. The project will be completed on November 30, 1984.

b. Objectives

The project objectives were the creation of a training center, the development of market-garden crops and improved cultivation techniques. The project also promoted cooperative activities in such fields as credit, procurement and marketing. The activities geared to women involved health, cooking, nutrition and basic literacy instruction.

6. Guidimaka Integrated Rural Development Project (IRIG - Project de développement rural intégré du Guidimakha)

The project is located in Seliaby.

a. Financing

The USAID - Project No. 682 02 01 from the Convention of September 16, 1977 provided funding.

Following several amendments, the funds were raised to US\$ 6,151,000.

The project was completed in June 1983. The balance of UM 10,471,152.5 was spent during the second semester of 1983.

b. Objectives

The objectives included experimental management of pasture lands, the introduction of fodder crops, herd management, improved cultivation techniques, and animal traction technology.

c. Accomplishments

Most objectives were met in the following areas: veterinary medicine, animal husbandry, environmental protection, agronomy and equipment (wells, slaughterhouses, classrooms).

However, the impact of the extension program was limited compared to the importance of the research program. Also, the project had an extremely high financial cost vis-a-vis the results obtained.

7. Cuidimaka Integrated Rural Development Project at Gouraye
(War on Want)

a. Objectives

(1) Technical objectives

It is necessary to gradually improve traditional techniques, and find new opportunities for the area's development potential.

(2) Social and economic objectives

It is necessary to improve food self-sufficiency, reach different sectors of the population and improve collective organization capabilities.

(3) Objectives concerning the target methods

The objectives are to establish a dialogue between the farmers and the trainers, through the use of pedagogical means which make it possible to reach the highest number of people within the limits of available staff, and to achieve a balance between assessment and intervention activities (Research and Development).

b. Accomplishments

Traditional farming techniques have been improved thanks to the introduction of more drought-resistant varieties and to the extension of techniques such as early sowings, seed processing and early thinning. Regarding soil cultivation, animal traction was successfully introduced. Some results were achieved in the area of seed procurement. The introduction of market gardening among women made it possible to develop some of the environment potential (water).

E. Recommendations for Extension

Recommendations to the organization cover communication and information, management and training, specific recommendations and extension themes.

1. Organization

In terms of organization, it is necessary to:

- o Organize the Directorate of Agriculture to follow up and promote sectors and projects;
- o Re-define the purpose of the agricultural sectors;
- o Work toward the settlement of disputes between farmers and livestock herders;

- o Facilitate the coordination of extension services at the national and regional levels;
- o Enforce cooperative legislation and promote the management of cooperatives; and
- o Solve the marketing problems of market-garden products.

2. Communication and Information

In this area, it is necessary to facilitate the dissemination of research findings through the development of structural links between the research and extension facilities. Another goal should be to improve dialogue and participation in rural areas.

3. Management and Training

Here, the recommendations are to:

- o Update the training of the extension agents and develop training in rural engineering and cooperation;
- o Intensify the education and training of farmers and livestock herders;
- o Identify the different types of management necessary to development operations; and
- o Institute instructor training sessions.

4. Specific Recommendations

These include:

- o Solve the farmers' debt problems;
- o Solve the problem of the heterogeneity of agricultural equipment;
- o Solve the procurement problem in rural areas;
- o Increase the sectors' resources;
- o Increase the share of regional budgets allocated to agricultural activities; and
- o Study the possibilities of implementing local projects in the traditional sector activities.

VI. CONSTRAINTS

A. Rainfed Crops (Miliet and Sorghum)

1. Physical Constraints

The surveys have shown that physical constraints hinder agricultural production. The local climate has deteriorated steadily over the past few years. This, and the uneven distribution of rainfall in both seasonal and locational terms have been major causes of the low productivity of the soil.

The production of rainfed crops (jeery) and crops grown behind dams, which are subject to climatic hazards, vary widely since the cultivated areas and the yields vary according to annual precipitation. Even when the amount of rainfall is sufficient, there is often a recrudescence of predators, locusts, insects, etc., which cuts into the expected production. This was the case in 1980-81, when the losses caused by locusts and other predators were estimated to be 15 percent of the production. This is why it is important to strengthen the crop protection service by providing it with the technical means necessary to control parasitic animals.

2. Institutional Constraints

Among factors restricting agricultural productivity, institutional problems are also important. Mauritanian farmers experience difficulties in obtaining information on grain production. There are a number of reasons for this, including the lack of sustained and efficient extension (the agricultural instructors are the extension workers) and the lack of agricultural material (animal traction equipment). In addition, the absence of communication between farmers (producers), researchers and extension workers works to retard long-term agricultural research and development.

a. Agricultural labor

Rainfed crops are uncertain producers and thus usually only require a low number of agricultural workers. Agricultural workers often prefer to migrate to urban centers in search of higher paying and more secure jobs. In many cases, the agricultural workforce is comprised of women and children, which is reflected in the level of output.

b. Lack of capital

Agricultural credit is almost nonexistent for rainfed crops, because they are the riskiest to grow and therefore are not profitable from the bankers' perspective.

The National Development Fund (FND - Fonds national de développement), whose purpose is to promote agricultural development, has not yet played a role because of financial and technical

constraints (problems tied to the lack of guarantees for credit reimbursements, etc.).

c. Uncertainty

A feeling of uncertainty, which is linked to land tenure patterns, is a significant constraint because land structures are very complex and the relationships between tenant farmers and landlords are still those of dependence. The sharecropping system still prevails although new legislation on land ownership was adopted by the government.

d. Marketing

The Committee for Food Safety (Commissariat à la sécurité alimentaire) is responsible for marketing and collecting of grain.

3. Production Constraints

To boost grain production, the State subsidizes prices. These subsidies are among the highest in the sub-region. The price paid for one kilogram of sorghum, for instance, is UM 13 (or FCFA 65 in 1981 without adjustment for inflation). But in view of the deterioration of the terms of trade and the high cost of agricultural inputs, incentives to producers are still weak. In addition, the importation of some cereals (wheat) which are sold on the domestic market at a lower price may discourage farmers.

Rural areas lack infrastructure, which hinders the timely delivery of inputs to agricultural areas.

4. External Constraints

In addition to these domestic constraints, there are external factors which cannot be overlooked in a country like Mauritania, which has a market-oriented economy. World prices for raw materials, export policies and the high costs of energy imports (oil) continue to weigh heavily on the national balance of payments.

B. Irrigated Crops (Rice)

It is widely acknowledged that the vulnerability of crops to climatic hazards can only be overcome through irrigation. This is why harnessing the Senegal River with the construction of the Diama and Manatali Dams is necessary for the development of irrigated crops along the river. In other inland areas, tapping the underground water resources is the only possible solution.

One of the major constraints facing producers of irrigated crops in Mauritania is the availability of land for small plots. The topography coupled with the scarcity of land (heavy soils requiring advanced technical farming methods) reduces the availability of plots for farmers. The average small plot covers less than 2,000 m². The average Gorgol Project plot measures 5,000 m².

Along with irrigated crops, SONADER has introduced agricultural credit. At the beginning of each crop year, the organization provides loans for agricultural inputs (seeds, fertilizers, etc.) which are reimbursed by the farmers at the end of the crop year. In spite of its flaws, this method has the advantage of involving the farmer in the irrigated crop cycle, instilling the necessary discipline for irrigation and cultivation purposes, timely rice transplanting, spreading of natural fertilizer, etc.

In the large SONADER plots, the inadequacy of extension services and the scarcity of the equipment required for the maintenance of canals, dikes and tracks are constraints hampering rice production.

C. Livestock

Aside from the risks of diseases, there are cattle feeding and watering problems. A simple increase in the livestock population may overload the available pasture lands which then causes undernourishment, leading in turn to depressive conditions and deaths. In view of this situation, the careful management of the scarce grazing lands and herd management are essential.

VII. GENERAL CONCLUSIONS AND RECOMMENDATIONS

A. Agronomic and Veterinary Research

Considering the fundamental importance of the rural sector and of the priority given to the objectives set by the National Directorate, considering the persistent drought and its serious impact on the population lifestyle and the deterioration of the environment, and considering the role agronomic research should play in order to meet the population's needs regarding food self-sufficiency and the protection of the environment against desertification, we recommend that:

- o Research institutions be given the financial, human and material means necessary for them to achieve the objectives;
- o An administrative framework be created for research scientists;
- o Initiative and cooperation efforts between research institutions and development agencies be developed;
- o Communication and contacts between national and sub-regional institutions be strengthened;
- o The necessity for the regionalization of agronomic, veterinary and animal husbandry research be taken into account; and
- o The importance of circulating the results of agronomic and veterinary research through the creation of a scientific publication be taken into account.

B. Research - Development

Agronomic and veterinary research must meet the requirements of rural development which originate from: the guidelines set in the National Development Plan; development projects matching national priorities; national and sub-regional development structures; and from the producers (farmers and livestock herders).

For this purpose, research planning must be organized in order to tackle the following problems: water management; animal husbandry research; agricultural mechanization; research on renewable energy sources; knowledge of rural environment; study of production systems; and techniques to improve farmers' involvement.

It is necessary to restructure research activities in order to decentralize so that research can cover the country's various ecological areas.

It is necessary to set up a single national research structure for rural development. This single structure would allow more efficient management of the programs and budgets in the various sectors, as well as a better coordination of research activities among existing and future centers.

It would be desirable to promote the exchange of information among all participants in the areas of research and development through contacts, periodicals, seminars, field visits, demonstration and training sessions, and conferences.

It is desirable to set up a publishing office for the publication of scientific and technical documents and extension manuals.

Training should be fostered inside the country as much as possible. It is necessary to link vocational training to the training of civil servants. New conditions have to be created to retain cadres who have been trained as researchers in their original agencies through the upgrading of working conditions. It is also necessary to set up a training program for all research institutions.

C. Coordination of Research, Development and Training

The creation of national institutions for agronomic and veterinary research is recent, but there is still a lack of overall research planning. A number of issues have not yet been researched; some of them, however, are of prime importance, for example:

- o Research on forestry and prevention of desertification;
- o Research on fish;
- o Research on animal husbandry; and
- o Research into rural farming practices and analysis of the different production systems. This can be explained by the lack of sufficient funding allocated to research activities. Because of limited resources, only animal health programs and the development of irrigated crops in the middle valley are being implemented.

There are other research operations which are conducted as part of the projects, but coordination between the researchers and project workers is difficult.

There are examples of projects, though, in which various research and development organizations cooperate and bring together extension agents and farmers participating in the integrated projects, but these projects have had a limited local impact.

These successes are seldom replicated. There are no seminars to bring together participants in the research and development fields despite the number of extension structures which are not coordinated.

There were, however, some successful attempts to introduce innovations and carry out demonstrations for rice cultivation as a result of technical contacts between research scientists and producers.

If there is no research planning, it is because, at the development level, no general requests are addressed to the research institutions. There are, however, a few local requests originating from regional development or project organizations and a recent attempt to organize cooperative work on a contractual basis.

As far as training is concerned, research scientists and development agents participate little in the training of agricultural cadres. Few research scientists are trained locally. Students at the National School of Agricultural Training and Rural Extension (ENFVA) are not involved in research and development operations.

The conditions necessary to retain the cadres who are trained as researchers within the research organizations do not exist.

ANNEX 1
Projects

ANNEX 1

Projects

A. Strengthening CNRADA Research Capacities

1. Justification and goals

The ambitious but necessary objectives of agronomic research require that CNRADA have a team of experienced and competent specialists in order to build new research structures in Mauritania.

2. Need for expatriate staff

It is necessary to recruit a research scientist specializing in fruit crops, with considerable experience in the area of citrus fruits, fruits and fruit diversification (external financing); a research scientist specializing in market-garden crops; an engineer specializing in irrigated market-crops (external financing); a research scientist specializing in date palm crops; and an engineer with good experience in the cultivation of palm trees, oasis crops and rainfed crops (external financing).

3. Equipment

The following equipment is necessary:

- o Three long-bed diesel Land Rovers (for the expatriate staff), 3 x UM 1,000,000: UM 3,000,000;
- o One bus with a 40 person capacity (transportation of personnel), UM 3,000,000;
- o One long-bed Diesel Land Rover for the transportation of managerial staff, UM 1,000,000;
- o One vehicle, 504 type (for the use of the management), UM 800,000;
- o One tractor (90 to 110 hp) with trailer, plow, leveler and spare parts, UM 2,500,000;
- o One 35hp tractor with transportation and processing equipment (for fruit and vegetables), UM 1,000,000;
- o Three hydromobile pumping stations (BATI Company, new system), UM 1,000,000;
- o Two generators (hydromobile pumping station), UM 2,000,000;
- o One sprinkling irrigation unit, UM 1,600,000;
- o One Renee, UM 400,000;

- o One photocopier, UM 250,000;
- o One generator (Rindiaw fruit division), UM 1,000,000; and
- o Two six-cylinder Lyster pumps, UM 2,000,000.

The total sum for the equipment is UM 20,350,000.

4. Infrastructure (general services)

The requirements include test plots, pumping stations, an irrigation canal, roads and reforestation work. The total cost is UM 5,000,000.

5. Construction (general services)

It will be necessary to construct four-room buildings, four offices, two hangars and four fences, for a total of UM 20,000,000.

6. Personnel

Overhead, travel, bonuses and moving costs will total UM 500,000.

7. Operations

The total funding required for the purchase of fertilizer (UM 3,000,000), processing materials (UM 900,000) and fuel and lubricant (UM 3,700,000) is UM 7,600,000.

The grand total of all costs is UM 54,450,000.

B. Strengthening CNRADA Technical Structures

1. Justification and goals

The area surrounding the Belinabe central station is particularly conducive to the experiments that the CNRADA must undertake in order to achieve the national objectives.

An enlarged station could cover all of the traditional agricultural areas with the country's characteristic soils and environments whose extension problems will have to be studied by the agronomic research organizations in the medium and long run. Studies will be conducted on:

- o The Fondes and Hollaldés irrigable lands for rice cultivation development;
- o The Dieri sandy soils for experiments on rainfed crops and irrigation sprinkler systems;

- o The river basin and flood-recession lands for rainfed crop improvement experiments; and
- o The rocky plateaus for reforestation experiments, and pasture development.

Those divisions already in place at provisional sites, which can only undertake short-term research, will be reorganized in order to find more favorable settings necessary for medium- to long-term research and development, within the enlarged and strengthened structures of the Bélinabé Station.

The strengthening of technical structures, the enlargement of the Bélinabé Station, and the definitive development of test plots will pose no insurmountable problems, since sufficient land is available.

2. Expatriate personnel

There is one manager who is in charge of all equipment, generators, fertilizer, vehicles, and the workshop, under external financing.

3. Equipment

The equipment requirements are a dump truck (UM 8,000,000) and a hydraulic shovel (UM 2,000,000).

4. Facilities

The following is required:

- o Enlarge the Bélinabé Station over 200 ha (length of one km on the river side and depth of 5 km on the hill side);
- o Establish test plots, demarcations by roadways, drains, canals which follow terrain topography (see Request No. 1); and
- o Construct three hydromobile pumping stations (BATI - see Request No. 1).

5. Construction

It will be necessary to construct three buildings for generators, at a cost of UM 2,500,000.

N.B. The other components of the estimate of development work can be found in Request No.1.

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C. Construction of the National Agronomic Research Center in Kaedi

1. Objectives

The objectives are to:

- o Provide the National Agronomic Research and Agricultural Development Center with buildings (offices, laboratories, housing) that are indispensable for independent operations;
- o Eliminate the contract-leasing system, which was a temporary solution to meet service requirements, that has been in effect since the Center was established in 1975; and
- o Update the FAC construction project by allocation of project funds.

2. Construction

The construction plans for the Agronomic Research Center include the following work:

- o Construction of CNRADA support buildings (conference room from 100 to 120 m², a library and documentation center measuring 40 m², and six 20 m² offices) which will cover a total surface area of 280 m²;
- o A wood and ironworks shop (60 m²) and a storage warehouse with shelves (240 m²) must also be built (total of 300 m²);
- o Construction of four 60 m² modular laboratories (240 m²) and seven 20 m² researchers' offices (140 m²) surrounding the laboratories for a total of 380 m²; and
- o Building housing for researchers on a 7.5 ha campus area - there will be seven 140 m² units for a total of 980 m².

The total surface for all the buildings described above amounts to 1,940 m².

The equipment and supplies needed include scientific laboratory equipment and equipment for the offices, housing, warehouses and workshops.

Concerning development work, the area required for the various facilities of the new National Agronomic Research Center was initially estimated at 15 ha (dried land).

The urban development works required include building roads, a water supply system, piping and drains, equipment shelters and sheds, electricity, etc., none of which are currently in place.

3. Technical implementation

The labor, supplies and services required to complete these projects will be procured through open-competition public bidding or a call for tenders.

The amount of the initial project was estimated to be UM 60 million payable in three installments of UM 10,25 and 25 million. This sum will have to be reevaluated to adjust for current economic conditions.

D. Support to Food Crops Research

1. Objectives

- o Short-term improvement of agronomic research results on traditional food crops;
- o Strengthen medium-term research activities, especially in varietal selection of maize and sorghum, research that is currently conducted by the CNRADA; and
- o Fulfill urgent research requirements for facilities and operations equipment necessary to carry out the program.

2. Expatriate personnel

One researcher specialized in various food crops is required; the researcher should be a certified expert in the fields of selection, irrigation, and crop systems.

3. Equipment

A four-wheel drive diesel vehicle with spare parts (UM 2,500,000) and a tractor equipped with a trailer, plows and spare parts (UM 2,000,000) must be purchased.

4. Installations

The installations needed include a pumping station, an irrigation canal, roads and public works and a reforestation program (work by companies, see Requests No. 1 and 2.)

5. Construction

Fences, offices, and sheds must be built (work by companies, see Requests No. 1 and 2.)

6. General costs (services)

The total amount required for leases, employee bonuses and repairs is UM 200,000.

7. Operations

The following is required: testing equipment, office supplies, documentation, fertilizer and chemicals, small agricultural machinery, fuel, lubricants and crop material for a total of UM 4,000,000.

Total needs for support to food crops research amount to UM 8,700,000. After adding the unforeseen costs (UM 87,000) the grand total is UM 9,750,000.

E. Research Support on Sugar Cane Testing

1. Objectives

- o Creation of a pilot-nursery for reproduction of sugar cane varieties (20 ha); and
- o Research on varieties and the development and diversification of irrigated crops (sugar cane and food crops, product improvement, technical feasibility of an industrial sugar refinery).

2. Expatriate staff

A farm director must be recruited who is an engineer with experience in sugar cane technology, irrigated crops, and mechanization.

3. Equipment

Two four-wheel drive vehicles (UM 2,500,000), a 90 to 110 hp agricultural tractor with trailer and other agricultural equipment (UM 2,000,000) must be acquired.

4. Installations (for billing, see Requests No. one and two)

The following installations are necessary:

- o A pumping station;
- o An irrigation canal;
- o Roads and public works; and
- o Reforestation.

5. Construction

Fences, offices, laboratories, sheds and storage areas will have to be built (see Requests No. one and two).

6. Operations

The following will be necessary for operations: fertilizers and chemicals (UM 4,100,000), crop material (UM 450,000), small agricultural equipment (UM 650,000), office supplies (UM 350,000), documentation (UM 300,000), fuel and lubricants (UM 2,500,000), vehicle operations (UM 550,000) and missions and travel (UM 500,000).

The total cost for facilities and equipment is UM 13,400,000; with the addition of the unforeseen costs (UM 1,340,000) the grand total comes to UM 14,740,000.

F. Support for Research on Date Palm Experiments and Palm Tree Crops in Kankossa

1. Objectives

The objectives are the renovation of the Kankossa Research Station which has an infrastructure (palm tree collections, research buildings, agricultural facilities) worth UM 125 million, and resumption of agronomic research on date palm trees (varieties, reproduction, plantations). Also, experiments should be conducted on traditional food crops (wheat, maize, sorghum, alfalfa, vegetables) in palm groves.

2. Expatriate personnel

These requirements include one date palm expert (see Request No. 1), one research scientist to conduct experiments on various crops growing in palm groves and one specialist in palm tree entomology and phytopathology.

3. Equipment

The following equipment is required:

- o Equipment for the biometry laboratory, UM 1,500,000;
- o A generating set, UM 1,460,000;
- o Irrigation, UM 900,000;
- o Workshops, warehouses, UM 1,000,000;
- o Tractors and agricultural equipment, UM 3,500,000;
- o Animal traction equipment, UM 1,300,000;
- o Agrometeorological equipment, UM 2,000,000;
- o Vehicles, rolling stock, UM 18,000,000;

- o Mechanical workshop, garage, UM 1,800,000; and
- o Equipment for the maintenance of infrastructure, UM 6,000,000.

The total sum for the equipment needs is UM 34,460,000.

4. Infrastructure

The requirements are:

- o A pumping station, UM 1,800,000;
- o A hydraulic system, UM 1,000,000;
- o Roads and public works, UM 2,000,000;
- o Palm tree groves, UM 1,000,000; and
- o Demonstration plots, UM 2,000,000.

5. Construction

It is necessary to construct some fences at a cost of UM 2,600,000.

6. Management

Management costs total UM 5,000,000.

7. Operations

In terms of operations, the following is needed: fertilizers and fertilizer products; plants; small agricultural equipment; office equipment; documentation; motor fuel and lubricants; vehicle operation funds; and travel expenses for a total of UM 8,400,000.

The total cost for equipment and supplies is UM 52,260,000, to which UM 5,826,000 are added to cover unforeseen expenses, for a grand total of UM 64,086,000.

G. Development Research

1. Objectives

The objectives are to create a permanent coordination unit for research scientists from various divisions of research and development organizations (ministries, companies and extension services) to establish links between research and the rural world; to summarize research findings and circulate the results; and development orientation and priorities of agronomic research.

2. Expatriate personnel

It is necessary to recruit one general agronomist and project manager, one agro-economist expert, and one consultant to conduct agricultural surveys and compile statistics.

3. Equipment (for billing)

Requirements include a vehicle and field and office equipment for a total of UM 6,090,000.

4. Construction (for billing)

Here the needs are: offices at the Ministry of Rural Development in Nouakchott; offices at the CNRADA headquarters; and regional offices, investigators and laboratories for a total of UM 36,000,000.

5. Operations (for billing)

The operations requirements are motor fuel and lubricants, office equipment, documentation, travel expenses, field equipment, and fiscal provision for equipment replacement, for a total of UM 6,000,000.

The total is thus UM 48,090,000. Assuming unforeseen expenses shall require UM 4,809,000, the grand total for the project is UM 52,980,000.

H. Standard Production Units

1. Objectives

These are:

- o Inventory of findings in agronomic research which can be used as themes by extension services in all areas (food, market-garden, and fruit crops, etc.);
- o Technical and scientific assistance for new projects; and
- o Design and implementation, financing, operation and monitoring of new projects.

2. Expatriate personnel

Recruiting requirements include one program manager (project coordinator with the Ministry for Rural Development) and one agro-economist to coordinate activities with research and development services.

3. Equipment (for billing)

Equipment needs include vehicles and field and office equipment.

4. Construction (for billing)

It will be necessary to build an office within the Ministry for Rural Development in Nouakchott and an office at the CNRADA headquarters.

5. Operations (for billing)

The following is necessary: motor fuel and lubricants; office equipment; documentation; travel funds; field equipment; and reserves for the replacement of equipment.

6. Project identified in 1983

These are:

- o Fruit plantations (citrus fruits, bananas, guavas) in three regions of Mauritania--Gouraye, Kaedi and Boghé for a total of UM 19,700,000;
- o Fruit tree and Roufiadi forest nursery, for a total of UM 12,432,000; and
- o Seed cooperatives (rice in Kaedi), for a total amount of UM 20,000,000.

I. Adaptation of New Techniques and Innovations in Agriculture

1. Objectives

These include:

- o Inventory and follow-up of research activities and projects around the world to find new solutions adaptable to agronomic research in Mauritania;
- o CNRADA implementation and technical studies of identified projects; and
- o Adaptation, control, economic feasibility studies and circulation of proven techniques, systems and equipment.

2. Expatriate personnel

It is necessary to recruit one program manager.

3. Equipment (for billing)

It is necessary to acquire vehicles and field and office equipment.

4. Construction (for billing)

It is necessary to build a CNRADA main office and some equipment sheds and test platforms.

5. Operations (for billing)

The following is required: fuel and lubricants, office equipment, documentation, travel funds, field equipment and reserves for the replacement of equipment.

6. Projects identified in 1983

These are:

- o Pilot biogas-compost program, UM 9,000,000;
- o Intermediary mechanization, including rice-growing equipment, for herbicide treatment, a lightweight aircraft before the flooding of the Walo river (improvement of flood-recession sorghum and a solar dryer (preservation of tomatoes and vegetables, and various surpluses of seasonal produce), for a total of UM 3,000,000;
- o Diversification of production and agricultural activities, which include forage production and cattle fattening experiments (Sylla), introduction of cotton as an irrigated crop (preliminary experiments), production of forage millet in rice growing areas during the hot season, storage of products, utilization, etc., for a total of UM 3,000,000;

The total cost of the project is UM 15,000,000.

J. Network of Multi-Site Experiments

1. Objective

The objective is the creation of experimental research stations in five ecological areas of Mauritania.

2. Expatriate personnel

One program manager will need to be recruited.

3. Equipment (for billing)

The requirements include vehicles, equipment for the new stations, experimentation plots (5 ha), offices and supplies.

4. Construction

It will be necessary to construct buildings, sheds and fences.

5. Management (for billing)

Management costs will total UM 710,000.

6. Operations

It will be necessary to acquire fertilizer products, plants, small agricultural equipment, office equipment, documentation, motor fuel and lubricants, funds for vehicle maintenance and travel.

7. Projects identified by region

The projects will be carried out in the five regions: Adrar; Brakna; Gorgol, Guidimakha and Hodhs. The total cost for the five sites is UM 55,000,000.

K. Study of Traditional Farming Systems, Inventory of Local Food Crop Varieties and Species

1. Objectives

The objectives are the description and study of traditional farming systems and the collection and preservation of local food crop species.

2. Expatriate personnel

It will be necessary to recruit one expert for a twenty-four month mission and one consultant for a two-month mission.

3. Equipment (for billing see project)

The cost for the equipment totals UM 5,100,000.

4. Operations (for billing see project)

These can be broken down as follows:

- o Consumer supplies, UM 3,000,000;
- o Miscellaneous costs (building costs), UM 700,000; and
- o Travel, bonuses, UM 2,000,000.

The total cost of this is UM 10,800,000.

L. Training of National Cadres

1. Students receiving high level training in France and Belgium

- o Mr. Ba Mamadou Lamine, specializing in fruit orchard technology in Montpellier, will finish training in 1983;
- o Mr. Sidi Fall, studying general agronomics in Montpellier, will finish training in 1983;
- o Gam Abou Oumar, studying agricultural mechanical engineering in Paris and Montpellier, will finish training in 1984;
- o Ba Mamadou, specializing in the selection of varieties in Montpellier, will end training in 1984;
- o Mr. Barro Amadou Bachirou, specializing in nitrogenous fertilizers and azolla crops, internship in Montpellier, will end training in 1984; and
- o Mr. Soumare Abdoulaye, entomology, training in brussels, will end training in 1985.

2. Scholarships

For the new projects and previous requests, scholarships have been requested for the training of national cadres in the following areas of specialty:

- o Sugar cane: one scholarship for general agronomics and internship for the study of sugar cane cultivation;
- o Date palm tree: one entomologist specializing in crop protection, and one scholarship for general agronomics with emphasis on palm groves;
- o Development research: one agro-economist;
- o New techniques; and
- o Mechanics.

M. Support Mission

The requested missions are to help with the strengthening and orientation of domestic programs, organized by division.

1. Food crops division

- o Maize and sorghum selection;
- o Irrigated crops, water requirements and;
- o Bird control.

2. Fruit crops division

- o Program orientation;
- o Citrus fruits, mango trees, various fruits; and
- o Fertilization.

3. Market gardening division

- o Program orientation; and
- o Cultivation projects, drying, small-scale industries.