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**THE UNITED STATES NATIONAL COMMITTEE FOR MAN AND THE BIOSPHERE**

Department of State, IO/UCS •

WASHINGTON, D. C. 20520

An Introductory Note on Draft Environmental Profiles:

The attached draft environmental report has been prepared under a contract between the U.S. Agency for International Development (A.I.D.), Office of Science and Technology (DS/ST) and the U.S. Man and the Biosphere (MAB) Program. It is a preliminary review of information available in the United States on the status of the environment and the natural resources of the identified country and is one of a series of similar studies now underway on countries which receive U.S. bilateral assistance.

This report is the first step in a process to develop better information for the A.I.D. Mission, for host country officials, and others on the environmental situation in specific countries and begins to identify the most critical areas of concern. A more comprehensive study may be undertaken in each country by Regional Bureaus and/or A.I.D. Missions. These would involve local scientists in a more detailed examination of the actual situations as well as a better definition of issues, problems and priorities. Such "Phase II" studies would provide substance for the Agency's Country Development Strategy Statements as well as justifications for program initiatives in the areas of environment and natural resources.

Comments on the attached draft report would be welcomed by USMAB and DS/ST and should be addressed to either:

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# NIGER

- International boundary
- - - - - Département boundary
- (e) National capital
- o Département seat
- Railroad
- Road
- - - - - Track

A département has the same name as its administrative seat

0 50 100 150 Miles  
0 50 100 150 Kilometers

BOUNDARY REPRESENTATION IS NOT NECESSARILY AUTHORITY

LIBYA

KENYA

PLATEAU DU DIADO

Bilma

MALI

AIR

Agadez

Gao

Ayorou

Tahoua

Tanout

CHAD

Tillabery  
Tera

Filingue  
Ouallam  
Bosso

Birni Nkorn

Dakoro

Gao

Gouré

Ngouré

Bosso

UPPER VOLTA

NIAMEY

Birni Ngouré

Sokoto

Tessoué

Maradi

Tarna

Maragoumia

Kaura Namoda

Zinder

Takésta

Nguru

Diffa

FORT-LAURY

DAHOMEY

NIGERIA

Kano

Makurdi  
CABON

## Summary

Niger falls entirely within the arid and semi-arid zones of West Africa, and many of its major environmental problems are related to this fact. Over half the country is uninhabitable even by nomads, while only about one fifth of Niger is suitable for sedentary agriculture. Recurring droughts in the Sahel-Sudan region make life even in these relatively "fertile" areas precarious. Population increases put increased pressure on agricultural and range resources, which leads to degradation even in good years; drought greatly accelerates the process. Niger's major environmental problems include:

1. Devegetation. This covers two processes in the two traditional sectors of Niger's economy. In agricultural areas, trees are cleared from the land for farming. Practices of burning off brush and grass cover kill any seedlings. In addition, firewood is the only energy source in most rural areas. In pastoral areas, overgrazing of range land is common. Both of these have led to a serious depletion of ground cover.
2. Soil Erosion and Depletion. One direct result of devegetation is soil erosion. This is serious in areas of human activity, but wind and water erosion of soils is by no means confined only to areas of human activities. Sparse ground cover is a characteristic of the arid climate, and erosion proceeds even without man's help. In addition, agricultural soils are being degraded rapidly as traditional methods of maintaining soil fertility can no longer keep pace with the demands on the soil.
3. Health. Public health standards are quite low. Much of the problem can be linked to hazardous water supplies, which aid in transmission of communicable disease.

Niger recognizes these and many other problems, and has addressed most of them to some extent in law.

Mark Speece  
Compiler

## 1.0 General Information

### 1.1 Preface

This draft environmental report is the result of an eight-week review of information available in the United States on the natural resources and environment of Niger. This is the first step in the process of developing an environmental profile for use by the U. S. Agency for International Development and Niger government officials. The next step in this process should be a field study which would evaluate the information contained herein, obtain additional information, define issues, problems, and priorities, and provide direction for future efforts to deal with the management, conservation, and rehabilitation of the environment and natural resources.

The information and interpretations presented in this report are preliminary in nature and are not intended to attain the detail and accuracy needed for development planning. This study represents a cooperative effort by the entire staff of the Arid Lands Information Center, but the primary focus, research, and writing were done by Mark Speece. The cooperation of personnel at AID, the Library of Congress, the National Park Service, and the University of Arizona is gratefully acknowledged.

## 1.2 Geography and Climate <sup>1/</sup>

With an area of 1,257,000 sq. km. (489,191 sq. mi.) the Republic of Niger is one of the largest states in West Africa. The country is land-locked, surrounded by (clockwise from the north) Algeria, Libya, Chad, Nigeria, Benin (formerly Dahomey), Upper Volta, and Mali.

Niger falls into the three broad climatic zones of Sahara, Sahel, and Sudan which stretch across all of West Africa. Usually each of these zones is subdivided into latitudinally. The Saharan zone proper and the southern Sahara are characterized by high summer temperatures and little annual rainfall. Vegetation and livestock can survive only in oases throughout most of these zones, but in the slightly wetter and cooler southern part an occasional tuft of grass or sagebush can be found.

The northern Sahel zone usually receives less than 250 mm annual rainfall. There is a distinct three-month rainy season and a cooler winter. Agriculture is usually impossible, but this is an area of cattle nomadism. The southern Sahel has similar conditions, except that the 500-750 mm annual rainfall can support dryland agriculture.

The southwesternmost corner of Niger falls into the northern Sudan zone (savanna on the map in App. I). Annual rainfall may be up to 1000 mm and the rainy season extends for 5 or 6 months.

In addition to these general observations on West African climatic zones, Niger can be divided roughly into the extremely arid north and the cultivable, populated southern area. Each of these areas is again conveniently divided in two. The north, about four-fifths of the country, contains the arid highlands of the Aïr Massif. On either side of this centrally-located feature, the sandy regions of the Nigerian Sahara extend southwards. The southern area consists of the Niger River valley in the southwest corner of Niger, and the strip of land along the southern border with Nigeria.

### 1.2.1 The Northern Highlands

The Aïr Massif is an extension of the Ahaggar mountains of Algeria. A series of plateaus connects these mountains with the Algerian ones as well as with the Tibesti mountains of Chad. Aïr extends about 400 km (250 mi) from north to south, and about 240 km (150 mi) from east to west. The highest point, Mt. Greboun (~ 2000 m, 6562 ft.), is a little over 100 km. from the Algerian border. Although rainfall in general decreases from south to north in Niger, parts of Aïr can receive slightly more rain than other areas in the north. The 250 mm isohyet which roughly marks the northern limit of enough vegetation to support nomadic pastoral life, passes to the south of Aïr. However, parts of the highlands can get 250 mm, and some nomadism can be found there. This rainfall is quite erratic and usually comes in thunderstorms, which can cause severe erosion. Temperatures can be extreme in the highlands and 50°C may be reached. In general, because of the altitude, Aïr is slightly cooler than other areas of

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<sup>1</sup>Source: Church, R. J. H. et al. 1974.  
Encyclopedia Britannica. 1975.  
Europa Publications. 1980.

northern Niger. In the mountains, minimum temperatures of  $-31^{\circ}\text{C}$  have been recorded.

### 1.2.2 Northern Deserts

Except for the Air Massif and a few scattered oases, Niger north of about  $16^{\circ}$  is generally uninhabitable, even for nomadic groups. West of Air the Talak region is an area of almost pure desert, including great fossil valleys filled with moving sand dunes. East of the Air the Tenere region is a vast area of sandy and stony desert. At Bilma, an oasis in the middle of this wasteland, the average daily maximum temperature remains above  $100^{\circ}\text{F}$  for six months. Average annual precipitation at Bilma is around 20 mm. This type of desert extends to the area around Lake Chad.

### 1.2.3 The Southern Agricultural Zone

The area south of the 300 mm isohyet (roughly  $16^{\circ}$  N) is able to support cultivation. However, agriculture is not really secure until near the 600 mm isohyet along the Nigerian border. The westernmost part of this region is Djerma Ganda, the area around the Niger valley. Much of this area is still desert, and several fossilized former tributaries to the Niger River are filled with sand. Cultivation and population are concentrated along the river itself, where irrigation is possible, until the southern portion of the rivercourse is reached. The 600 mm isohyet passes through the area around Niamey. The southernmost portion of this region is in the zone of over 800 mm of rain annually.

The belt along the Nigerian border gradually changes from desert in the north to Sahel type climate and vegetation southwards. The southernmost strip is usually categorized as belonging to the Sudan zone. In this narrow strip rainfall averages over 600 mm annually. Temperatures in the whole southern area generally average a few degrees warmer in the winter and a few degrees cooler in the summer than in the north.

## 1.3 Demographic Characteristics

### 1.3.1 Population <sup>2/</sup>

Figures on Niger's population vary somewhat between various sources (cf app. II, 1). In 1980 there are approximately 5,200,000 inhabitants. All Data and Europa both estimate Niger's urban population to be about 9% (1976, 1978 respectively), and the World Bank gives a figure of 10.3% (1977). None of these sources defines the term "urban". In 1977 there were 8 towns with 10,000 inhabitants or more, constituting about 8% of the population at the time. Population densities are highest along the southern border east of Goure and along the Niger River, and drop off quickly to the north. Except

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<sup>2/</sup>Source: Europa Publications. 1980.  
U.S. AID. 1980a.  
U.S. AID. 1980b.  
World Bank. 1976.  
World Bank. 1980.

in Air, north of about 16° N latitude is virtually uninhabited. The growth rate for Niger is generally estimated to be somewhere around 2.6 - 2.8%. More complete statistics can be found in Appendix II.

### 1.3.2 Composition <sup>3/</sup>

Niger's population can be roughly divided into five major ethnic groups. The largest, the Hausa, made up just under 54% of the population in 1972. They are overwhelmingly sedentary agriculturalists, and also make up the majority of the small merchants and traders. Various groups of Hausa people in Niger can be found all along the Nigerian border as far east as Zinder. They still maintain close contacts with kinsmen in Nigeria, where the majority of the Hausa people live.

The Djerma-Songhai constituted about 24% of the population in 1972. These two related peoples are generally found along the Niger River, are sedentary agriculturalists, and account for the majority of Niger's civil servants. The majority of the Songhai people live in Mali, and the Djerma also inhabit areas south of Niger.

About 9% of the population is made up of loosely-related peoples grouped under the name of Kanuri. They are found in the southeast from Zinder to Lake Chad, as well as in the other countries surrounding the lake. They have a mixed agricultural-pastoral economy.

The Fulani (sometimes called Peul) were just under 11% of the population in 1972. They are primarily cattle nomads, and can be found scattered across habitable Niger where agricultural density is low. Like the other groups, they are found in other countries, mainly in the Sahel zone of West Africa.

The Tuareg constitute only about 3%, but they are predominant in the northern part of Niger. In general they inhabit areas north of the agricultural zone, including the Air Massif, as well as in most other countries which share the southern fringes of the Sahara. Their pastoral economy is based on sheep, goats, and camels. The Tuareg and the other nomadic groups were hard-hit by the 1967-1973 Sahel drought, which caused an increasing trend toward sedentarization among them.

These population composition figures often differ between sources; one source (USAID 1980b) gives Hausa 45%, Djerma-Songhai 21%, Fulani 14%, Tuareg 11%, and Beri-Beri (Kanuri) 8%.

Although language tends to follow ethnic group closely, about 85% of Niger's inhabitants can speak Hausa. By adding Songhai, one can

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<sup>3</sup>Source: Dankoussou, I. et al. 1975.  
Encyclopedia Britannica. 1975.  
Europa Publications. 1980.  
Niger. Centre d'Information du Niger (Paris). Undated.  
U.S.AID. 1980b.

be understood nearly everywhere in the country. French is the official language and the language of instruction, but it is understood only by a small minority.

### 1.3.3 Migration and Urbanization <sup>4/</sup>

Despite the low proportion of urban population in Niger, urbanization is an important factor. The urban growth rate is twice that of the overall growth rate, and Niger is probably the country with the fastest growing urban network in the Sahel region. Fully half of this urban growth can be attributed to migration. The case of Niamey is even more striking: a growth rate of 10%, with nearly 3/4 due to migration.

Actual migration from rural areas is much greater than indicated by looking only at urbanization figures. Old figures from the 1960 census show that there were then about 130,000 temporary migrants who left their homes during the dry seasons to look for work. About 80,000 of these went to Nigerien urban centers. The rest left the country, most often to Nigeria, Ghana, or the Ivory Coast. Most of this was only temporary migration during the season when little agricultural activity took place. However, several cases were known even then where lack of manpower due to migration held back rural development.

The drought greatly accelerated all of these processes. For example, the International Red Cross estimated in 1974 that up to 100,000 nomads had fled from their territories to Niamey. Other estimates placed over half a million Nigeriens in Nigeria in 1974.

### 1.3.4 Public Health <sup>5/</sup>

Health care in Niger is in need of improvements. The death rate in 1977 was around 22 per 1,000, which was down from 27 in 1960. Average life expectancy at birth was anywhere from 38 to 42, according to various sources. In general, the death rate is much higher in the north than in the south and much higher among nomads than sedentary peoples. Malnutrition, lack of sanitation facilities, poor personal hygiene, and severe shortages of medical personnel and facilities are all contributing factors to the low standards of public health.

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<sup>4</sup>Source: Dankoussou, I. et. al. 1975.  
Godiksen, L. H. et. al. 1974.  
Cohen, M. A. et al. 1979.

<sup>5</sup>Source: Niger. Centre d'Information du Niger (Paris). undated.  
Stanbury, J. B. and J. A. Childs. 1974.  
U.S. AID. 1975.  
U.S. AID. 1980a.  
U.S. AID. 1980b.  
World Bank. 1980.

The Sahel drought of 1967-1973 hit Niger very hard, and the country is only now beginning to recover in many factors, including health and nutrition. For example, the per capita daily caloric intake, estimated at 2,175 in the early 1960's, had recovered by 1977 to only about 2,140, approximately 78% of the estimated daily requirement. The situation was worse among nomads. Incidence of several diseases also increased during the drought years.

Malaria was the leading cause of death in the early 1970's, responsible for about 28% of all deaths. Malaria does not occur north of the 200 mm isohyet, is seasonal during the rainy season south to the 500 mm line, and south of the 700 mm isohyet is a continuous year-round problem. Measles is a close second, and is particularly deadly among children. There were 28,423 cases and 937 deaths reported in medical facilities during 1972. Considering the shortage of these facilities, actual incidence and deaths must have been much greater.

Cerebro-spinal meningitis is another important cause of death, and seems to become epidemic every four years. The following table shows reported cases and deaths over five years:

	Cases	Deaths
1968	3,131	134
1969	2,989	190
1970	11,791	1,105
1971	4,142	246
1972	2,233	180

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Source: Stanbury, J. B.  
and J. A. Childs.  
1974.

Although they may not result in as large a number of deaths, a number of other diseases are common and are major problems in Niger. Among these are trachoma and conjunctivitis, venereal disease, intestinal parasites, and tuberculosis. Perhaps because of the large-scale population displacements due to the drought, cholera became a problem after 1970, and 10,000 cases were reported in the first half of 1971, with 2,000 deaths.

Tables showing incidence of a number of diseases can be found in App. II.

## 1.4 Economic Characteristics <sup>6/</sup>

Niger is one of the poorest countries in the world. Less than 3% of its territory is under cultivation, but agriculture remains a major sector of the economy. The per capita GNP in 1977 was somewhere around US\$ 190, and the average annual per capita real GNP growth rate from 1960-1977 was -1.4%. Agriculture contributed approximately 50% to the GDP in 1976, but perhaps a better measure of its influence in Niger is the observation that 92% of the labor force is involved in this sector (1977).

### 1.4.1 Agriculture and Livestock

Agricultural production is heavily oriented toward food crops. Over 50% of the total planted area is usually used for millet. Other major foodcrops are sorghum and cowpeas. Niger's major cash crops are groundnuts and, less importantly, cotton and vegetables. Groundnuts have been the major foreign exchange earner until recently. Although production was hurt by the drought, groundnuts accounted for nearly 40% of exports by value in 1972. Since then, production has been further cut by crop diseases. In 1976 groundnuts were only about 6% of exports. Uranium had become a major export by then, but these figures also represent a real drop in production. Cotton production had all but ceased by 1980.

Livestock production, which is largely in the nomadic sector, was severely hit by the drought. However, exports of animals and animal products did not suffer, because of widespread forced sales as the animals could no longer be supported. In 1972 animals and animal products were about 16% of total exports. By 1976 improved production kept this figure at about 16%. The 1979-83 five year plan, however, calls for restricting the growth of these exports in order to raise the domestic nutritional status.

Agriculture is one of the priorities in government development plans. Improvements in rainfed agricultural productivity and recovery of livestock herds to at least 65% of pre-drought levels are two of the main factors on which the government is depending for economic growth. Toward this end the 1976-78 Three Year Plan allocated 22% of the budget to investment in those sectors. The 1979-83 Five Year Plan earmarks 30% of public spending to rural development and irrigation. However, World Bank projections forecast a food deficit for Niger by 1990 under the best conditions.

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<sup>6</sup>Source: Africa Research Bulletin. March 31, 1980.  
Europa Publications. 1980.  
Niger, Ministère du Développement Rural, Direction de l'Agriculture. 1978.  
U.S. AID. 1975.  
U.S. AID. 1980a.  
U.S. AID. 1980b.  
West Africa. 28 April, 1980.  
World Bank. 1976.  
World Bank. 1980.

#### 1.4.2 Other Sectors

The third and by far the single most important factor contributing to economic growth is uranium. Although not yet a large percentage of the GDP (about 6% in 1976), it is a fast-growing industry and the major foreign exchange earner. In 1970 uranium contributed nothing to export earnings; by 1977 it accounted for nearly 75% by value.

Manufacturing is the least developed of all the Francophone African countries. It takes the form mostly of processing agricultural goods, and contributed 11.6% to the GDP between 1970-1976. During that period 15% could be attributed to trade and finance.

#### 1.4.3 Foreign Aid <sup>7/</sup>

Interest in Niger by the international community developed only in the later phases of the Sahel drought and was then primarily relief aid. Since then, Niger has been able to attract non-emergency funds to be used for development. In Niger, as in most other Sahel states, a great deal of development effort is associated with CILSS/ Club du Sahel and its donor-beneficiary framework. In 1978 France provided about 27% of all aid to Niger. Other major donors were the EEC, the World Bank, West Germany, Japan, the U.S., and Arab states, but a great many other countries and organizations were also involved.

Projects range from watershed management schemes involving several Sahel countries to the establishment of individual industrial concerns. U.S. AID projects are focusing on the areas of transportation networks, crop production, rural development, and livestock management. Appendix IV lists AID projects.

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<sup>7</sup>Source: Legum, C., ed. 1980.  
U.S. AID. 1980b.  
U.S. AID. 1980c.

## 2.0 Natural Resources

### 2.1 Mineral Resources and Energy<sup>8/</sup>

Minerals are the sector which shows the most potential for economic development in Niger. By far the most important mineral at present is uranium. Proven reserves are about 200,000 tons, with another 200,000 tons reasonably assured, amounting to about 15 percent of the world's known resources. Niger's first uranium mine went into production in 1971 at Arlit. A second was opened in 1978, a third will begin in 1980, and several others should come into production within the decade, all in the Air region north-northwest of Agadez. Niger hopes to be producing 8,000 tons a year by 1984, up from 2,100 tons in 1978.

Cassiterite (tin ore) is the only other economically important mineral which has been in production for some time. Deposits are also found in Air northeast of Agadez. Production of 90 tons in 1978 was down considerably from the peak of 140 tons in 1974, but there are indications of new deposits which could be developed. The following table shows both uranium and cassiterite production and exports for 1969-1978.

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<sup>8</sup> Sources: Africa Research Bulletin. February 29, 1980.  
Europa Publications. 1980.  
International Monetary Fund. 1970.  
Legum, C. 1980.  
Niger, Ambassade des Etats-Unis. undated.  
Niger, Centre d'Information du Niger (Paris). undated.  
Sonssou, J. E. 1974.  
U.S. AID. 1980b.  
U.S. Bureau of Mines. 1976.  
West Africa. 21 January 1980.  
World Bank. 1976.

Production and Sales of Mineral Products

Year	Mineral d'uranium			Cassitérite		
	PRODUCTION	VENTES		PRODUCTION	VENTES	
	Tonnes	Tonnes	Milions de francs c.f.a.	Tonnes	Tonnes	Milions de francs c.f.a.
1969 .....	.	.	.	124	117	57.5
1970 .....	.	.	.	108	96	57.1
1971 .....	410	400	2 000	128	91	52.0
1972 .....	869	300	1 484	137	146	70.0
1973 .....	949	1 090	5 011	138	140	99.0
1974 .....	1 114	1 250	5 396	140	112	177.0
1975 .....	1 305	1 400	13 999	127	132	138.0
1976 .....	1 459	1 500	21 005	118	119	112.0
1977 .....	1 441	1 466	28 421	105	99	87.0
1978 .....	2 109	2 249	52 352	90	77	144.0

Source: Bank Centrale des Etats de l'Afrique de l'Ouest. January 1980.

Several other minerals are of little importance to the national economy at present rates of production. These include gypsum and limestone in the area of Tahoua, and silica, salt, and gold. Past production of these is noted in the following table:

	Production (tons)	Year	Source
gypsum	2,000	1974	1
limestone (cement)	40,000 (21,000)	1974 (1974)	1 (1)
silica	1,900	1966	2
salt	2,000	1974	1
gold	3.7 kg	1971	3

Source: 1. U. S. Bureau of Mines. 1976.  
2. International Monetary Fund. 1970.  
3. Niger, Ambassade des Etats-Unis. undated.

Several other minerals are presently entering the production stage, and may be of some importance eventually. An estimated reserve of 4.5 million tons of coal near Agadez is being developed. Production is scheduled to be 120,000 tons a year by 1982. Coal will be used to fuel the uranium mines, thus lessening dependence on oil imports. There are large phosphate deposits near Tahona and south of Niamey in the "W" National Park (at least 100 million tons averaging 23 percent  $P_2O_5$  in the Park), which could supply domestic fertilizer needs. An estimated 700,000 tons of iron ore at Say, just south of Niamey, is being jointly developed with Nigeria to supply that country's new Ajaokuta iron and steel complex.

Oil has been discovered in the area just north of Lake Chad, but it is not yet certain the deposits are large enough to make development worthwhile.

Several other minerals have been found also, such as manganese, lithium, and molybdenum deposits northwest of Niamey. Again it is not certain whether these deposits can be economically developed. At any rate, exploitation must await an improved transportation network.

### 2.1.1 Mineral Policy<sup>9/</sup>

Ownership of all minerals, including petroleum, is vested in the state. Jurisdiction over all exploration, geological research, and mining is held by the Bureau de Recherche et Exploitation Miniere (BUREMI). Mining companies are privately held, but the government is usually an important stockholder (e.g. holdings of 33 percent in the Arlit uranium mine).

In the uranium industry, Niger's pricing and tax structure allowed about 14 percent of the total profits to go to foreign shareholders, while nearly all of Niger's share goes into a national investment fund. It has been Niger's policy not to develop a uranium deposit until there is a long-term guaranteed market. Specific legislation on minerals may be found in Appendix VI.

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<sup>9</sup>Source: U. S. Bureau of Mines. 1976.  
World Bank. 1976.  
Europa Publications. 1980.  
West Africa. 21 January 1980.

### 2.1.2. Energy<sup>10/</sup>

In 1970 per capita energy consumption in Niger was estimated at  $4.96 \cdot 10^6$  Btu (World Bank estimate: 25.0 kg. of coal equivalent, 1970). About 93 percent of this energy was derived from wood, the implications of which are discussed in later sections. Various forms of annual energy consumption are noted in the following table:

			year	source
Fuel wood consumption	2.0	$10^6$ m <sup>3</sup>	1969	1
Electric power	70	$10^6$ kwh	1975	3
Oil consumption for transportation				
Petrol	14.3	$10^3$ m <sup>3</sup>	1970	1
Diesel	15.1	$10^3$ m <sup>3</sup>	1970	1
Total petroleum products	51,623	tons	1970	1
Total energy consumption	25.0		1970	2
per capita (kg. of coal equivalent)	37.0		1977	2

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Sources: 1. Soussou, J. E. 1974.  
 2. World Bank. 1980.  
 3. Europa Publications. 1980.

Non-wood energy comes primarily either directly or indirectly from petroleum, which must be imported. A number of projects, some of which may have environmental implications, are underway or being contemplated to lessen this dependence. A bilateral agreement with Nigeria concerning hydroelectric power was implemented in 1976, allocating 30 MW annually to Niger from the Kainji dam in Nigeria. Small dams are being considered on the Mekrou River or on the "W" of the Niger River. Either would probably require agreements with Benin, Upper Volta, or both. The planned Kandadji dam on the Niger

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<sup>10</sup>Source: Niger, Ambassade des Etats-Unis. undated.  
 Soussou, J. E. 1974.  
 World Bank. 1976.  
 Africa Research Bulletin. March 31, 1980.  
 Europa Publications. 1980.  
 Legum, C. 1980.

River near the border is a larger multi-purpose project which will include hydroelectric power. The Liptako-Gourma Organization (Mali, Niger, Upper Volta) has already sponsored one study of this project.

Nuclear power is another possibility which has been considered for some time. Although earlier in the decade the option had been rejected because of costs, by 1978 it had been revived and international loans secured to build a 250 m kwh plant in Air near the uranium mines.

A small Office of Solar Energy (ONERSOL) was established in 1966, which by 1976 had 4 full time researchers and 3 technicians on the staff. The 1978-1983 five year plan calls for research into solar and wind energy. Economic uses in Niger will essentially be limited to small-scale energy needs, such as domestic heating, cooling, or cooking. Solar powered groundwater pumps have also been experimented with. These kinds of energy sources are still largely in the research and experimental stage as of 1980.

## 2.2 Water

### 2.2.1 Surface Water<sup>11</sup>

#### Niger Basin

The majority of Niger falls within the Niger River basin, and the Niger River itself flows across the southwestern portion of the country. To the north of the river a set of shallow stream channels is left from a period when a wetter climate prevailed. These extend into the Air Massif and other mountain regions in Mali and Algeria. Though these dry beds, called dallol, may occasionally flow during heavy rains, they are more important for their shallow water tables. Such conditions prevail all across Niger, with more southerly stream beds more likely to flow for a few months. There are no perennial tributaries to the Niger in the Nigerien Niger basin.

The Niger River rises in West Africa in the region of eastern Guinea, northern Ivory Coast, and southern Mali. From Timbuctou in Mali to the Niger border, there are no tributaries, and the river loses about 10 percent of its volume to evaporation. Small southern

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<sup>11</sup> Source: Major, D. C. et al. 1974.  
U. S. AID. 1975.  
Arid Lands Natural Resources Committee. 1979.  
Inter African Committee for Hydraulic Studies (CIAH).  
Vol. 1, 2, 3. 1979.

bank tributaries nearly offset evaporation losses from the border to Niamey, where the average flow is about  $33.1 \times 10^9$  cubic meters. A number of tributaries between Niamey and Gaya, all of which originate south of the border, increase the annual flow to  $37.8 \times 10^9$  cubic meters by the time it reaches Gaya.

Peak low on the Niger is during January or February at Niamey, when the volume is normally over twice the average. The lowest flow is normally during July, and can be as little as 10 to 20 percent of the average. At Gaya the January-February peak is also over twice the average flow. Since Gaya is in the wettest part of Niger, there is also a smaller second peak in September due to local rains. Peak flow on all the tributaries is due solely to local rains, rather than basin-wide collection, and thus comes in August-September. These tributaries are all dry for several months during the dry season.

Little water quality data is available beyond the general observation that surface water is usually low in hardness, alkalinity, and total dissolved solids. Analysis of a sample of Niger River water taken at Tillabery in November 1979 showed the following:

Field Ph	ppm of:	Na	K	Ca	Mg	Cl	SiO <sub>2</sub>
7.1		1.9	2.0	3.4	1.8	<1	9

#### Chad Basin

Niger shares Lake Chad with three other countries, and the eastern portion of the country falls within the Chad basin. The only tributary to the lake of even minor importance anywhere near Niger is the Komadugu Yobe. This streambed starts in northern Nigeria and serves as the Niger-Nigeria boundary for the last 150 km of its course. The Komadugu Yobe flows only during the wet season, and contributes only  $.5 \times 10^9$  cubic meters of water annually to the lake, which is 1.2 percent of the total.

Lake Chad itself fluctuates greatly in area by year and season. In the 20th century its recorded area has varied from 10,000 to 25,000 sq. km. Maximum depth is only from 7-12 meters. Lake Chad loses over 90 percent of its inflow to evaporation, but rather surprisingly is a freshwater lake. There are several possible explanations. The most important salt removal mechanism seems to be that constant seepage into the clay and water bearing sandy layers on the northern rim of the lake causes the salt to be deposited in the sands. Salinity of wells in this area is 10 times greater than in water discharged into Lake Chad.

### 2.2.2 Groundwater<sup>12/</sup>

The African Shield, or Precambrian basement complex, underlies most of Africa, including Niger. The Air Massif, the western corner of Niger, and a small area near Zinder are part of this but in the rest of the country various sedimentary formations overlie the ancient basement complex. The Nigerien portions of these sedimentary basins are generally good groundwater reservoirs, and Niger is one of the most well-situated Sahel countries with regard to groundwater resources.

Groundwater depth in certain sedimentary basins may average 40-60 meters; in others it is 200-300 meters. In general, central Niger is overlain by basins with deeper aquifers, and in the eastern and western portions groundwater is closer to the surface.

Groundwater level fluctuations can be 5-10 m or even greater between rainy and dry seasons. Recharge of aquifers is nearly all due to rainfall, and thus is practically nil in areas of less than about 400 mm annually. Estimated safe yield from southwestern Nigerien aquifers is about  $1.8 \times 10^9$  cubic meters per year. For the aquifers in southeast Niger, which is part of the Chad basin, this figure is only slightly greater, not quite  $1.9 \times 10^9$  cubic meters per year. Total storage in the aquifers of southern Niger is estimated at about  $200 \times 10^9$  cubic meters which means that the safe yield is around 2 percent.

Water quality in the sedimentary basins is generally quite good, and in the basement it is excellent. Total dissolved solids may be in the range of 250 mg/liter and 500-1000 mg/liter for basement and sedimentary groundwater respectively.

Detailed water resources data for the area of southern Niger and for a small study area west of Agadez can be found in Appendix V.

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<sup>12</sup>Source: Schreuder, P. J. 1973.  
U. N. Dept. of Economic and Social Affairs. 1973.  
Major, D. C. et al. 1974.  
U. S. AID. 1975.  
Arid Lands Natural Resources Committee. 1979.

### 2.2.3 Water Use<sup>13/</sup>

Although irrigation potential is still largely undeveloped, one of the major uses of surface water is for irrigation. Present consumption (1976-1978) of water for agriculture on the Niger River is shown in the following table:

Irrigated area:	24,000 ha
Water use (irrigation):	720 $10^6$ m <sup>3</sup> /yr
Flood recession area:	50,000 ha
Water Use (flood recession):	750 $10^6$ m <sup>3</sup> /yr

Source: Inter African Committee for Hydraulic Studies, 1979. Vol. 5.

In addition, about 1,100 ha are irrigated from small reservoirs near Tahoua and a few hundred hectares are irrigated with water from Lake Chad. Groundwater is usually used for household water needs and for livestock. Wells for these purposes are most often hand dug and water is hand drawn.

The Niger valley has a potential irrigable area of about 140,000 ha, which depends largely on the completion of the Kandadji dam near the Mali border. Another 100,000 ha could potentially be irrigated through the construction of hundreds of small dam reservoirs on small watercourses throughout the country. The Nigerien portion of the Lake Chad area has only about 7,000 ha potential. The Inter African Committee for Hydraulic Studies projects that water use in the savanna portion of Niger in the year 2000 will be about 4,264  $10^6$  cubic meters per year, about 92 percent of which is for irrigation. Projections are shown in the following table, and a number of proposed dam projects which will help realize irrigation potential can be found in Appendix V.

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<sup>13</sup>Sources: Major, D. C. et al. 1974.  
Janka, B. 1976.  
Inter African Committee for Hydraulic Studies.  
1979. Vol. 5, 7 .

Year 2000 Projected Water Use ( $10^6 \text{ m}^3/\text{yr}$ )

Total Irrigation	Human Consumption				Livestock	Industry	
	(Total	Rural	Small Towns	Niamey)			
4264	3920 (92%)	237 (67)	150	30	57	85 (2%) (6%)	22 (1%) (<1%)

Source: Inter African Committee for Hydraulic Studies. 1979. Vol. 7.

2.2.4 Water Law<sup>14/</sup>

Legislation in force concerning water is primarily based on French colonial laws, unless amended or superceded by subsequent legislation. Appendix VI includes water legislation. In the event no legislation applies, Islamic and other customary law is used. Ownership of water is generally in the public domain, except in certain cases such as a well built by private means on private land. In practice, water users further from administrative influence may tend to act as owners themselves. The issue of priorities is not addressed in legislation. Thus customary and Islamic law is referred to, and sets these priorities in decreasing order of importance as: drinking water, animal watering, irrigation, then industrial and recreational use. Though not formally law, these priorities tend to give urban areas with higher population concentrations needing drinking water preference over rural and grazing areas.

In general, legislation does not cover the amount of water which may be used either in rural or urban areas. However, pumping stations in livestock areas may only be opened once surface water from the rainy season is exhausted.

Water quality is controlled only in urban areas, where the supplier must meet certain standards and test its water periodically. Companies may be held liable for poor quality if they are determined to be at fault; otherwise the urban administration is empowered to trace the source of pollution and take action against those at fault.

Niger is a member of several international organizations which regulate water resources to some extent. The Lake

<sup>14</sup> Source: U. N. Economic Commission for Africa. 1972. Caponera, D. A. 1978.

Chad Basin Commission is made up of Niger, Nigeria, Chad, and Cameroon. It is charged with seeing that exploitation and development of water resources in the area do not have detrimental effects on water courses in the basin or on the lake itself. This broad definition of powers allows the commission to take an interest in such things as livestock production, agriculture, fisheries, transport and communication, tse-tse fly eradication, and hydrology.

The Niger River Commission consists of nine African states which share the Niger Basin. Its purpose is similar to the Chad Basin Commission. Activities include projects and studies on fishing, hydrology, hydrography, solar energy, and transport. Both of these organizations may recommend legislation to member states, and theoretically are responsible for ensuring implementation by member states of any agreements reached.

The Inter African Committee for Hydraulic Studies is charged primarily with facilitating exchange of information and cooperation on research. The committee also conducts its own research. The Liptako-Gourma Region Integrated Development Authority (Mali, Niger, Upper Volta) is to promote regional development of the contiguous parts of these three states. Water, water use for agriculture and livestock, and fishing are among the interests of this body.

Several internal agencies are also concerned with various aspects of water resources. The Ground Water Authority (OFEDES) is charged with construction, operation, and maintenance of wells and baseholes in rural areas. The Water Commission is responsible for determining Niger's water policy, for coordinating projects of various governmental agencies, and for evaluating the impact of such projects. It may also examine and advise on any legislation on water matters.

## 2.3 Soils and Agricultural Land Use

### 2.3.1. Soils<sup>15/</sup>

The Sahel-Sudan portion of Niger has been included in a study on resources by the Inter African Committee for

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<sup>15</sup>Source: Church, R. J. H. 1974.  
Arid Lands Natural Resources Committee. 1979.  
Inter African Committee for Hydraulic Studies. 1979.  
Vol. 1, 6.

Hydraulic Studies (CIEH). Soils were classified by their agricultural or range potential and divided into five categories as follows:

- Class 1: Generally good soils. These soils do not have any serious limitations, and are able to produce good yields of suitable, climatically-adapted crops.
- Class 2: Generally moderate to good soils which have slight to moderate limitations which may restrict their use. Yields of climatically-adapted crops are moderately good.
- Class 3: Generally poor to moderate soils. These soils have limitations of moderate intensity, are usually of fairly low natural fertility, and generally give low to moderate yields of climatically-adapted crops under traditional systems of management.
- Class 4: Generally poor soils. These soils have moderately severe to severe limitations and, under traditional systems of management, give generally poor yields.
- Class 5: Soils generally unsuited to cultivation, though sometimes locally suitable for rough grazing or other extensive uses. They suffer from limitations which are generally severe enough to exclude cultivation, such as shallow depth, steep slope or very unfavorable soil reaction (extreme acidity of salinity/alkalinity), virtually preventing crop growth unless improved.

Class 1 soils are hydromorphic soils by the French terminology. In the FAO mapping system they are Gleysols (humic, eutric and undifferentiated), Fluvisols, eutric and undifferentiated gleyic Luvisols, and gleyic Cambisols. In Niger these are found along the Niger River and its tributaries, in the major dallois extending towards Air, in some of the dry stream beds of south-central Niger, and along the border with Nigeria near Lake Chad.

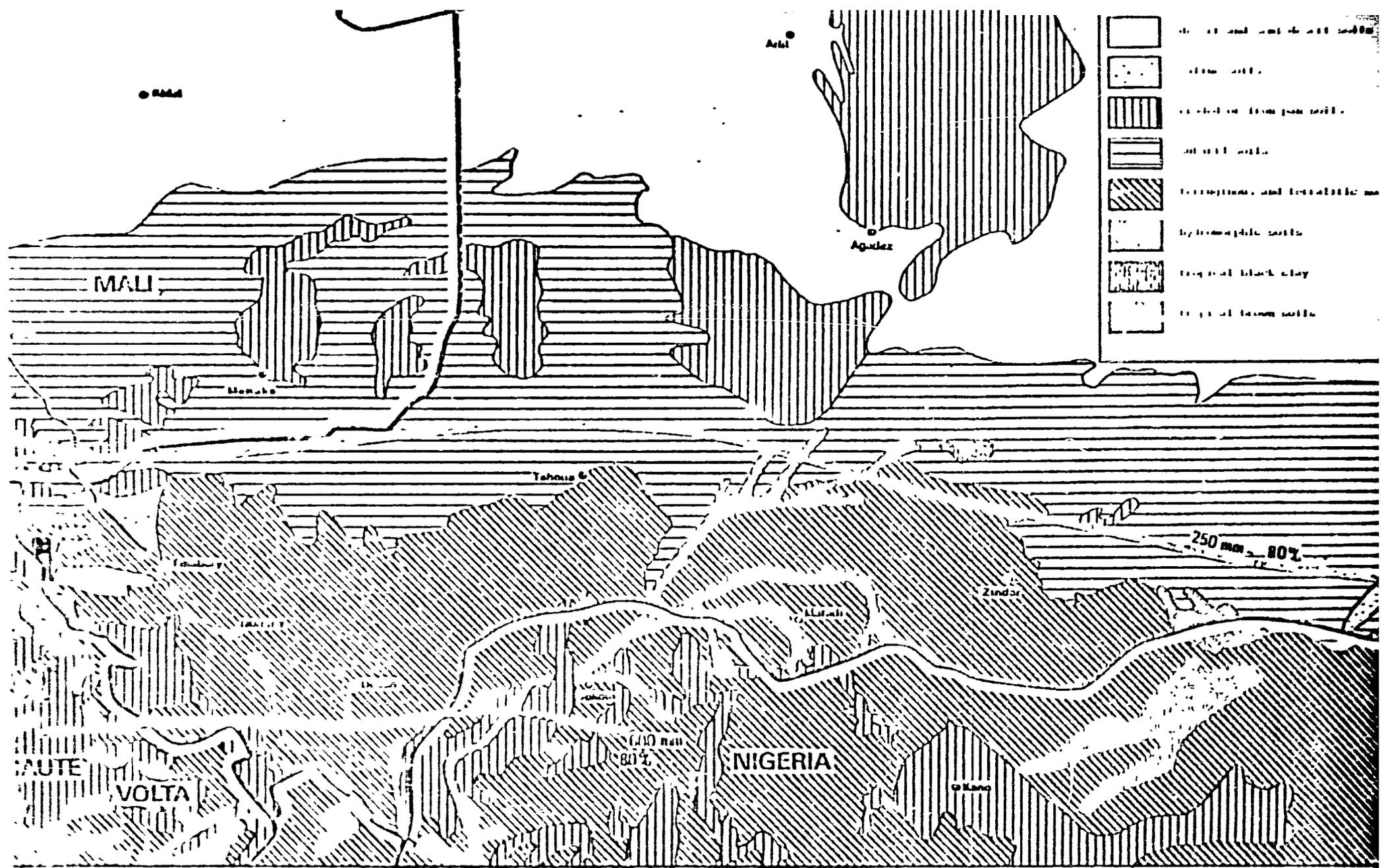
Class 2 soils are also hydromorphic soils excluded from class 1, such as acid humic and vertic hydromorphic soils, those gleyed throughout, or immature soils over sandy alluvium. A few ferruginous or brown subarid soils are also included here. Their distribution is in general similar to class 1, and like class 1 they are usually found in association with other classes.

Soils of class 3 are Tropical Ferruginous (plinthic and ferric luvisols in FAO terminology) and desaturated Ferrallitic soils (FAO: ferric and orthic Acrisols, some Nitisols) The are common in southwest and southcentral Niger.

Class 4 soils are made up of two major groups. Light textured and sandy soils with little profile development, mainly immature, Reddish Brown Subarid, and Tropical Ferruginous over eolian sands (FAO: Regosols, luvisol, cambic, and ferralic Arenosols) comprise the first group. The second group consists of heavy textured vertisols. This class, especially the light textured group, is the most common one of the Sahel, and these soils extend all across Niger south of about 17° N.

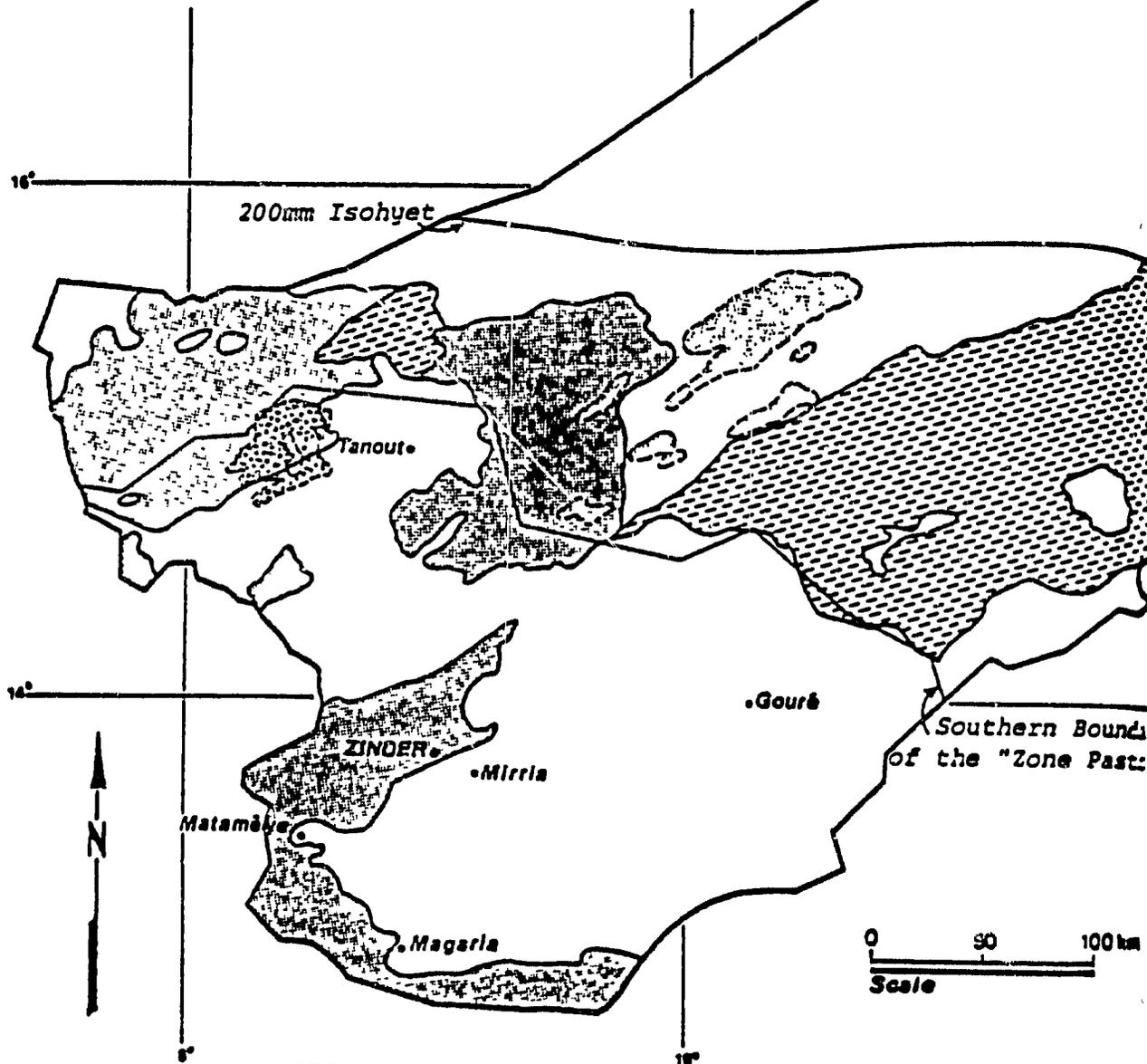
Class 5 is comprised of loose shifting sands, shallow lithosols, and saline soils. The vast majority of Niger is of this type. Generally, a band of shallow lithosols extends from the Sahel into the desert until it merges with the completely raw mineral soils of the Sahara. In the east, these raw desert soils extend to the area around Lake Chad.

Unfortunately, the CIEH has not published a soils map which is usable for specific countries. The following map from another source gives an idea of soil distribution in Niger.



Anonymous. Undated.

Soils throughout Niger are often subject to severe erosion. Causes can sometimes be attributed to human mismanagement, but often are unconnected to agriculture or pastoralism. With such sparse plant cover, many areas are subject to wind erosion or water erosion during short, heavy rains. Estimates for Zinder district show that human activities are the major factor only in localized areas, as shown in the following map.



**FACTORS INVOLVED IN MODIFICATION OF LAND SURFACES**

- |   |                  |   |                   |
|---|------------------|---|-------------------|
|  | Wind Erosion     |  | Remobilized Dunes |
|  | Water Erosion    |  | Wind Deflation    |
|  | Human Activities |   |                   |

Source: Arid Lands Natural Resources Committee. 1979.

### 2.3.2 Agriculture

While agriculture is a major sector of the economy, and a major land use in southern Niger, cultivation only takes up a small proportion of total surface area. For 1976-77, only 2.2 percent of Niger's surface was under cultivation, and in the most heavily cultivated district, Dosso, this figure was only 16.7 percent. The following table shows area under cultivation by district for the early 1970's and 1976-77.

Area under Cultivation by Region, 1971-73

Districts	Total Area ( '000 ha.)	Area under Cultivation				% of Total Area			
		1971	1972	1973	1976-77*	1971	1972	1973	1976-77*
Niamey	9,030	970	1,021	750	761	10.7	11.3	8.3	8.4
Dosso	3,100	484	402	382	518	15.6	13.0	12.3	16.7
Tahoua	10,668	368	380	372	450	3.5	3.6	3.5	4.2
Maradi	3,858	384	424	427	440	10.0	11.0	11.1	11.4
Zinder	14,543	430	434	361	524	3.0	3.0	2.5	3.6
Diffa	14,022	92	16	21	41	0.7	0.1	0.2	0.3
Agadez	71,479	-	-	-	-	-	-	-	-
<b>Total</b>	<b>126,700</b>	<b>2,729</b>	<b>2,677</b>	<b>2,315</b>	<b>2,734</b>	<b>2.2</b>	<b>2.1</b>	<b>2.8</b>	<b>2.2</b>

Source: World Bank. 1976.

\*1976-77 from Niger, Ministere du Developpement Rural, Direction de l'Agriculture. 1978.

It is estimated that nearly another 12 percent of Niger's area may be potentially cultivable, so there is quite a lot of room for expansion. Only about 1 percent of the cultivated land in 1976-77 was irrigated.

Agriculture in Niger is overwhelmingly subsistence-oriented. Over 95 percent is on small farms of less than five hectares, which average holdings of around three hectares.

<sup>16</sup>Source: U. S. AID. 1975.  
 Food and Agriculture Organization. 1976.  
 World Bank. 1976.  
 Niger, Ministere du Developpement Rural, Direction de l'Agriculture. 1978.  
 Inter African Committee for Hydraulic Studies. 1979. Vol. 6.  
 U. S. AID. 1980b.

The land is worked by hand, as farmers do not keep live-stock. Herding is almost entirely the provenance of the nomadic groups. Over half the cultivated area is planted in millet as soon as the first rain comes in June, and the other major food crops are planted soon after. Cowpeas (Niabe) and peanuts are usually intercropped. Cotton may be planted last after a farmer feels he has enough food crops. There tends to be little specialization in cropping. Most farmers produce a mixture, including some cash crops. Production by district of major crops is shown in the following table and is followed by a general map showing economic activity including agriculture.

Regional Production of Major Crops 1972-1976

DISTRICT	CROP	1972			1973			1974			1975			1976		
		P	A	Y	P	A	Y	P	A	Y	P	A	Y	P	A	Y
SIKASSO	MILLET-MIL	377,751	625,244	419.0	243,163	712,673	347.6	227,450	729,50	217	168,740	448,12	257	231,477	714.3	477.0
	SORGHUM-SORGH	31,447	90,179	442.0	9,637	23,473	107.3	47,120	192.20	440	37,300	70.47	293	21,572	42.72	66.7
	COUPEAS-NIABE	60,513	264,123	174.2	26,237	239,119	11.0	26,000	296.70	110	24,770	241.47	117	22,522	171.11	111.7
	RICE-RIZ	31,240	16.69	2,746.0	43,808	16.98	2,698.0	29,730	14.00	1,100	28,100	16.39	1,010	27,320	19.37	1,122.0
	GROUNDNUTS-ARACHIDES	0.003	0.010	146.0	0.337	1.012	121.6	0.300	1,200.00	416	1.00	2,112.00	663	1.170	2.70	619.0
COTTON-COTON																
BOUKO	MILLET-MIL	222,300	430,000	530.0	167,851	290,737	416.8	164,790	641.10	374	149,220	434.93	187	262,470	326.77	479.0
	SORGHUM-SORGH	40,348	75,300	476.0	37,012	81,490	470.2	36,900	87.60	920	12,120	31.73	100	15,170	32.72	266.0
	COUPEAS-NIABE	7,830	92,100	235.0	29,873	120,330	244.4	26,120	171.70	130	44,170	119.72	170	92,370	109.77	426.0
	RICE-RIZ	0.330	0.300	350.0	0.104	0.290	359.0	0.270	0.30	490	0.140	12.20	270	1.470	1.43	1,122.0
	GROUNDNUTS-ARACHIDES	16,600	44,730	425.0	13,070	34,470	276.0	5,200	11.60	430	0.200	17.60	510	19,140	22.22	927.0
COTTON-COTON	2,190	0.370	320.0	0.100	0.400	260.0	0.140	0.30	460	0.130	0.25	630	0	0	0	
SIPHA	MILLET-MIL	144,713	375,692	470.0	91,143	313,300	238.0	213,320	400.60	322	126,470	325.93	474	167,770	409.77	577.0
	SORGHUM-SORGH	29,308	120,120	374.4	20,944	79,450	291.6	36,900	87.60	400	91,770	239.23	373	93,170	191.77	366.0
	COUPEAS-NIABE	31,364	226,441	164.2	23,199	216,400	107.0	32,900	229.70	164	99,470	244.73	324	96,970	169.77	362.0
	RICE-RIZ	73,300	0.100	350.0	77,000	0.100	350.0	0.090	0.12	750	0.120	5.12	320			
	GROUNDNUTS-ARACHIDES	144,971	182,100	633.0	31,700	122,490	230.0	71,400	140.40	370	15,170	192.40	70	66,100	177.77	642.0
COTTON-COTON	0.022	0.032	170.0	0.017	0.030	170.0	0.010	0.02	900	0.010	0.02	400	0	0	0	
SIFTA	MILLET-MIL	4,732	13,373	333.3	5,100	13,100	329.0	5,100	13.30	320	10,900	27.9	310	6,270	17.77	100.0
	SORGHUM-SORGH	0.448	1,987	293.0	0.320	2,320	206.3	20,300	21.20	930	0.370	0.49	1,010	0.170	11.72	223.0
	COUPEAS-NIABE	0.003	1.030	96.3	0.038	1,100	34.3	0.200	3.00	67	1.170	5.90	190	0.900	6.77	279.0
	RICE-RIZ	0.124	0.090	1,123.0	0.320	0.400	800.0	0.133	0.17	300	0.250	0.30	850	0.220	0.32	739.0
	GROUNDNUTS-ARACHIDES	0.420	1.000	330.0	0.009	2.700	23.7	0.900	3.00	200	1.300	2.00	300	0.900	1.70	416.0
COTTON-COTON																
NABALI	MILLET-MIL	101,900	297,000	243.0	95,631	316,642	302.0	136,700	333.30	420	79,220	240.30	493	196,220	246.12	321.0
	SORGHUM-SORGH	79,610	147,000	246.0	19,784	129,271	213.4	50,900	162.20	313	60,290	204.00	240	77,300	122.72	423.0
	COUPEAS-NIABE	22,100	143,000	126.0	22,490	150,757	83.1	28,700	132.30	190	30,320	149.90	320	36,000	110.80	229.0
	RICE-RIZ															
	GROUNDNUTS-ARACHIDES	93,700	176,300	487.3	28,634	109,000	109.4	67,700	89.00	340	13,200	103.82	140	27,920	69.93	362.0
COTTON-COTON	0.943	3.330	218.4	0.322	1.750	182.7	0.730	1.00	294	0.485	1.00	300	0	0	0	
TANONA	MILLET-MIL	84,475	236,300	283.0	36,999	236,400	187.0	117,200	290.90	417	35,470	126.70	220	146,270	189.62	419.0
	SORGHUM-SORGH	41,067	123,000	333.3	18,333	116,400	243.0	36,200	126.20	413	31,120	147.33	210	77,220	134.82	273.0
	COUPEAS-NIABE	1,275	94,300	15.0	2,341	75,000	33.37	10,400	70.00	140	1,240	16.30	80	11,100	66.92	166.0
	RICE-RIZ															
	GROUNDNUTS-ARACHIDES	2,460	14,000	270.0	1,170	12,500	91.7	3,400	10.80	320	0.990	2.93	270	1,370	1.92	519.0
COTTON-COTON	4,923	10,873	448.0	3,123	7,750	303.1	7,030	13.30	510	0.900	16.00	190	0	0	0	
TOTAL	MILLET-MIL	919,801	2,196,311	396.1	626,938	2,007,640	312.3	682,690	2,230.00	399	591,220	1,692.93	363	1,194,000	2,331.10	472.0
	SORGHUM-SORGH	250,337	566,790	344.1	126,124	677,990	281.6	218,900	341.62	640	251,820	727.93	322	307,970	673.60	666.0
	COUPEAS-NIABE	124,899	923,390	132.6	92,184	822,976	112.0	132,700	913.00	143	218,300	630.20	260	227,720	810.10	279.0
	RICE-RIZ	31,783	17,183	1,193.0	46,309	17,773	2,403.3	30,175	16.78	2,040	29,320	16.14	1,020	29,170	21.63	1,109.0
	GROUNDNUTS-ARACHIDES	260,193	418,454	631.8	77,896	363,787	211.0	129,100	256.00	300	41,740	319.70	130	99,450	178.80	376.0
COTTON-COTON	6,077	13,200	308.1	9,371	10,140	332.1	7,930	13.07	300	9,440	17.20	340	0	0	0	

P - Production (1000 Tons) A - Area (1000 Hectares) Y - Yield (kg/ha)  
 NA - Not available

Source: CILSS. 1977. Vol. 2.

# ECONOMIC ACTIVITY

## AGRICULTURE

- |   |           |   |                      |
|---|-----------|---|----------------------|
| 1 | □ Peanuts | 4 | □ Rice               |
| 2 | ▨ Cotton  | 5 | □ Millet and sorghum |
| 3 | □ Grazing | 6 | □ Wasteland          |

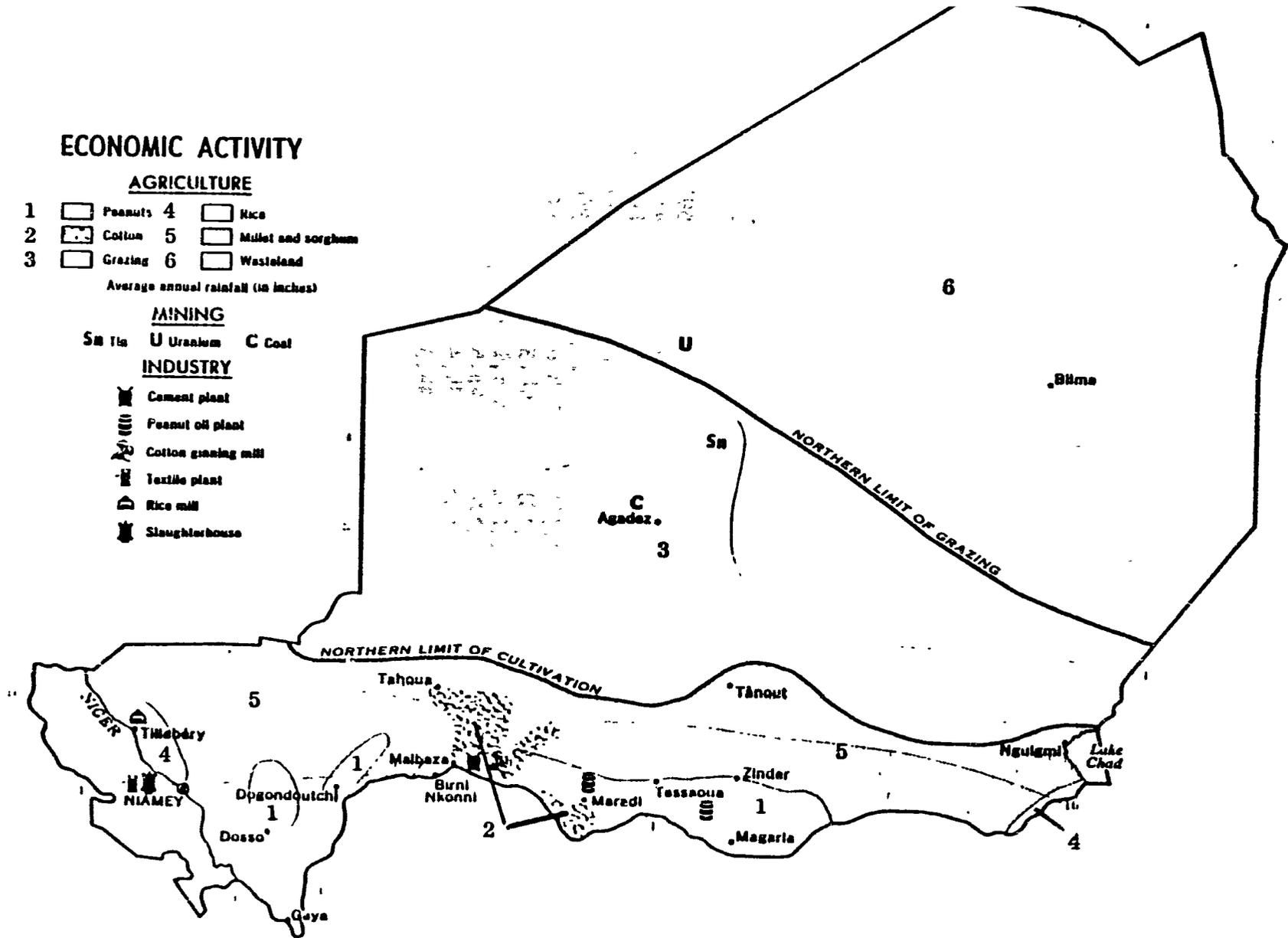
Average annual rainfall (in inches)

## MINING

- |    |     |   |         |   |      |
|----|-----|---|---------|---|------|
| Sm | Tin | U | Uranium | C | Coal |
|----|-----|---|---------|---|------|

## INDUSTRY

- ▣ Cement plant
- ▨ Peanut oil plant
- ▨ Cotton ginning mill
- ▨ Textile plant
- ▨ Rice mill
- ▨ Slaughterhouse



Source: Available from U. S. Government Printing Office, Map No. 59203, 4-69.

Final rights to the land are usually vested in the tribal chief, but for practical purposes land belongs to the patrilineage as a group. It is parcelled out to members of this kin group on the basis of need. Decisions, direction, and actual work involved in farming are usually collectively carried out by the patrilineage.

Farmers are generally aware of elementary procedures which can improve productivity. They often treat seed, and are aware of the beneficial effects on the soil of groundnut cultivation and of manure application. However, the effectiveness of such measures is not very great due to poor application of such methods. Yields of major food crops gradually dropped throughout the 1970's, to the extent that even with increased planting area, production has dropped. This trend can be seen in the following table.

Millet and Sorghum, 1964-75

<u>Year</u>	<u>Area</u>		<u>Production</u>		<u>Yield/hectare</u>	
	('000 ha)	(index) <u>1/</u>	('000t)	(index) <u>1/</u>	(kg/ha)	(index) <u>1/</u>
1964	2,230	} 100.0	1,328	} 100.0	595	} 100.0
1965	2,275		1,055		464	
1966	2,273		1,119		492	
1967	2,421	107.2	1,342	115.0	554	107.2
1968	2,491	110.3	948	81.2	380	73.5
1969	2,867	126.9	1,384	118.6	483	93.4
1970	2,903	128.5	1,101	94.3	379	73.3
1971	2,935	129.9	1,226	105.1	418	80.9
1972	2,761	122.2	1,126	96.5	408	78.9
1973	2,456	108.7	753	64.5	307	59.4
1974	2,772	122.7	1,100	94.3	394	76.2
1975	2,800	123.9	1,000	85.7	357	69.1

Source: World Bank. 1976.

1/ Average index of three years, 1964-66, which may be considered "normal" years.

The use of chemical fertilizers, insecticides, and mechanical equipment is very rare in Niger. In 1975 there were only 50 tractors in the country, and 130 tons of fertilizer were used. Chad and Mali, countries with roughly similar populations and climates, had 300 and 200 tractors respectively. They used 2,000 and 5,000 tons of fertilizer respectively.

## Major Problem in Agriculture

One of Niger's most obvious problems is its climate. Even in normal years the agricultural situation is precarious. Production falls drastically during droughts, such as between 1967-1973, because 99 percent of crop production is by dryland farming. More over, the traditional farming methods are no longer adequate to sustain a population which is no longer in balance with the environment. Emigration from rural areas further aggravates the situation by increasing even more rapidly a segment of the population which is non-productive in term of agriculture. Cultivation must be intensified, but with traditional methods this only results in further degradation of the land. Niger has very little agricultural infrastructure which might be able to rapidly introduce modern techniques into rural areas, and the cost of many such techniques remains quite high by local standards. Crop disease is yet another problem that the traditional farmer cannot cope with. Groundnut production, which survived the drought with only slight decreases, was hit immediately afterwards by disease. Production was severely hurt for several years and is not yet up to early 1970's levels.

### 2.4 Vegetation<sup>17/</sup>

The International Union for the Conservation of Nature and Natural Resources (IUCN) has mapped and described the vegetation cover of West Africa. The following vegetation zones are found in Niger (refer to map following this section):

#### 1. Sudanian undifferentiated woodland (mapping unit 12)

Most of the region has been inhabited for centuries and practically all the vegetation has been deeply modified by cultivation, cutting, grass fires and grazing.

Woodland remains only on rock hills and ironstone plateaux. Larger trees are 8 to 12 meters high and the most common species are Anogeissus leiocarpus, Balanites aegyptiaca, Lannea microcarpa, Prosopis africana, and Sclerocarya birrea. The lower tree stratum, about 6 meters tall with short boles, includes Combretum glutinosum, Strychnos spinosa, and Terminalia avicennioides.

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<sup>17</sup> Source: International Union for the Conservation of Nature and Natural Resources (IUCN). 1979.

## 2. South-Saharan zone (mapping unit 17)

This is a zone of contrasting seasons due to the extreme difference between rainy and dry seasons. In the rainy season pastures are dominated by annual plant species which, providing it rains in a regular fashion, ensure their perenniality by producing a vast quantity of seeds. Pastures, which become dry due to the change of season, continue to vegetate, and a considerable amount of plant matter is produced so long as there is water available.

Hay pastures include the following:

- a. Aristida mutabilis and Eragrostis tremula pasture cover wide areas of land, ranging from the lower part of Senegal to Chad.
- b. Schoenefeldia gracilis pastures consist of loamy sand soils, which are very suitable for livestock but their production very much depends upon climatic changes.
- c. Aristida pastures of the group pallida, with low agrostologic value, perennial and hard stubble, abandoned by livestock.

Trees providing fodder are just as important for livestock as for wild fauna, gazelles in particular. In the middle of the dry season these are the only source of green fodder and proteins. Among the true evergreen trees, the most important are Balanites aegyptiaca and Maerua crassifolia. Trees with deciduous leaves include Commiphora africana, Grewia spp., Zizyphus, Cordia rothii, and Combretum aculeatum, which shed their leaves during part of the dry season, e.g. Acacia raddiana.

These trees have suffered greatly from the continuous drought. In some of the Nigerian and Chadian zones, more than half of the Acacia raddiana died. It is difficult for trees to regenerate; the young ones are always mutilated and herdsmen prune the "green" trees in order to give fodder to their herds. The disappearance of trees accelerates desertification. Animals are deprived of protection against the intense heat of the sun and of food plants which grow under trees, sheltered from excessive heat.

Desert grasslands on sands in West Africa are dominated by two species of tufted perennial grasses: Panicum turgidum and Stipagrostis (Aristida) pungens. Woody species include Acacia senegal, Balanites aegyptiaca, Commiphora africana. Further north Acacia tortilis becomes the principal woody species.

3. North-Sahelian zone (mapping unit 19)

This is a steppe, herb-like vegetation, of which the plants cover less than 3 percent of the soil. The main types of pastures are:

- a. Fanicum turgidum, very much sought after by pastoralists, is the basic food of the addax and oryx.
- b. Cyperus conglomeratus pasture - on poor soils; is low-quality fodder.
- c. Aristida longiflora pasture, in sub-desertic regions, which retains nutritive value even when dry.
- d. Aristida acutiflora pasture found along the desert fringe; good fodder for camels, gazelles and addax.

The only shrubs and trees are to be found on the edges of the Quadis, of which the principal species are Zizyphus mauritiana, Acacia raddiana, Balanites aegyptiaca, Maerua crassifolia, and Combretum aculeatum.

4. The Sahara desert (mapping units 24, 26, 27, 28)

The Sahara is the largest desert in the world and most extreme in its climatic conditions. Daily amplitude in temperature can exceed 35° C and annual amplitude 60° C.

Apart from the high mountains of limited extent, the Sahara consists of several basins isolated from the sea and lacking any outward drainage. Depressions are either sand desert (erg) or gravel desert (reg). Between the depressions, the stratified terraced landscape forms a stone desert (hamada) incised by dry valleys (ouadi or wadi). Oases occur wherever water of low salt content issues as spring in the desert.

Wadis are the only habitats where trees and large bushes are found. There are three main vegetation communities: Tamarix communities in larger sandy wadis; Acacia communities on rocky beds of wadis and gravelly alluvium of outwash fans, the most widespread of which is characterized by Acacia tortilis and Panicum turgidum; and Hyphaene ("Doum") communities in the larger wadis radiating from the southwestern slopes of the Tibesti and which locally form well grown fringing forests. Dominant trees are Hyphaene thebaica, Salvadora persica, Tamarix articulata, and Acacia nilotica.

- a. Vegetation of ergs - after heavy rains, desert dunes may have a 50 percent cover or otherwise may be completely sterile. Stipagrostis pungens and Cornulaca monacantha is present throughout in western Sahara.
- b. Vegetation of sandy regs - extremely homogeneous and almost exclusively composed of xerophytes. Frequent species are Danthonia forskalii, Plantago ciliata, and Polycarpaea fragilia.
- c. Vegetation of hamadas - plants only grow in rock crevices and water receiving depressions. The vegetation is relatively uniform throughout and rather rich in species, which include Forskalea tenacissima, Asteriscus graveolens, Salvia aegyptiaca, and Beseda villosa.

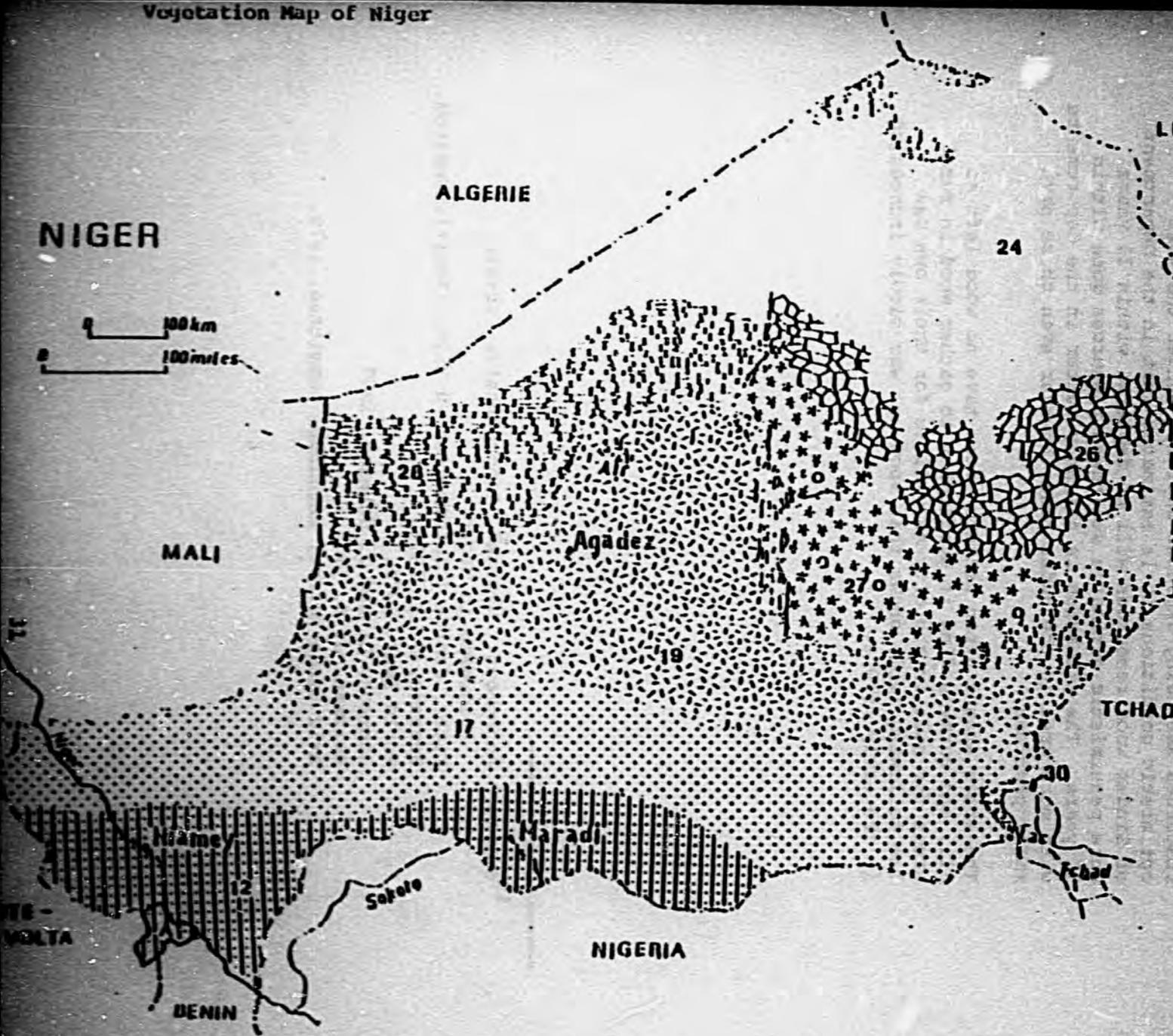
There is also a tiny area of semi-aquatic vegetation (mapping unit 30) which the IUCN does not describe. Another classification scheme<sup>18</sup> calls this undifferentiated swamp, and describes the vegetation as follows:

Cyperus papyrus is a common sedge fringing the edges of swamps and lakes and some of the more characteristic hydrophilous grass species of the perennial swamps are Echinochloa pyramidalis, E. stagnina, Vossia cuspidata, Brachiaria mutica, Vetiveria nigritana, Oryza barthii, Phragmites spp., Leersia hexandra, Acroceras macrum, Panicum repens, Pennisetum purpureum, Chasmopodium sp., Anadelphia arrecta, Saccharum spontaneum and Paspalum commersonii. Common sedges are species of Typha, Juncus and Scirpus.

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<sup>18</sup>Source: Rattray, J. M. 1960.

Vegetation Map of Niger



**KEY**

- 1. Multiple natural savannas (Savannas)
- 17. Multiple natural savannas (Savannas) and multiple savannas
- 19. Multiple natural savannas (Savannas)
- 20. Multiple natural savannas (Savannas)
- 24. Absence of all
- 26. Forest zones without vegetation
- 27. Forest zones with vegetation
- 30. Vegetation of the Sahel, Sahelian and Sahelian (a) Diffuse (b) Contracted
- 31. Semi-arid vegetation

Source: IUCN. 1979.

#### 2.4.1 Forestry<sup>19/</sup>

Except for local stands in such places as dallol beds, trees are found only in the Sudan and to some extent the southern Sahel zones of vegetation (units 12 and 17 on map respectively). These "forests" are not dense, compact areas of trees, but rather dispersed trees which very seldom have crowns touching one another. This "forest" area corresponds roughly with the area of sedentary agriculture, and since most energy needs in Niger are met by wood fuel, even these sparse tree resources are being depleted rapidly. Under the most optimistic conditions it is estimated that in the Department of Zinder wood resources will be depleted within 23 years. More pessimistic estimates see these resources gone within 11 years. The situation is slightly better in the departments with more area in the Sudan zone; however even these have major problems.

The areas around urban centers often have no wood left at all, and farmers find it profitable to gather wood in rural areas for sale in the city as well as for their own use. The following table shows that wood use was slowly increasing in the early 1970's.

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<sup>19</sup>Source: Anonymous. Undated. Comprehensive Forestry Programme in Niger.  
Niger, Centre d'Information du Niger (Paris). Undated.  
Soussou, J. E. 1974.  
World Bank. 1976.  
Johnson, H. and J. Johnson. 1977.  
Holzman, J. S. 1977.  
Arid Lands Natural Resources Committee. 1979.

## Roundwood Removals

(FAO estimates, '000 cubic metres, all non-coniferous)

	1971	1972	1973
Industrial wood . . . . .	160	255	170
Fuel wood . . . . .	2,180	2,250	2,320
TOTAL . . . . .	2,340	2,415	2,490

1974-76: Annual production as in 1973 (FAO estimates).

Source: Europa Publications. 1980.

This increase in use was taking place at the same time that desertification was rapidly spreading, and must be counted as at least a minor contributing factor. Depletion of tree cover has serious consequences not only in terms of rural energy needs, but also because the cover helps prevent soil erosion and desert encroachment.

The government of Niger has been well aware for some time of the problems inherent in allowing such trends to continue. A number of programs to reverse the trend have been implemented or are being considered. From 1965-1968 a program aimed at reforesting 3,290 hectares was only partially successful and actually reforested 775 hectares. Similar programs since then have also only been partially successful, but over 8,300 hectares have been planted with over 830,000 trees by the early 1970's. The main trees used for these plantings have been Acacia albida or other Acacia species.

Other work being carried out includes managing areas of fast growing trees to relieve pressure on natural growth, developing green belts around towns, and attempts to maintain stricter controls over exploitation of wood resources. Most activities in the area of forestry are carried out by the Department of Water and Forestry (or Water and Forest Service), within the Ministry of Local Economy. The effectiveness of such programs is limited by lack of funds and trained personnel.

### 2.4.2 Pastoralism<sup>20/</sup>

Pastoralism is the major activity of the northern Sahel zone

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<sup>20</sup> Source: Niger, Centre d'Information du Niger (Paris). Undated.  
Horowitz, M. M. 1972.  
Boeckm, E. et al. 1974.  
U. S. AID. 1975.  
Gerhart, D. D. et al. 1976.  
World Bank. 1976.  
Europa. 1980.

(unit 19 on map), and is also widespread in the southern Sahel (unit 17 on map) in areas where agriculture is not practiced. After the rainy season, some vegetation can be found in the southern Saharan regions (units 27 and 28), and nomads may move their animals to take advantage of this. In general, Fulani cattle pastoralists utilize the more southern portions of these areas, and the Tuareg live in the northern portions.

The livestock sector has always been a major factor in the traditional economy. Even in the modern economy it still contributed about 12 percent to the GNP in 1971, and about 17 percent to export earnings in 1976. Herd sizes may be seen in the following tables, which also serve to show the extent to which the livestock sector, especially cattle, were hit by the 1967-1973 drought.

Livestock Population

Breed	1958	1968	1969
Cattle	3 500 000	4 300 000	4 000 000
Sheep	1 800 000	2 470 000	2 070 000
Goats	5 000 000	6 140 000	5 700 000
Horses	110 000	170 000	170 000
Donkeys	300 000	360 000	330 000
Camels	350 000	360 000	330 000

Source: Niger. Centre d'Information du Niger (Paris). Undated.

Livestock

('000 head)

	1975	1976	1977*
Horses . . .	191	206	210
Asses . . .	344	384	370
Cattle . . .	2,508	2,581	2,900
Camels . . .	257	253	265
Pigs . . .	26*	27*	28
Sheep . . .	2,159	2,323	2,560
Goats . . .	5,395	5,946	6,200
Poultry . . .	7,200*	7,300*	7,400

\* FAO estimates.

Source: Europa Publications. 1980.

### Problems of the Livestock Sector

As with agriculture, the livestock sector is heavily influenced by climate. In years of good rains, pastoralists increase herd size, since animals are regarded as the main source of wealth. When drought comes, such as in 1967-1973, the reduced pasture is more intensively grazed.

Eventually this pasture fails from a combination of overgrazing and the effects of drought, and herds must be drastically reduced. Some animals may be sold for emergency cash. More often they simply die, and the nomads lose their livelihood and must become refugees. The effect on the land is to increase erosion, reinforcing the effects of the drought and compounding desertification problems.

The same cycle can be set in motion even without drought. In years of good rains, the agricultural sector tends to expand into the best grazing areas, and herds are restricted from grazing many former pastures. The result can be the same as during drought, since herds are concentrated on less pasture.

Under these conditions, the combination of private ownership of animals with collective rights to grazing land can compound range problems. Many individual herders are actually quite well aware of the dangers of overgrazing. However, if a herder restricts grazing by his animals, someone who does not recognize the problem will immediately step up grazing in the area. The net result for the conscientious herder is simply to deprive his animals of pasture without anything at all having been accomplished in terms of range conservation.

Other constant problems include animal diseases. Although the health status of Nigerien herds is generally good, locally certain diseases can be a significant factor. The Niger valley south of Say is infested with tse-tse fly, and trypanosomiasis is a major concern to cattle owners in this area. Bovine and caprine pleuropneumonia are both present, as are aphic fever, blackleg, Rinderpest, anthrax, sheep pox, and a number of other diseases. Internal and external parasites are problems in all herds, and ticks especially transmit a number of diseases such as piroplasmosis.

### Government Involvement

A number of programs are being carried out by the Government of Niger in the livestock sector. A large scale immunization program for Rinderpest and CLPP has been underway for some time. Other activities have been aimed at rebuilding herds, and at reestablishing nomads who lost their animals in the drought. Several research stations have been set up, and some regulation on burning does exist.

Most activities are carried out by various departments of the Ministry of Rural Economy. As in every other endeavor, extreme shortages of trained personnel have hampered progress. In addition, there is often a lack of understanding of nomadic life, or of the impact of various programs on this life or on the range itself.

## 2.5 Fauna and Protected Areas<sup>21/</sup>

Wildlife is best considered in conjunction with protected areas. The population of wildlife is generally lower where human density is greater. In addition, data on wildlife populations is in general only available for protected areas. All types of wild fauna are hunted as a supplementary food source, and even protected areas are not usually well-patrolled. Hunting regulations and laws protecting some species are on the books, but the means do not exist for rigorous enforcement.

### "W" National Park (334,375 ha)

This park extends over three countries and has areas of both Sudanian and to a lesser extent, Sahelian vegetation and climate.

"W" National Park Area	1,186,425 ha
of which in Benin:	502,050
Upper Volta:	350,000
Niger:	334,375

The park abounds with large numbers of antelops. Species like roan (Hippotragus equinus), hartebeest (Alcephalus bucephalus), and kob (Kobus kob) roam the savannas. Sitatunga (Tragelaphus spakii), Defassa water buck (Kobus defassa), Bohor reedbuck, oribi (Ourebia ourebia), and red-fronted gazelle can be found near aquatic habitats, and topi (Damaliscus korrigum) graze on the northern plains near the Tapoa River. Several duiker species (Cephalophus sp.) and the grey duiker (Sylvicapra grimmia) also occur. Warthog (Phacochoerus aethiopicus), elephant (Loxodonta africana), and buffalo (Syncerus caffer) are found throughout the park, and hippopotamus (Hippopotamus amphibius) are present along the rivers. Baboons, vervets, and several monkeys are often encountered. Carnivores include serval (Felis serval), caracal lynx (Felis caracal), lion (Panthera leo), leopard (Panthera pardus), cheetah (Acinonyx jubatus), spotted hyaena (Crocuta crocuta), striped hyaena (Hyaena hyaena), jackal (Canis mesomelas), and sand fox. Migratory aquatic birds visit the region when the rivers leave their beds and flood the surroundings (Dec.-May). Species include geese, ducks, cormorants, pelicans, waders, ibises, storks,

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<sup>21</sup>Source: International Union for the Conservation of Nature and Natural Resources. (IUCN). 1979.  
Johnson, H. and J. Johnson. 1977.  
IUCN. 1977.  
Curry-Lindahl, K. and J.-P. Harroy. 1972.  
IUCN. 1971.

herons, and egrets. Guineafowl, Abyssinian ground hornbills, and secretary birds inhabit the wooded savannas. Vultures, brown harrier eagles, fish eagles, martial eagles, and swallow-tail kites are frequently seen.

Vast grasslands provide food for an abundance of seed-eaters, including doves, finches, weavers, Denham's bustards, pipits, and larks.

The most conspicuous reptiles are crocodiles, monitor lizards, pythons, and turtles.

In general, protection throughout the park is poor, and poaching is heavy. However, each section of the park is managed separately by the individual countries. Niger's portion, administered by the Ministry of Rural Economy, seems to be better managed and controlled than the other two portions. This is the area where large phosphate deposits have been discovered, and the Nigerien "W" National Park could be seriously jeopardized if future development of these deposits are not carefully managed.

The park is open to tourism from December through April, and is closed the rest of the year when heavy rains occur.

#### Tamou Total Reserve (142,640 ha)

This reserve adjacent to the "W" National Park on the northwest is covered with degraded secondary forest and gallery forest, and contains fauna similar to "W". The reserve covers part of the regular seasonal movements of several species such as lion, elephant, buffalo, roan, topi, and gazelle. Among the birds recorded are white pelican, egrets, saddle-bill stork, marabou stork, and secretary bird.

Villages still practice shifting cultivation within the reserve, and much illegal grazing and burning occurs. Officially, entry is by permit only and hunting is prohibited, but poaching is nevertheless intense.

A partial reserve apparently extends beyond the borders of the total reserve and the "W" park.

#### Tadress Total Fauna Reserve (1,600,000 ha)

Hardly any information is available on this unofficial reserve in the Air massif. Because agreements have not yet been reached with the local nomadic populations, Niger has not yet been able to declare this an official reserve as of 1979.

Termit Massif (900 sq. km.)

This reserve in the desert southeast of Agadez contains a wealth of fauna, including dama gazelle, dorcas gazelle, ostrich, cheetah, mouflon, and possibly addax, as well as many birds. No other information is currently available.

Tenere Partial Fauna Reserve (8,600,000 ha)

Also in the Tadress area, this reserve is still in the planning stage.

Niger also has plans to institute protection of the giraffe in the Tillaberi region and migratory aquatic birds along the Niger River. No other information is currently available about these projects. A Gadabegi Fauna Reserve is listed by IUCN (1977, 1971) without further identification or information.

2.5.1 Endangered Species<sup>22/</sup>

The IUCN Red Data Book lists the following four species in Niger as endangered:

<u>Lycaon pictus</u>	African wild dog
<u>Oryx dammah</u>	Scimitar-horned oryx
<u>Addax nasomaculatus</u>	Addax
<u>Gazella leptoceros</u>	Slender-horned gazelle

The Leopard (Panthera pardus) and cheetah (Acinonyx jubatus) are listed in the Red Data Book under neighboring countries, but their status in Niger is unknown. The Federal Register List of Endangered and Threatened Wildlife and Plants includes the African Elephant and Western African ostrich on its lists, as well as those mentioned above.

2.5.2 Fishing<sup>23/</sup>

Fishing is important only locally in a few areas. The total catch in the mid 1970's was about 12,000 tons per year. About 10,000 of this is from the Niger River and its tributaries; the rest is from Lake Chad and the Komadugu River. For the sake of comparison, Mali's catch from the Niger River is 110,000 tons per year, and the total Lake Chad catch is about 90,000 tons per year.

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<sup>22</sup> Source: U.S. Dept. of the Interior, Fish and Wildlife Service. 1979.  
IUCN. 1976.

<sup>23</sup> Source: Niger. Ambassade des Etats-Unis. undated.  
U. S. AID. 1975.  
Inter African Committee for Hydraulic Studies (CIAH).

### 3.0 Major Environmental Problems

#### 3.1 Drought<sup>24/</sup>

One of Niger's greatest problems is largely natural. Most research indicates that drought is a recurring climatic phenomenon in the Sahel. This is not likely to be changed, although careful management and planning could help alleviate many of the hardships caused by drought.

Droughts typically last at least several years in the Sahel. The latest, 1967-1973, actually became noticeable in Niger around 1968. Rainfall may decrease to much less than half the average. For example, at Agadez, with a 30 year average of 165 mm per year, the drought figures were 86 mm in 1969, 40 mm in 1970, and 74 mm in 1972. In addition to less rain, the rainfall pattern is much more irregular.

The nomadic sector is usually the hardest hit by prolonged drought. In Niger the last drought caused the loss of nearly 48 percent of the cattle herd, nearly 36 percent of sheep, and about 16 percent of goats. By 1970, nomads who had any animals left were migrating en masse to the southernmost areas of the country, or even into Nigeria and Benin. Those who had no or too few animals left to support them converged on the cities, especially after relief camps were established.

The agricultural sector was also severely affected. Niger was self-sufficient in food in the early 1960's, but had to import 120,000 tons of grain in 1972/73 and 250,000 tons in 1973/74. Cash cropping was all but abandoned as farmers concentrated on growing what food they could. Many farmers were also forced into the relief camps as crops often failed entirely.

Public and animal health also suffers during drought. Disease can be much more serious in victims weakened by hunger. In addition, the mass population movements resulting from drought facilitate the spread of communicable disease. Cholera apparently first became a major problem in Niger during the drought. Migrations further to the south than normal exposed cattle to trypanosomiasis, to which most cattle in Niger are quite susceptible.

That careful management and good planning can help alleviate some of the hardship should be evident from even the modest progress Niger

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<sup>24</sup>Source: Africa Research Bulletin. Dec 31, 1979; Ja. 31, 1980; Feb. 29, 1980, May 31, 1980  
DuBois, V. D. 1974.  
Nicholson, S. E. 1978.  
Thomas, M. E. K. 1973.  
U. S. AID. 1974.  
U. S. AID. 1975.

has made since 1973. Niger was probably the hardest hit country in West Africa during the 1967-1973 drought. In 1979 the rains failed again, possibly signalling the beginning of a new drought. Conditions as of early 1980 were reportedly as serious as during 1973.

Crop failures throughout the western Sahel have led to requests for food aid by every CILSS member except Niger. Niger, however, announced a modest grain surplus and may actually ship small amounts of grain to Nigeria.

### 3.2 Desertification<sup>25/</sup>

If drought is an inevitable fact of life in the Sahel, many of the consequences of drought are greatly aggravated by man's activities. Desertification has been defined as:

"the impoverishment of arid, semiarid, and some subhumid ecosystems by the combined impact of man's activities and drought. It is the process of change in these ecosystems that can be measured by reduced productivity of desirable plants, alterations in the biomass and the diversity of the micro- and macro- fauna and flora, accelerated soil deterioration, and increased hazards for human occupancy."  
(Dregne, 1977)

Desertification does not proceed uniformly in a steady advance, but occurs at scattered points, very often in areas where human activity has degraded the environment. These local areas then expand and link up. A number of man-made causes are responsible for desertification. These have been analysed for Zinder department, and since these causes are applicable to Niger as a whole, they are listed here:

- a. Overgrazing. The combination of a period of favorable weather, improved animal health, and increasing human population resulted in a dramatic increase in animal numbers in Zinder. When drought occurred in 1968-73, many areas were subjected to intense grazing pressure and many mini-deserts were created, especially around wells and surface water supplies. Overly intensive grazing also can cause irreparable damage in the wet season.
- b. Tree cutting faster than regrowth. Wood is the principal source of energy for the farmers and herders in Zinder who comprise about 90 percent of the population, and is a major construction material. Extensive cutting of trees for fuel and construction without adequate programs of replacement has resulted in gradual but continuous depletion of forest resources. People now travel greater and greater distances to find wood. The loss of the trees results in increased soil erosion, laterization, decreased infiltration and increased runoff. All are factors contributing to land degradation and ultimately desertification.

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<sup>25</sup> Source: Arid Lands Natural Resources Committee. 1979.  
Dregne, H. A. 1977.

- c. Cultivation of marginal lands. Population pressures caused, and good weather permitted, the movement to the north of crop cultivation. When the drought came (1968-73), the crops failed; cleared fields were quickly and severely eroded by strong winds and the infrequent rains, and inherent soil fertility was lost. Many years of fallow will be required to restore fertility to previous levels.

The spread of cultivated crops into the grazing zone is being supported "de facto" by the courts which bring judgements against herders for destruction of fields by animals. This law was intended to apply only in the cultivated zone.

- d. Inadequate response to drought. When the inevitable drought came, the response capability of the people in Zinder had been greatly reduced by the increased numbers of humans and animals. Alternate strategies of coping with drought, mainly by moving south to more favorable areas, were severely limited by the fact that somebody else was already there. The result was continued pressure on the vegetative and water resources at a time when these resources were already stressed. Additional desertification ensued.
- e. False diagnosis of the problem and poor planning. Plans formulated for increased productivity in the early 1960's wrongly or incompletely identified the problem of the region to be lack of water during the dry season. The Government of Niger planned on this basis. A study in the late 1960's by the Institut d'Elevage et de Medecine Veterinaire des Pays Tropicaux, a French agency, of the grazing zone did not uncover the fallacy in problem identification. Their calculations showed that the area had not reached its maximum stocking rate in spite of rapid increases in herd sizes. They assumed that the herds were distributed equally throughout the region. This was and is not the case: pastoral use is discontinuous in time and in space. Thus while the total region was not overloaded, there were very high concentrations of animals around dependable water sources. By not taking a systems approach, the planners of the 1960's missed the fact that the animals were dependent on the vegetation, and the vegetation is dependent on both the amount and distribution in time and space of rainfall.

The establishment of new markets and new administrative settlements in the grazing zone increased the number of people in the region in total and especially during the dry season. Their demands for wood and other products increased the demands on the local vegetation.

Clearly, man, of Niger's major environmental problems can be grouped under the broad heading of desertification.

### 3.3 Deforestation and Devegetation<sup>26/</sup>

Depletion of ground cover is one of Niger's most serious problems and is, as noted above, a major cause of desertification. In southern Niger where trees exist, wood is widely used for fuel and construction. In addition, expansion of farmland into new areas means that these areas will be cleared of trees and shrubs. The bush is then burned off, which usually kills any seedlings. Thorn branches are the main material used in constructing stock fences. Those few trees which are available in the pastoral zones may also be used for fuel or occasionally for fodder, especially when grasses die during droughts. Niger does have laws against woodcutting, and permits are required to cut any tree. However, field studies show that such measures are and will remain largely unenforceable until the general population has access to wood substitutes.

Overgrazing is another major means of devegetation, and is especially serious in the pastoral zone. A project area between Agadaz and Dakoro, in Maradi Dept., shows evidence that perennial grasses once predominated. Overgrazing of these more palatable grasses gradually shifted the predominance to annual grasses. At present, continued overgrazing over a long period can lead to invasion by inedible shrubs or simply complete devegetation.

As noted above, most of these processes are greatly accelerated by drought.

### 3.4 Soil Erosion and Degradation<sup>27/</sup>

Another of Niger's major problems is soil erosion, much of which is a direct result of the depletion of ground cover discussed above. The short intense rainstorms can carry away much topsoil, but probably an even more important cause is wind. Very few figures are available on the magnitude of erosion except for an occasional local area. At the Ibohamane Dam in Tahoua Dept. 220,000 cubic meters of alluvial material accumulated in 1972. This would represent a soil loss of 31 tons per hectare within the drainage basin, much too large to be attributed to water erosion only.

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<sup>26</sup>Source: Arid Lands Natural Resources Committee. 1979.  
Gerhart, D. D. et al. 1976.  
Ormerod, W. E. 1978.  
Thomson, J. T. 1977.  
U. S. AID. 1979.  
UNESCO, Man and the Biosphere Programme. 1975

<sup>27</sup>Source: Arid Lands Natural Resources Committee. 1979.  
DuBois, V. D. 1974.  
Gerhart, D. D. et al. 1976.  
Ormerod, W. E. 1978.  
UNESCO, Man and the Biosphere Programme. 1975.

Soil degradation is also becoming critical in Niger. In agricultural areas, increased pressure on the land has led to more intensive cultivation. Traditional practices of fallow periods can no longer be followed. Intercropping and crop rotation with cash crops such as groundnuts has decreased. The result has been that soils no longer have any opportunity to recover, which has led to declining yields.

Soil depletion can be a problem even on range lands. Overgrazing does not allow normal litter to be recycled into the soil to help maintain fertility.

In addition, salinization can be a problem locally, usually where irrigation is used. Pollution from insecticides or fertilizers is not likely to become a very great problem for some time.

### 3.5 Water<sup>28/</sup>

Most of Niger has problems with shortages of surface water, but the country is relatively well endowed with groundwater. However, if surface water shortages are to be alleviated by sinking new wells, care must be taken that the wells do not aggravate other problems such as desertification. If stockwells are not spaced, for example, to allow stock access to pasture away from the well, the area around the well will be overgrazed.

The major problems in this sphere are those of contamination of water supply and water-facilitated transmission of disease. Traditionally, wells are shallow, hand dug, and remain open. Contamination by livestock or people is very common in these wells, as well as in the streams in southwest Niger. Conditions in the river area especially, but also in local ponds and wells, favor the breeding of schistosomiasis-carrying snails. Simulidae flies (onchocerciasis carriers) require flowing water to breed, such as is found in the Niger tributaries. Onchocerciasis may be one reason why the southwesternmost corner of Niger has very low population densities despite abundant rainfall and relatively good soils. Malaria-carrying mosquitos breed on still water. Solutions to such health problems can be extremely complex. Damming a stream to deny swift flowing water to Simulidae flies may simply provide them a better environment on the spillway, or it may provide the kind of slow flowing or still water that other vectors prefer. Killing larvae by putting insecticides into streams may have repercussions on water used downstream.

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<sup>28</sup> Source: Arid Lands Natural Resource Committee. 1979.  
Berry, E., C. Hay, and E. Scott, 1978.  
Gerhart, D. D. et al. 1976.  
Ormerod, W. E. 1978.  
U. S. AID. 1975.

Other<sup>29/</sup>

Preservation of wildlife is not perceived as important relative to these other problems, which have a more direct impact on human well-being. However, any success in combating other problems, especially if reforestation can be achieved to some extent, will indirectly relieve pressure on wildlife.

Population must be mentioned as an environmental problem, because increasing population will continue to increase pressure on resources. Religious traditions and ethnic customs favor large families, and the government has been reluctant to take any action on the matter.

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<sup>29</sup>Source: U. S. AID. 1980 b.

#### 4.0 Development<sup>30/</sup>

Niger's stated goals in its 1979-1983 development plan are food self-sufficiency through the development of the agricultural and livestock sectors, increasing exploitation of the country's mineral wealth, overcoming Niger's geographic isolation, and increasing the number of qualified personnel within the country. The total cost is to be 730.2 billion CFA Fr., broken down as shown in the following table:

##### Planned Investment 1979-83

(CFA Fr. based on 1979 prices)

	Public	% of Public	Private	% of Private
Mines, Energy, Industry	70.2	18.3	305.5	88.4
Rural Sector	116.5	30.3	-	-
Health, Education	84.8	22.1	-	-
Transport and Infrastructure	67.8	17.6	32.9	9.5
Tertiary Sector	20.0	5.2	5.7	1.6
Other	25.2	6.6	1.6	0.5
Total (% of total)	384.5	(52.7)	345.7	(47.3)

Source: West Africa, 21 April 1980.

For comparison, the previous 3 year plan is noted:

##### Total Investment 1976-1978:

\$601 million US

**Total (US million \$)**      public-388 (64.6%)      private-213 (35.4%)

	% of public	% of domestic govt.	% of private
Industry (incl. mines)	4.3	12.7	40.8
Rural	33.6	10.0	-
Social	15.3	33.7	-
Infrastructure	46.8	43.6	59.2
Other	-	-	-

Domestic Funding      24.4%      (of which govt.: 55%, private: 45%)

Foreign Funding      75.6%      (of which official: 66.7%, private: 33.3%)

Source: Horenstein, N. 1979.

<sup>30</sup> Sources: Africa Research Bulletin. March 31, 1980  
Horenstein, N. 1979.  
U. S. AID. 1980b.  
West Africa, 21 Jan. 1980.

Breakdowns for the 1979-1983 expected funding by foreign or domestic sources are not available, but if the previous plan is used as a guide, about three-fourths of all funding will be from outside the country. The Niger government expenditures will probably be heavily oriented toward infrastructure and human resources development. This does not indicate a downplay of rural development but rather recognition that it is easier to get donor funding for rural development than for most other projects.

In the agricultural sector, the plan calls for modest increases in sorghum and millet production of about 2.2 percent per year. Rice production, however, is expected to increase dramatically with the aid of a number of irrigation projects. The plan also calls for reversing the trend in cash crops and increasing production. Targets for 1983 are shown in the following table:

	1979	(1000 tons)	1983
millet & sorghum	1,589		1,731
rice	23		60
cassava	190		236
groundnuts	80		120
cotton	4		12-15
ni/abe	280		320
sugarcane	155		315
onions	80		90

Source: Africa Research Bulletin. March 31, 1980.

In the industrial and mining sector, uranium mining is expected to continue rapid expansion, financed largely by private funds. The government's share of uranium income is to be one of the major sources of Niger's public expenditures, and will be reinvested in other sectors. Coal and phosphates are to come into production and will primarily be used domestically. In industry, food industries receive the most attention. Several other industries to be developed are textiles, chemicals, metal and wood.

Niger hopes to increase primary school attendance from the current 18 percent to 25 percent, and also plans to expand professional and university education. Preventive medicine is a priority as Niger attempts to expand the facilities and personnel in its health field. Water supply and distribution are also priority areas.

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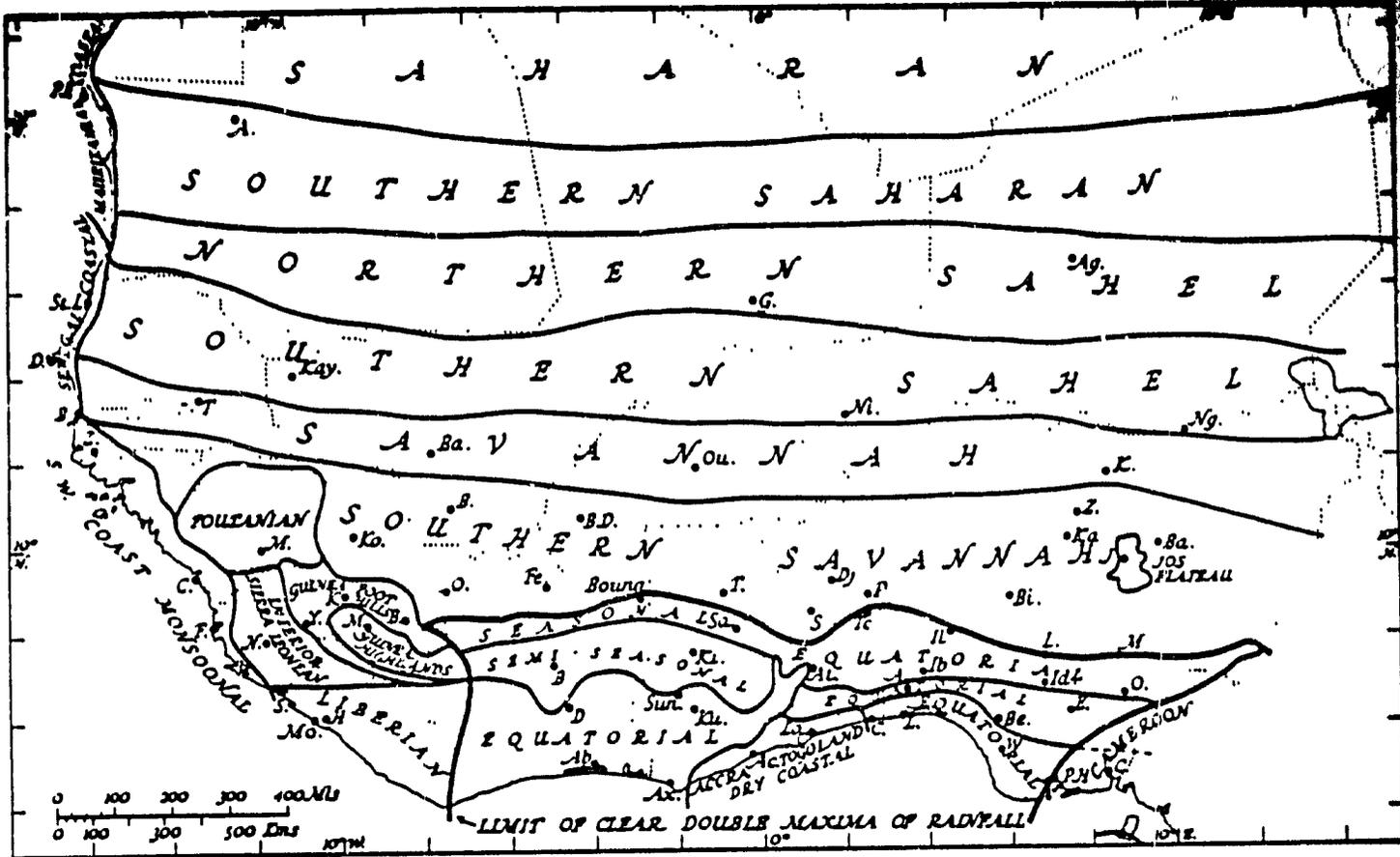
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## APPENDIX I

### Geography

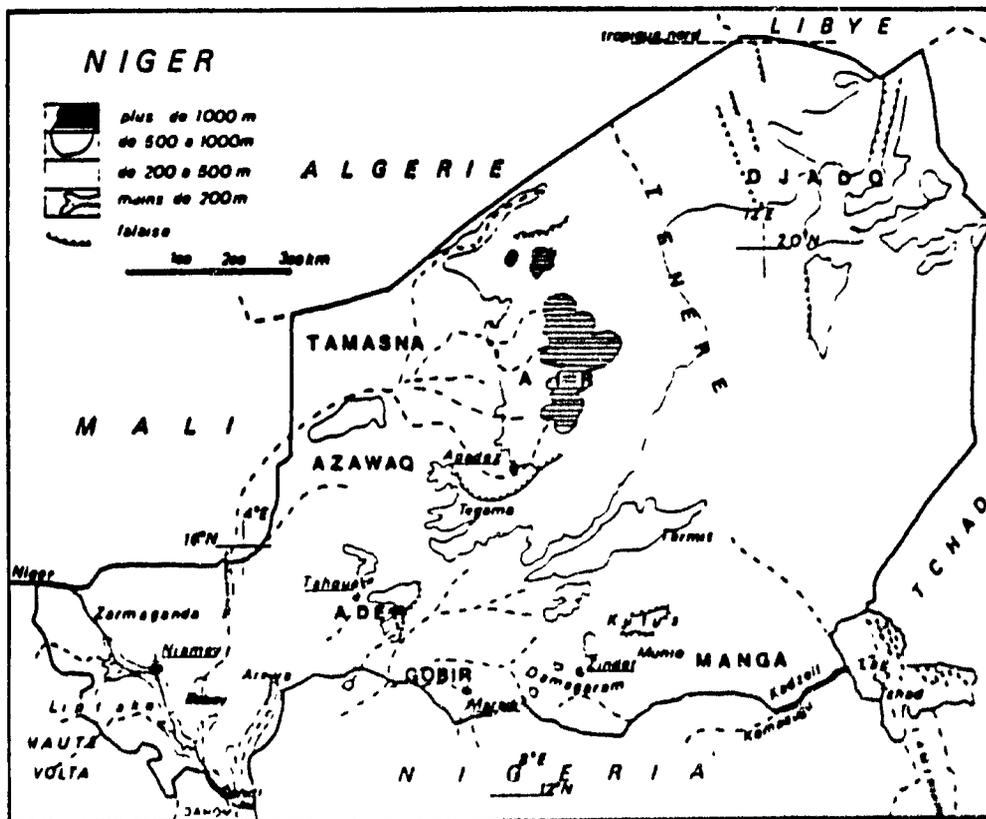
1. Climate Zones of West Africa
2. Physical Features
3. Rainfall Isohyets and Location of Climatic Stations
4. Average Monthly Temperatures (1967-1977) (°C)
5. Rainfall
6. Climatograms of Six Stations

# 1. Climatic Zones of West Africa



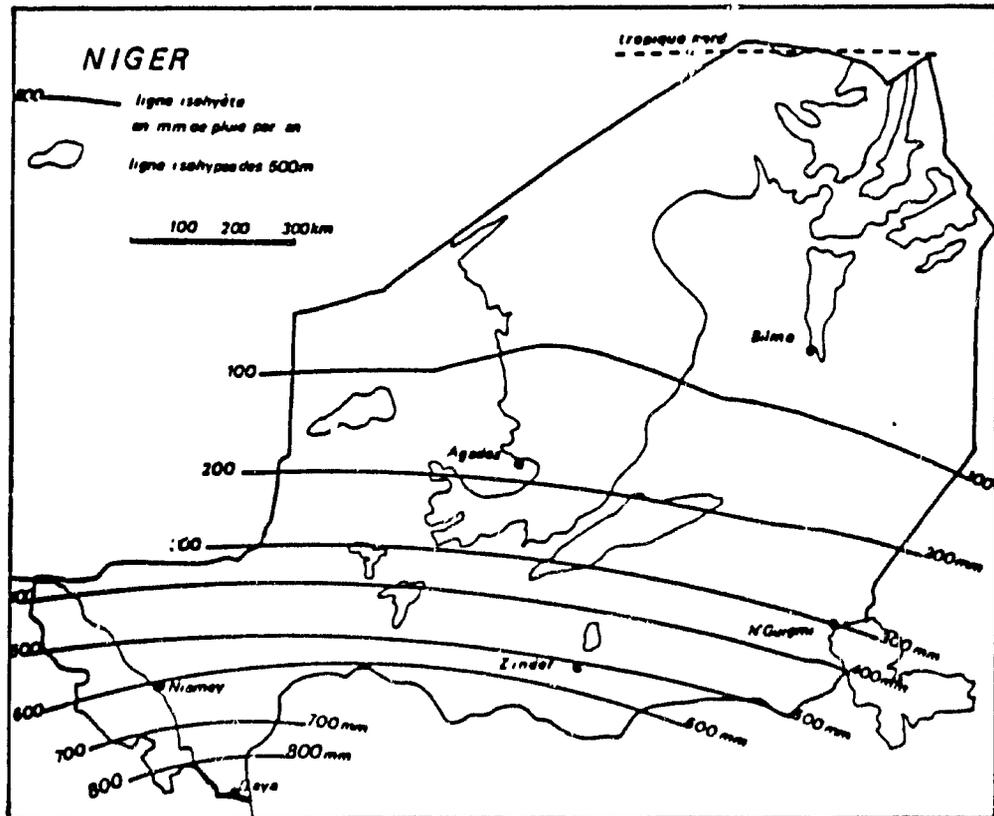
Source: Church, R. J. H. 1974.

# 2. Physical Features



Source: Donaint, P. 1975.

### 3. Rainfall Isoyets and Location of Climatic Stations



Source: Donaint, P. 1975.

4. Average Monthly Temperatures (1967-1977) (°C)

	Agadez		Bilma		Nguigmi		Niamey		Zinder		Gaya (1977 only)	
	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.	min.
Jan.	29.2	11.3	26.3	8.6	28.9	12.7	33.5	15.7	30.5	14.8	36.6	19.0
Feb.	32.1	13.3	29.8	10.7	31.3	14.7	36.3	18.2	33.4	17.1	35.7	20.8
March	36.0	17.4	33.9	15.3	35.2	19.0	39.4	22.3	37.4	21.5	26.8	24.0
April	39.6	22.1	38.4	20.0	37.5	21.9	40.9	26.3	40.0	22.8	40.4	26.8
May	41.2	24.5	4.41	23.0	38.7	23.8	40.0	27.2	39.9	25.8	35.7	25.9
June	41.6	25.5	42.2	24.4	38.3	24.4	36.7	25.3	37.7	24.8	34.1	23.8
July	39.1	23.9	41.0	25.1	36.1	24.2	33.6	23.5	33.6	23.0	32.2	23.2
Aug.	37.0	23.0	39.9	25.8	33.3	23.3	31.5	22.6	31.3	21.9	30.3	22.4
Sept.	38.6	23.0	39.9	23.1	35.3	22.9	33.3	23.0	34.1	22.5	32.5	22.3
Oct.	37.8	20.6	37.2	18.6	35.9	20.5	37.3	23.2	37.1	22.1	35.1	22.9
Nov.	33.5	14.9	32.0	13.2	32.8	16.6	36.8	19.0	34.5	18.6	35.9	18.9
Dec.	29.7	12.6	27.9	9.4	29.6	13.0	33.9	16.1	31.4	15.5	33.1	17.3

Source: Niger, Ministère du Plan, Direction de la Statistique et des Comptes Nationaux. 1977a, 1977b, 1977c, 1977d.

## 5. Rainfall

(28 to 30 year averages ending 1977)

	Agadez		Bilma		Nguigmi		Niamey		Zinder		Gaya	
	Rf	Days	Rf	Days	Rf	Days	Rf	Days	Rf	Days	Rf	Days
Jan.	0.2	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Feb.	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
March	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.4	0.0	0.0	3.9	0.3
April	1.2	0.2	0.1	0.1	0.0	0.0	5.0	1.0	3.1	0.3	14.3	1.2
May	6.4	1.3	0.5	0.2	6.7	1.0	27.0	4.1	27.3	3.5	70.0	5.4
June	8.2	2.0	0.8	0.2	8.3	0.9	79.0	8.5	54.7	6.3	112.4	7.8
July	49.2	7.0	2.2	2.2*	57.3	5.2	159.0	13.0	153.1	11.3	204.3	10.0
Aug.	78.3	10.4	11.4	11.4*	140.8	9.8	201.0	16.6	232.4	14.0	282.0	12.6
Sept.	20.0	2.8	3.6	3.6*	22.4	2.9	103.0	10.6	71.4	7.8	156.6	10.0
Oct.	0.5	0.2	1.7	0.1	0.3	0.1	15.0	2.4	6.7	0.9	24.3	2.3
Nov.	NT	—	NT	—	NT	—	1.0	0.8	0.4	0.1	2.0	0.2
Dec.	NT	—	NT	—	NT	—	NT	NT	NT	NT	NT	NT
<b>Total</b>	<b>164.9</b>		<b>20.6</b>		<b>235.8</b>		<b>592.0</b>		<b>549.1</b>		<b>869.8</b>	

Rf = average rainfall (mm)

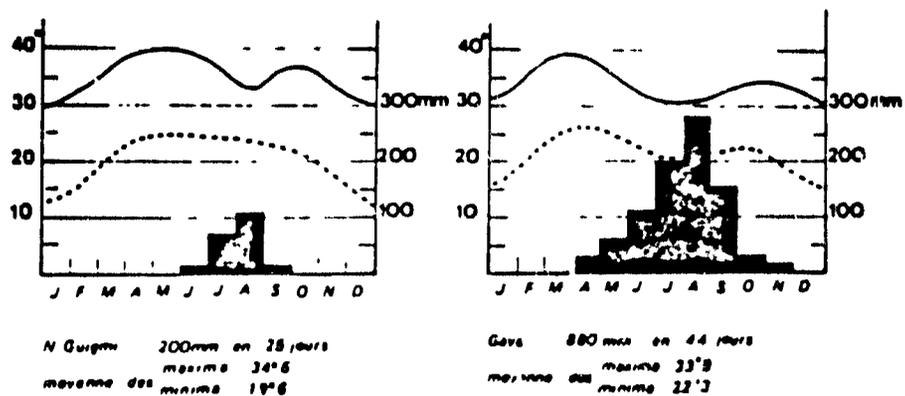
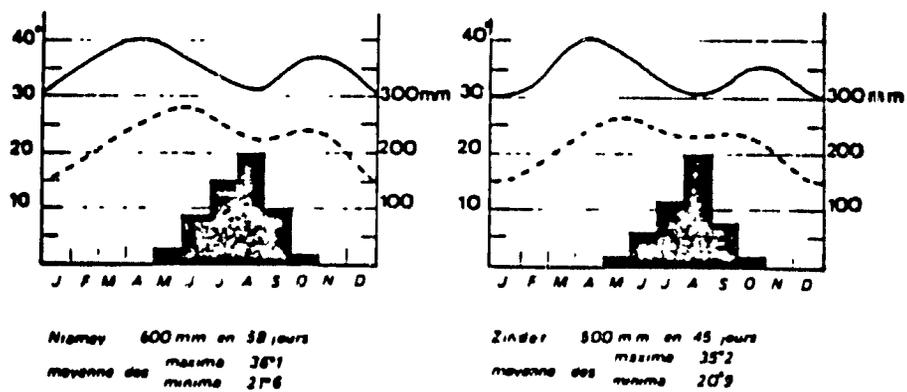
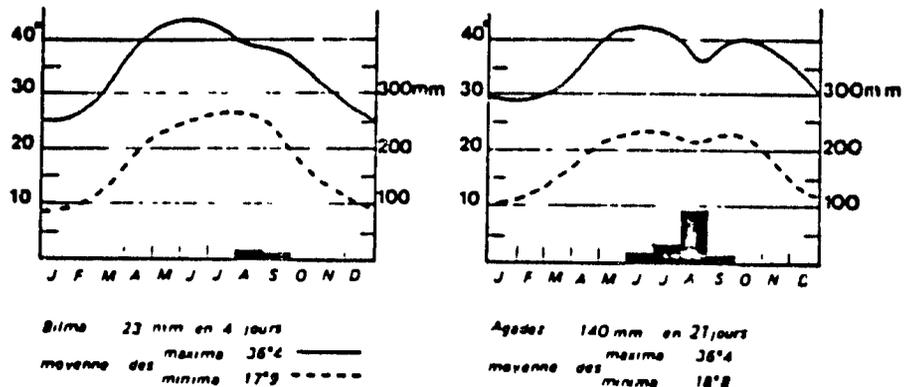
Days = average number of days in the month in which rain fell

NT = no trace

\*(sic)

Source: Niger, Ministère du Plan, Direction de la Statistique et des Comptes Nationaux. 1977a, 1977b, 1977c, 1977d.

## 6. Climatograms of Six Stations



Source: Donaint, P. 1975.

**Appendix II**  
**Demographic Characteristics**

1. **Population**
2. **Population Projections**
3. **Miscellaneous Demographic Features**
4. **Population, Area, Density by Administrative Division**
5. **Administrative Regions**
6. **Population Density**
7. **Map of Population and Ethnic Groups**
8. **Population by Age Group and Sex**
9. **Population Pyramid**
10. **Population of Main Urban Centers**
11. **Urbanization**
12. **U.N. Population and Urbanization Projections**
13. **Incidence of Certain Diseases**
14. **Cases, Deaths, Case Mortality of Some Infectious Diseases**
15. **Health Personnel**

## 1. Population

Date	Population	Source
1978	5,352,000	Legum. 1980.
1979	5,114,000	U.S.AID. 1980.
1977	4,859,000	Europa Publications. 1980
1980	5,272,000	Cohen. 1979.
	(projection)	
1977	4,862,000	World Bank. 1980.
1977	5,098,427	U.S.AID. 1980b.

## 2. Population Projections (in thousands)

<u>Year</u>	<u>Low Variant</u>		<u>Medium Variant</u>		<u>High Variant</u>	
	<u>Pop.</u>	<u>Growth Rates</u>	<u>Pop.</u>	<u>Growth Rates</u>	<u>Pop.</u>	<u>Growth Rates</u>
1970	4,016		4,016		4,016	
		2.55%		2.68%		2.77%
1975	4,562		4,592		4,611	
		2.57%		2.76%		2.83%
1980	5,186		5,272		5,313	
		2.58%		2.84%		2.91%
1985	5,901		6,077		6,144	
		2.59%		2.99%		3.08%
1990	6,716		7,049		7,166	
		2.51%		3.06%		3.22%
1995	7,613		8,212		8,419	
		2.22%		3.06%		3.31%
2000	8,505		9,568		9,932	

Source: World Bank 1976.

### 3. Miscellaneous Demographic Features

	<u>1977</u>
Population density per sq. km.	4.0
(Pop. density/sq. mi.)*	10
(pop. density/sq. mi. arable land)*	62
Population growth	2.8
Crude birth rate (per 1,000)	52
Crude death rate (per 1,000)	22
Life expectancy at birth	42
Average daily caloric consumption (% of estimated requirement)	2,139 (78%)
Population per practicing physician	42,970
% literate	8.0
Per capita GNP	194
Total labor force (thousands)	2,600
% women in labor force	10.1
% labor force in agriculture	92.0

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Source: World Bank. 1980.

\*U.S. AID. 1980a.

4. Population, Area, Density by Administrative Division (1977)

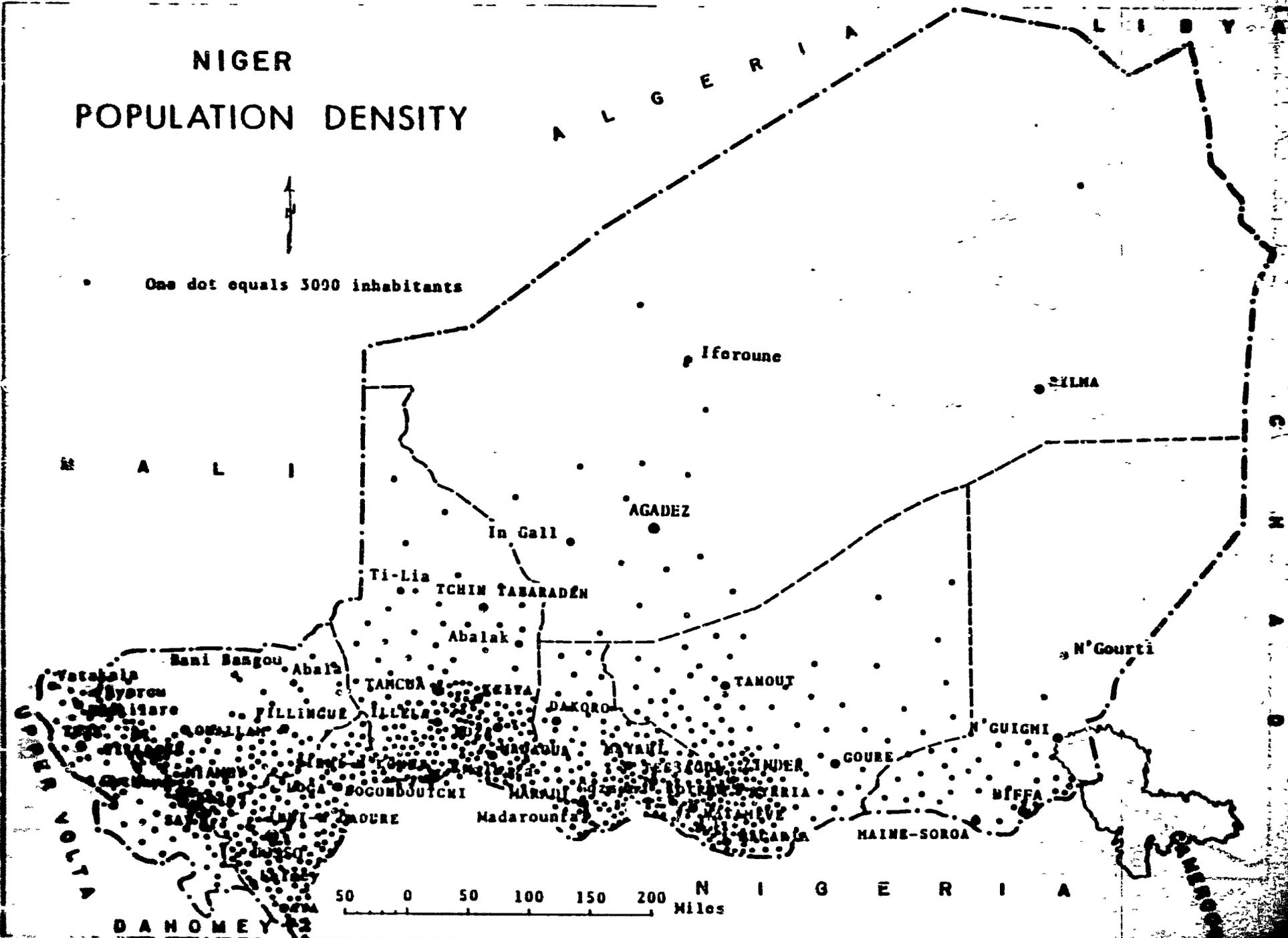
<u>Department/District</u>	<u>Population 1977</u>	<u>Area (km<sup>2</sup>)</u>	<u>Density (Pers./km<sup>2</sup>)</u>
<u>Niamey</u>	<u>1.094.000</u>	<u>90.293</u>	<u>12,1</u>
Niamey	293.800	8.299	35,4
Tera	294.000	12.444	19,6
Tillabery	123.200	7.975	15,4
Ouallam	154.500	20.497	7,5
Filingue	206.900	24.346	8,5
Say	71.600	16.732	4,3
<u>Dosso</u>	<u>657.000</u>	<u>31.002</u>	<u>21,2</u>
Dosso	147.000	7.800	19,0
Loga	72.100	3.691	16,8
Birni N'Gaoure	108.500	4.423	24,5
Dogondoutchi	230.000	11.044	20,8
Gaya	108.500	4.044	26,8
<u>Tahoua</u>	<u>1.042.000</u>	<u>106.677</u>	<u>9,8</u>
Tahoua	215.500	8.805	24,5
Tchin-Tabaraden	114.100	73.540	1,6
Illela	127.500	6.719	19,0
Keita	130.800	4.860	26,9
Bouza	116.400	3.589	32,4
Madaoua	174.500	4.503	38,7
Birni N'Konni	163.200	4.661	35,0
<u>Maradi</u>	<u>865.000</u>	<u>38.581</u>	<u>22,4</u>
Madarounfa (incl. Maradi)	163.400	3.540	46,2
Guidan Roudji	133.600	4.505	29,7
Dakoro	151.200	16.213	9,3
Mayahi	142.200	6.424	22,1
Tessaoua	171.400	5.319	32,2
Aguie	103.200	2.580	40,0
<u>Zinder</u>	<u>1.062.000</u>	<u>145.430</u>	<u>7,3</u>
Mirriah (incl. Zinder)	359.400	12.423	28,9
Matameye	104.200	2.109	49,4
Magaria	331.300	8.021	41,3
Tanout	154.100	33.947	4,5
Goure	113.000	88.930	1,3
<u>Diffa</u>	<u>154.000</u>	<u>140.216</u>	<u>1,1</u>
Diffa	50.000	6.979	7,2
N'Guigmi	30.000	118.126	0,3
Main Soroa	74.000	15.111	4,9
<u>Agadez</u>	<u>98.000</u>	<u>714.501</u>	<u>0,14</u>
Agadez	74.400	164.118	0,14
Arlit	14.600	234.028	0,06
Bilma	9.000	316.657	0,03
<b>NIGER</b>	<b><u>4.972.000</u></b>	<b><u>1.267.00</u></b>	<b><u>3,9</u></b>



6. Population Density

# NIGER POPULATION DENSITY

• One dot equals 3000 inhabitants



67

## 7. Map of Population and Ethnic Groups

ETHNIC GROUPS\*  
(estimated population at July 1st, 1974)

Hausa	2,279,000
Djerma-Songhai	1,061,000
Fulani (Fulɓe)	450,000
Twareg, etc	127,000
Herilari-Manga	380,000
<b>TOTAL</b>	<b>4,243,000</b>

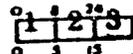
\* Provisional figures. Revised total is 4,249,000

### POPULATION

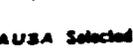
#### URBAN

- Over 15,000
- 5,250-15,000

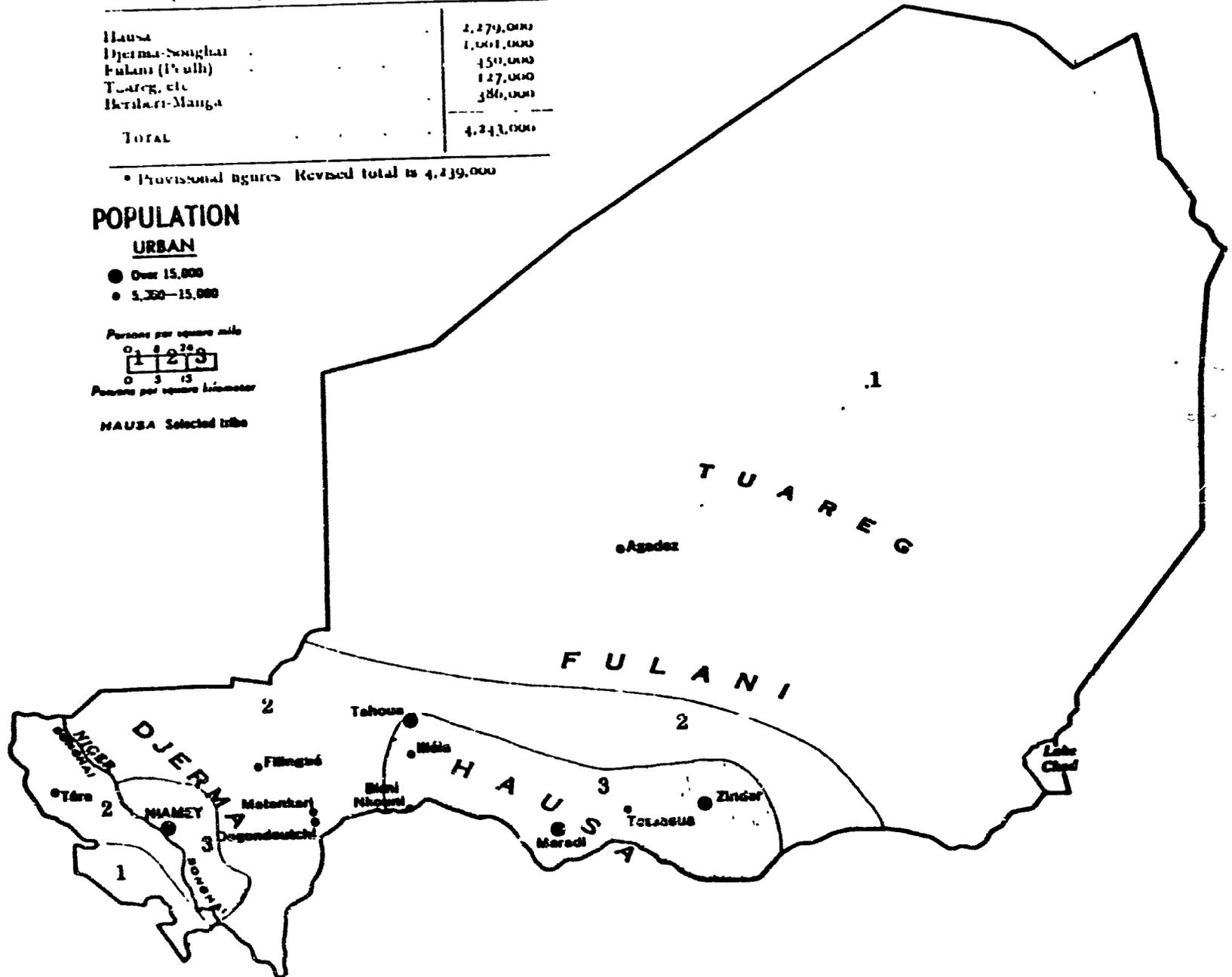
Persons per square mile



Persons per square kilometer



HAUSA Selected tribes

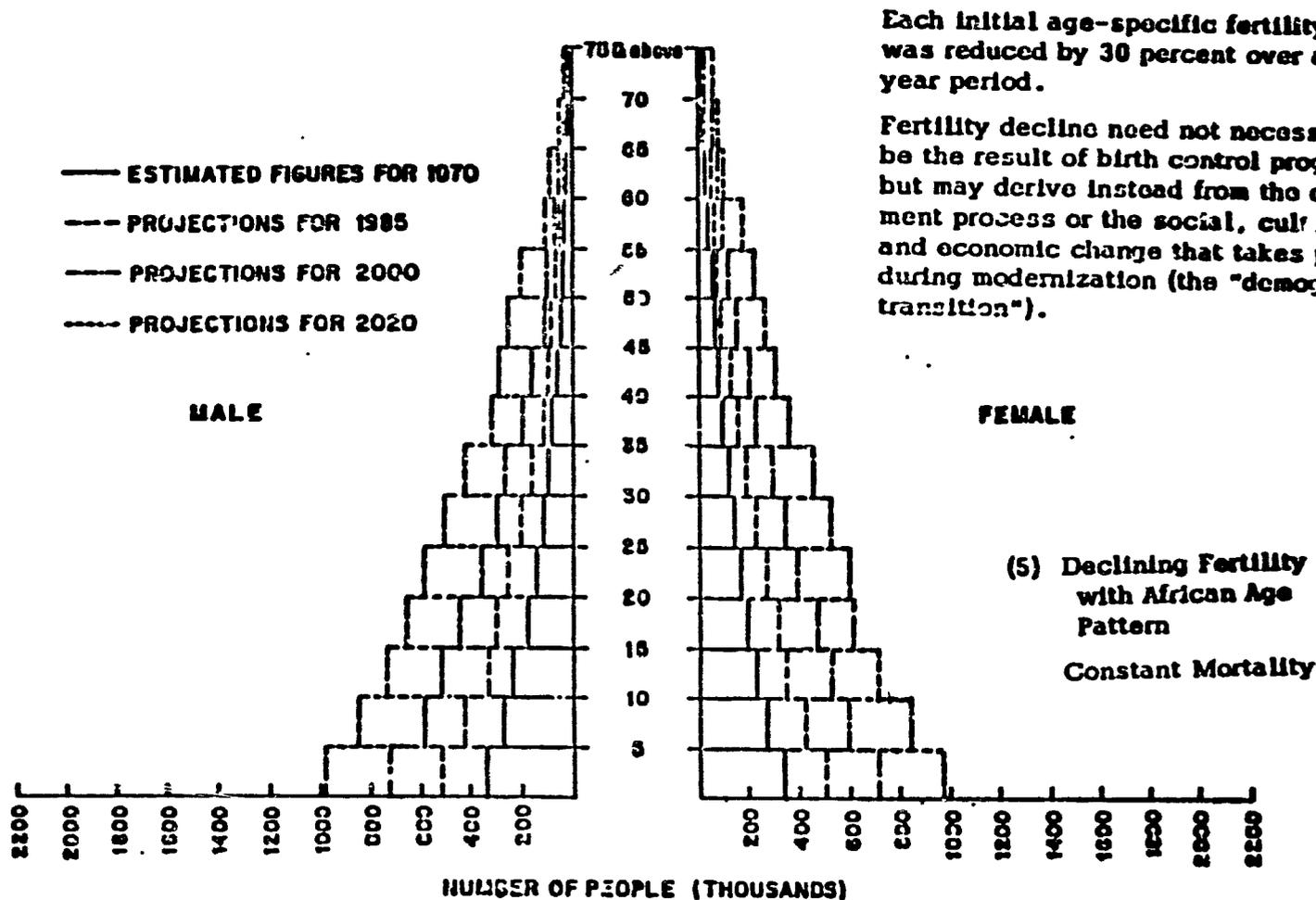


**8. Population by Age Group and Sex, 1973**  
**(Thousands)**  
**Niger**

<u>Age Group</u>	<u>Male</u>	<u>Female</u>	<u>Total</u>
0-4	402	403	805
5-9	305	306	611
<u>10-14</u>	<u>251</u>	<u>254</u>	<u>505</u>
0-14	958	963	1,921
15-19	213	215	428
20-24	185	186	371
25-29	161	160	321
30-34	137	137	274
35-39	115	115	230
40-44	96	98	194
45-49	79	81	160
50-54	63	63	126
55-59	49	49	98
<u>60-64</u>	<u>36</u>	<u>38</u>	<u>74</u>
15-64	1,134	1,142	2,276
65-69	24	26	50
70-74	14	19	33
75-79	7	10	17
<u>80-</u>	<u>3</u>	<u>4</u>	<u>7</u>
65-	48	59	107
<b>Total</b>	<b><u>2,140</u></b>	<b><u>2,164</u></b>	<b><u>4,304</u></b>

Source: Cohen M. A. et al. 1979.

## 9. Population Pyramid



Each initial age-specific fertility rate was reduced by 30 percent over a 50 year period.

Fertility decline need not necessarily be the result of birth control programs, but may derive instead from the development process or the social, cultural, and economic change that takes place during modernization (the "demographic transition").

Age-structure for Niger, assuming declining fertility, constant mortality, 1970, 1985, 2000, 2020.

Source: Stanbury, J. B. and J. A. Childs. 1974.

10. Population of Main Urban Centers (1977)

Niamey	225,000
Zinder	58,000
Maradi	46,000
Tahoua	31,000
Agadez	20,400
Birni N'Konni	15,200
Tessacoua	12,000
Dogondoutchi	10,200

Source: U.S. AID. 1980b.

11. Urbanization

		<u>growth rate</u>
Urban population (1975)	430,000	5.3
Niamey (1976)	122,000 = 28.4%	10.0
Other urban	308,000 = 71.7%	2.7
		<u>% due to migration</u>
Annual growth of all urban areas (1974)	25,000	49.4
Niamey	12,200	73.2

Source: Cohen, et al. 1979.

12. U.N. Population and Urbanization Projections

Year	Total Population (thousands)	Urban Population	% of population urban	Urban growth rate	Niamey* population	Niamey growth rate
1970	4,016	330,000	8.22	7.05		
1975	4,592	430,000	9.36	5.29	122,000 28.4%	10.0
1980	5,272	561,000	10.64	5.32	176,000 31.4%	7.6
1985	6,077	733,000	12.06	5.35	253,000 34.5%	7.6
1990	7,049	961,000	13.63	5.41	367,000 38.2%	7.7
1995	8,212	1,261,000	15.53	5.43	532,000 42.2%	7.7
2000	9,568	1,649,000	17.23	5.37	772,000 46.8%	7.7

\*% of urban population

Source: Cohen, et al. 1979.

### 13. Incidence of Certain Diseases

Diseases	Number of Cases	Number of Deaths
Trachoma	2,241	-
Leprosy	2,477	2
Whooping Cough	3,732	5
Diphtheria	47	3
Acute Poliomyelitis	129	2
Tetanus	216	49
Infectious Hepatitis	2,807	54
Grippe	5,329	26
Pneumonia	3,044	39
Amoebic and Bacillary Dysentery	14,388	21
Tuberculosis	1,469	45
Meningitis	2,233	100
Measles	28,423	937
Chicken Pox	4,646	

Source: Stanbury, J. B. and J. A. Childs. 1974.

# 14. Cases, Deaths, Case Mortality of Selected Infections Diseases

Year	Tuberculosis			Typhoid & Paratyphoid Fever			Meningococcal Infections			Measles			Hepatitis			Malaria			Year
	C	D	CM	C	D	CM	C	D	CM	C	D	CM	C	D	CM	C	D	CM	
1962				14	1	7	15365	1405	9	15058	1447	10	649	--		138798	221	1	1962
1963	963	39	4	37	3	8	2585	272	11	10493	320	3			93398	154	1	1963	
1964	907	41	5	4	2	50	2878	407	14	14410	579	4			93398	154	1	1964	
1965	717	16	2	70	--		4288	241	6	24421	819	2			101564	74	1	1965	
1966	862			18	3	16	947	80	5	6982	145	2			166043			1966	
1967										5548	111	2							1967
1968	895	24	3	6	1	17	2231	134	6	10513	200	2	275	--		113572	61	1	1968
1969	1114	3	1	40	--		3074	198	6	25268	632	3	930	22	2	148522	118	1	1969
1970				16	+		9907	+		1755	105	6							1970
1971				47	+		75	+		5148	+								1971
1972				--	--		--	--		29030	--								1972
1973				+	+		+	+		33532	1172	3							1973

\* Estimated figures  
 --- Figures unavailable  
 + Figures not available  
 2 Tuberculosis, all forms  
 3 All cases treated, old and new  
 4 Estimate based on first half of year

Source: Stanbury J. B. and J. A. Childs. 1974.

## 15. Health Personnel

### Medical & Social Services Personnel in Niger, 1970 - 1972.

Categories of Personnel	:	1970	:	1971	:	1972
Physicians		69		69		97
(of whom are Nigeriens)		... (9)		... (10)		... (16)
Pharmacists		10		...		9
(of whom are Nigeriens)		... (4)				... (5)
Dental Surgeons		4		5		6
(of whom are Nigeriens)		... (1)		... (2)		... (3)
Dentists		3		...		3
(of whom are Nigeriens)		... (2)				... (1)
Midwives		30		...		36
(of whom are Nigeriens)		... (28)		... (24)		... (33)
Registered Nurses		110		165		222
(of whom are Nigeriens)		... (110)		... (145)		... (207)
Health Service Assistants		45		45		45
Certified Nurses		461		460		603
Health Engineers		2		...		1
(of whom are Nigeriens)		... (1)				... (1)
Hygiene Agents		29		29		30
Social Assistants		6		9		7
(of whom are Nigeriens)		... (8)		... (7)		... (5)
Social Aides		...		9		...

-In addition: "Matrones," Hygienists and "Secouristes"  
(first-aid volunteers) of the village

-In 1973: 263 active "Matrones"  
2 active Health Educators

Source: Stanbury, J. B. and J. A. Childs. 1974.

## Appendix III

### Economic Characteristics

1. World Bank Economic Data Sheet
2. Agricultural Production, 1964-1976
3. Map of Agricultural Production
4. Projected Demand and Supply of Food
5. Uranium Exports
6. Industry
7. Principal Commodities
8. Principal Trading Partners

1. World Bank Economic Data Sheet

Economic Data Sheet 1 - Population, National Accounts, and Prices  
GNP Per Capita - 1977 (US\$) 190

	1980	1983	1985	1988	1990	1997	1998	1999	1999	1999	1999
<b>Population</b>											
(Total, midyear, thousands)	2283.0	2350.0	2878.0	3499.0	3593.0	3690.0	3790.0	3892.0	3997.0	4108.0	
<b>GDP by industrial origin</b>											At current factor cost
Agriculture	..	..	43100.0	56000.0	59900.0	60100.0	57000.0	56100.0	60500.0	64800.0	
Mining	..	..	..	..	..	..	100.0	100.0	100.0	1200.0	
Manufacturing	..	..	2800.0	5500.0	6000.0	6200.0	6500.0	6300.0	11000.0	12100.0	
Construction	..	..	2900.0	2100.0	2300.0	2200.0	2400.0	3100.0	3300.0	3100.0	
Electricity, gas, and water	..	..	200.0	300.0	400.0	400.0	400.0	600.0	700.0	800.0	
Transport and communications	..	..	1100.0	2100.0	2500.0	2800.0	2600.0	3200.0	4100.0	4800.0	
Trade and finance	..	..	6200.0	14000.0	15200.0	15200.0	14600.0	15900.0	16900.0	16100.0	
Public administration and defense	..	..	4000.0	4000.0	4500.0	4800.0	5200.0	5500.0	5500.0	5700.0	
Other branches <sup>a</sup>	..	..	2400.0	5700.0	5600.0	8000.0	8700.0	9300.0	2100.0	4800.0	
GDP at factor cost <sup>c</sup>	..	..	62500.0	91700.0	96800.0	99700.0	97500.0	100000.0	104100.0	112900.0	
Net indirect taxes	..	..	2200.0	4000.0	5100.0	4600.0	4500.0	5500.0	5500.0	6000.0	
GDP at market prices	..	..	62500.0	91700.0	96800.0	99700.0	97500.0	100000.0	104100.0	112900.0	
<b>GDP by industrial origin</b>											At constant factor cost
(constant 1972 prices)											
Agriculture	..	..	45300.0	59200.0	66300.0	66800.0	65300.0	60300.0	63800.0	67100.0	
Mining <sup>d</sup>	..	..	..	..	..	..	..	..	..	..	
Manufacturing	..	..	3600.0	7100.0	7100.0	7200.0	7900.0	14500.0	12200.0	14400.0	
Construction <sup>e</sup>	..	..	..	..	..	..	..	..	..	..	
Electricity, gas, and water <sup>e</sup>	..	..	..	..	..	..	..	..	..	..	
Transport and communications <sup>e</sup>	..	..	..	..	..	..	..	..	..	..	
Trade and finance <sup>e</sup>	..	..	..	..	..	..	..	..	..	..	
Public administration and defense <sup>e</sup>	..	..	..	..	..	..	..	..	..	..	
Other branches <sup>b</sup>	..	..	30700.0	42300.0	33900.0	33700.0	35400.0	30600.0	31400.0	32900.0	
GDP at factor cost <sup>c</sup>	..	..	79600.0	108600.0	107300.0	107700.0	108600.0	105400.0	107400.0	114100.0	
Net indirect taxes	..	..	..	..	..	..	..	..	..	..	
GDP at market prices	..	..	79600.0	108600.0	107300.0	107700.0	108600.0	105400.0	107400.0	114100.0	
<b>Resources and expenditures</b>											At current market prices
GNP	..	..	62800.0	91200.0	96200.0	96200.0	95800.0	97900.0	101600.0	110200.0	
Factor payments to abroad (net)	..	..	300.0	-500.0	-400.0	-1500.0	-1700.0	-2100.0	-2500.0	-2700.0	
GDP	..	..	62500.0	91700.0	96600.0	99700.0	97500.0	100000.0	104100.0	112900.0	
Imports of goods and N.F.S.	..	..	6000.0	17000.0	20400.0	17300.0	16700.0	19700.0	23900.0	21900.0	
Exports of goods and N.F.S.	..	..	5500.0	11000.0	15100.0	9700.0	9900.0	10700.0	13600.0	16600.0	
Total resources	..	..	63000.0	97700.0	101900.0	107300.0	105300.0	109000.0	114400.0	118200.0	
Private consumption	..	..	49400.0	76800.0	79600.0	83700.0	80200.0	89000.0	85500.0	92200.0	
General government consumption	..	..	5800.0	7000.0	8000.0	8600.0	8800.0	9300.0	10200.0	10300.0	
Gross domestic investment	..	..	7800.0	13900.0	14300.0	15000.0	16300.0	10700.0	16700.0	15700.0	
<b>Resources and expenditures</b>											At constant market prices
(constant 1972 prices)											
GNP	..	..	79600.0	108300.0	106900.0	105800.0	106700.0	103200.0	104800.0	111300.0	
Factor payments to abroad (net)	..	..	300.0	-600.0	-400.0	-1900.0	-1900.0	-2200.0	-2600.0	-2800.0	
GDP	..	..	79600.0	108600.0	107300.0	107700.0	108600.0	105400.0	107400.0	114100.0	
Imports of goods and N.F.S.	..	..	9700.0	27400.0	32100.0	27400.0	26700.0	27900.0	25700.0	22300.0	
Exports of goods and N.F.S.	..	..	7400.0	14600.0	19700.0	14200.0	13200.0	15200.0	16300.0	17600.0	
Total resources	..	..	81900.0	121400.0	119700.0	120900.0	122100.0	117700.0	116800.0	118800.0	
Private consumption	..	..	62600.0	93900.0	92500.0	91400.0	90700.0	94000.0	83800.0	91300.0	
General government consumption	..	..	8400.0	7400.0	9800.0	10300.0	11000.0	10900.0	11700.0	11300.0	
Gross domestic investment	..	..	10900.0	18100.0	17400.0	19200.0	20400.0	12800.0	21300.0	16200.0	
<b>Investment financing</b>											At current market prices
Gross domestic investment	..	..	7800.0	13900.0	14300.0	15000.0	16300.0	10700.0	16700.0	15700.0	
Gross national savings (excluding net current transfers from abroad)	..	..	7600.0	7400.0	8900.0	3900.0	6900.0	-400.0	5900.0	7700.0	
Net balance of goods and services	..	..	-200.0	-6500.0	-5700.0	-9100.0	-9500.0	-11100.0	-12800.0	-8000.0	
Gross national savings (including net current transfers from abroad)	..	..	..	..	..	..	11835.8	6671.6	14703.4	16066.3	
<b>Domestic price indexes (1970=100)</b>											
Consumer price (or retail price) index	..	..	73.6	82.5	91.2	92.0	89.3	99.2	100.0	104.3	
Wholesale price index	..	..	..	..	..	..	..	..	..	..	
Implicit GDP deflator	..	..	81.0	87.1	92.9	93.6	92.7	97.9	100.0	108.1	
<b>Foreign exchange rate</b>											CFA francs per US dollar
	174.950	175.000	246.853	246.853	246.853	246.853	246.853	259.710	277.710	277.820	

a. 1988. b. Revised. c. GDP at market prices. d. Included in manufacturing. e. Included in other branches.

1. World Bank Economic Data Sheet, cont.

1971	1972	1973	1974	1975	1976	1977	1966-69	1966-70	1975-77	
4223.0	4341.0	4462.0	4587.0	4722.0	4862.0	Average annual growth rate (percent)			(Total, midyear, thousands)	
						2.3	3.3	2.6		
(millions of CFA francs)						As percentage of GDP				
60700.0	60000.0	61800.0	72500.0	101000.0	97000.0	69.0*	65.1	51.7	Agriculture	
1300.0	1300.0	2300.0	9100.0	14400.0	21000.0	0.0	0.0	4.4	Mining	
13000.0	17600.0	16000.0	20000.0	21900.0	23900.0	4.2*	5.2	11.6	Manufacturing	
3300.0	4200.0	4300.0	5000.0	6800.0	8500.0	4.0*	3.1	3.3	Construction	
900.0	1000.0	900.0	1000.0	1300.0	2000.0	0.3*	0.3	0.7	Electricity, gas, and water	
4400.0	4900.0	4400.0	6000.0	8300.0	10500.0	1.8*	2.2	4.0	Transport and communications	
15400.0	17000.0	17400.0	20000.0	31900.0	40900.0	9.9*	14.1	15.0	Trade and finance	
5900.0	7100.0	7700.0	11000.0	12500.0	13700.0	6.4*	5.3	5.9	Public administration and defense	
3900.0	4400.0	3100.0	4600.0	9500.0	6500.0	3.8*	4.7	3.5	Other branches <sup>b</sup>	
106800.0	123700.0	138100.0	149200.0	207600.0	224000.0	100.0*	100.0	100.0	GDP at factor cost <sup>c</sup>	
6500.0	6900.0	9100.0	9600.0	11900.0	19000.0	3.5*	4.5	6.4	Net indirect taxes	
106800.0	123700.0	138100.0	149200.0	207600.0	224000.0	100.0*	100.0	100.0	GDP at market prices	
(millions of CFA francs)						Average annual growth rate (percent)				
60700.0	40800.0	49500.0	44300.0	56300.0	62100.0	..	3.3	-2.1	Agriculture	
..	..	..	..	..	..	..	..	..	Mining <sup>d</sup>	
14500.0	16900.0	14700.0	17000.0	18400.0	22600.0	..	13.9	7.2	Manufacturing	
..	..	..	..	..	..	..	..	..	Construction <sup>e</sup>	
..	..	..	..	..	..	..	..	..	Electricity, gas, and water <sup>f</sup>	
..	..	..	..	..	..	..	..	..	Transport and communications <sup>g</sup>	
..	..	..	..	..	..	..	..	..	Trade and finance <sup>h</sup>	
..	..	..	..	..	..	..	..	..	Public administration and defense <sup>i</sup>	
33400.0	35700.0	34800.0	38300.0	45400.0	38900.0	..	..	4.3	Other branches <sup>b</sup>	
106800.0	93400.0	99000.0	99600.0	120100.0	123600.0	..	2.9	1.2	GDP at factor cost <sup>c</sup>	
..	..	..	..	..	..	..	..	..	Net indirect taxes	
106800.0	93400.0	99000.0	99600.0	120100.0	123600.0	..	2.9	1.2	GDP at market prices	
(millions of CFA francs)						As percentage of GDP				
105600.0	119500.0	133090.0	141200.0	201000.0	216800.0	100.5*	99.1	96.6	GNP	
-3000.0	-4200.0	-3100.0	-8000.0	-6600.0	-7200.0	0.5*	-0.9	-3.4	Factor payments to abroad (net)	
106800.0	123700.0	138100.0	149200.0	207600.0	224000.0	100.0*	100.0	100.0	GDP	
28200.0	36800.0	52600.0	51200.0	64200.0	68400.0	9.6*	17.5	29.7	Imports of goods and N F S.	
18700.0	23000.0	21300.0	30400.0	39800.0	43800.0	8.8*	11.3	17.7	Exports of goods and N F S.	
118100.0	137500.0	169400.0	170000.0	232000.0	248600.0	100.8*	108.2	112.0	Total resources	
84800.0	92300.0	116900.0	120100.0	165600.0	166600.0	79.0*	81.1	79.1	Private consumption	
11400.0	11900.0	13200.0	15900.0	21600.0	29700.0	9.3*	9.0	10.6	General government consumption	
21900.0	33300.0	39300.0	34000.0	44800.0	52300.0	12.5*	16.1	22.3	Gross domestic investment	
(millions of CFA francs)						Average annual growth rate (percent)				
105600.0	90300.0	95300.0	94300.0	116300.0	119600.0	..	2.6	1.0	GNP	
-3000.0	-3100.0	-3700.0	-5300.0	-8800.0	-4000.0	..	..	..	Factor payments to abroad (net)	
106800.0	93400.0	99000.0	99600.0	120100.0	123600.0	..	2.9	1.2	GDP	
28200.0	32700.0	37900.0	31200.0	35400.0	33800.0	..	8.9	5.7	Imports of goods and N F S.	
18700.0	21400.0	11600.0	22700.0	24800.0	23000.0	..	6.9	5.0	Exports of goods and N F S.	
118100.0	104700.0	125300.0	108100.0	130700.0	134400.0	..	3.5	1.6	Total resources	
84800.0	62000.0	83100.0	70100.0	86800.0	87700.0	..	3.9	-0.3	Private consumption	
11400.0	10700.0	11500.0	12700.0	13300.0	15700.0	..	2.0	4.2	General government consumption	
21900.0	32000.0	30700.0	25300.0	30200.0	31000.0	..	3.0	7.6	Gross domestic investment	
(millions of CFA francs)						As percentage of GDI				
21900.0	33300.0	39300.0	34000.0	44800.0	52300.0	100.0*	100.0	100.0	Gross domestic investment	
..	..	..	..	..	..	..	..	..	Gross national savings (excluding net current transfers from abroad)	
9400.0	15300.0	2900.0	5200.0	13200.0	20500.0	97.4*	55.9	31.0	Net balance of goods and services	
-12500.0	-18000.0	-36400.0	-28600.0	-31000.0	-31800.0	-2.6*	-44.1	-69.0	Gross national savings (including net current transfers from abroad)	
20976.4	33739.5	31519.5	22602.7	13821.7	20523.0	..	..	66.9		
						Average annual growth rate (percent)				
114.4	127.8	132.1	144.1	178.1	219.6	..	2.9	11.2	Consumer price (or retail price) index	
..	..	..	..	..	..	..	..	..	Wholesale price index	
03.2	136.6	144.0	154.6	178.3	187.0	..	2.1	10.6	Implicit GDP deflator	
(annual average)										
232.210	222.700	210.500	214.320	238.940	245.670	..	..	..	Foreign exchange rate	

Source: World Bank, 1980.

## 2. Agricultural Production, 1964-1976

		1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
<u>MILLET</u>	P	781	934	977	1,013	790	842	1,000	733	1,095	871	959	919	627	883	581	1,195
Mil	A	1,640	1,885	1,868	1,777	1,810	1,743	1,865	1,895	2,272	2,310	2,356	2,195	2,008	2,230	1,693	2,532
	Y	470	506	523	570	436	483	537	387	482	377	407	419	312	395	343	472
<u>SORGHUM</u>	P	275	315	353	315	266	277	342	215	289	230	267	209	126	218	253	308
Sorgho	A	454	464	485	453	465	530	556	596	596	593	579	567	448	542	791	633
	Y	607	680	727	696	571	523	615	361	486	388	461	368	282	404	320	487
<u>COUPEAS</u>	P	46	57	63	66	48	68	77	74	83	84	72	144	92	133	219	236
Nièbé	A	405	454	484	493	432	608	690	745	968	980	1,000	921	823	919	839	857
	Y	112	112	131	134	111	112	112	99	86	86	72	156	112	145	261	275
<u>RICE(paddy)</u>	P	9.6	11.2	10.1	11.8	11.7	20.5	32.6	39.0	38.0	37.1	27.3	31.8	46.3	30.2	29.3	29.1
Riz(paddy)	A	9.1	9.1	9.4	9.4	8.7	9.2	11.5	15.3	15.5	16.4	17.1	17.2	17.8	14.8	16.2	21.1
	Y	1,043	1,228	1,072	1,260	1,340	2,218	2,829	2,553	2,521	2,262	1,595	1,850	2,605	2,037	1,820	1,384
<u>GROUNDNUTS</u> (in shell)	P	152	205	220	194	277	312	298	252	206	205	256	260	77	129	41	95
Arachides (en coques)	A	349	331	319	293	341	355	357	432	320	358	394	419	364	256	318	178
	Y	435	621	692	662	812	887	835	583	644	573	650	621	212	504	129	534
<u>COTTON</u>	P	3.4	5.1	6.4	6.1	7.0	6.7	6.2	7.0	12.6	10.5	9.0	6.1	3.6	7.9	9.4	--
Coton	A	8.2	10.3	12.9	14.6	16.3	16.3	17.2	17.3	20.2	19.9	20.6	15.9	10.1	15.7	17.4	--
	Y	414	498	497	418	429	411	360	405	624	528	437	384	356	506	540	--

P - Production (1,000 tons)    A - Area, Superficie (1000 hectares)    Y - Yield, Rendement (kg/ha)

Source: CILSS. 1977, vol. 2.



4. Projected Demand and Supply of Food, 1975-90  
('000)

	1975	1976	1977	1978	1979	1980	1981	1982
Population ('000)/1	4,591	4,715	4,842	4,972	5,107	5,272	6,077	7,049
Cereal requirements (gross) (250 kg/head)	1,148	1,180	1,210	1,243	1,277	1,318	1,519	1,768
Production (millet and sorghum)								
Assumption A	1,178	1,186	1,196	1,207	1,218	1,225	1,268	1,268
Assumption B	1,178	1,241	1,305	1,379	1,453	1,531	1,531	1,531
Balance (millet and sorghum)								
Assumption A	+30	+6	-14	-36	-59	-93	-251	-494
Assumption B	+30	+61	+92	+136	+176	+213	+12	-231
Production (paddy)								
Traditional	15	15	15	15	15	15	15	15
Modern /2	20	24	28	33	37	41	76	111
	<u>35</u>	<u>39</u>	<u>43</u>	<u>48</u>	<u>52</u>	<u>56</u>	<u>91</u>	<u>126</u>
Balance (food)								
Assumption A	+65	+45	+29	+7	-7	-37	-160	-368
Assumption B	+65	+100	+135	+185	+228	+269	+103	-105

/1 This Bank projection is somewhat lower than that of the Ministry of Agriculture, Niger in "Situation de l'Agriculture Nigérienne après la Sécheresse", 1975.

/2 With assumptions: 1975-80: irrigation of additional 600 ha/year with 7 tons of paddy/ha (two crops); this is the Government's present target.

1981-85: irrigation of additional 1,000 ha/year with 7 tons of paddy/ha (two crops). This is not yet a target but may be considered a possibility.

Source: World Bank. 1976.

5. Uranium Exports (millions of Francs CFA)

	total exports	uranium exports	% of uranium
1969	6,250	---	--
1970	8,795	---	--
1971	10,670	931	8.7
1972	13,712	2,604	19.0
1973	13,817	4,625	33.5
1974	12,621	6,086	48.2
1975	19,556	11,882	60.8
1976*	3.,978	20,500	64.0
1977**	39,900	29,500	73.9
1978**		52,000	

\*estimates

\*\*West Africa, 21 January 1980.

Source: Niger, Ministère du Développement Rural, Direction de l'Agriculture. 1978.

## 6. Industry

### SELECTED PRODUCTS

	1973	1973	1974	1975
Beer ('000 hl.)	33	38	n.a.	n.a.
Woven cotton fabrics (million sq. metres)	13	n.a.	n.a.	n.a.
Groundnut oil ('000 metric tons)	26	21	12	27
Cement ('000 metric tons)	33	73	31	13
Electricity (million kWh.)	30	37	65	70

1976: Cement 38,000 metric tons, Electricity 70 million kWh.

Source: Europa Publications. 1980.

## 7. Principal Commodities

(million francs CFA)

IMPORTS	1974	1975	1976	EXPORTS	1974	1975	1976
Road vehicles	2,812	2,397	5,394	Uranium concentrates	6,322	11,532	20,470
Petroleum products	3,139	2,750	3,525	Live animals	2,093	3,053	4,708
Non-electric machinery	2,234	2,080	3,142	Vegetables	152	573	2,753
Iron and steel cast iron	1,292	1,150	2,093	Groundnut oil	1,143	649	919
Textile yarn and fabrics	1,380	1,188	1,931	Groundnuts, shelled	—	2	697
Electrical machinery, etc	1,175	1,005	1,295	Groundnut cake	185	185	309
Paper, paperboard, printed matter	312	338	827	Hides and skins	607	177	477
Sugar and confectionery	1,367	642	739	Raw cotton	16	14	134
Rubber and rubber products	407	454	496	Meat and oils	124	283	210
Tobacco	242	374	470	Cotton yarn and fabrics	218	32	158
Pharmaceutical products	407	277	432	Artificial and synthetic fabrics	456	250	n.a.
Groundnuts	462	2,066	7				
<b>TOTAL (incl others)</b>	<b>23,144</b>	<b>21,889</b>	<b>30,383</b>	<b>TOTAL (incl others)</b>	<b>12,611</b>	<b>19,356</b>	<b>31,979</b>

Source: Europa Publications. 1980.

## 8. Principal Trading Partners

(million francs CFA)

IMPORTS	1974	1975	1976	EXPORTS	1974	1975	1976
Algeria	765	1,655	1,755	Benin	300	470	140
China, People's Republic	410	400	850	France	6,475	12,450	17,270
France	9,573	6,643	13,193	Germany, Federal Republic	933	140	1,140
Germany, Federal Republic	1,205	1,020	2,060	Italy	225	70	4,970
Ivory Coast	795	953	2,400	Ivory Coast	133	243	330
Japan	180	200	935	Japan	5	140	—
Netherlands	755	675	865	Nigeria	3,400	4,250	7,430
Senegal	260	2,300	455	United Kingdom	140	243	—
U.S.A.	2,955	2,673	1,950	U.S.A.	94	505	15
				Upper Volta	100	400	270
<b>TOTAL (incl others)</b>	<b>23,145</b>	<b>21,890</b>	<b>30,380</b>	<b>TOTAL (incl others)</b>	<b>12,610</b>	<b>19,355</b>	<b>31,975</b>

Source: Europa Publications. 1980.

**Appendix IV**

**List of U.S. AID Projects in Niger**

.....  
 \* COUNTRY/BUREAU: NIGER PROJECT: 6830205 SUB-PROJECT: 02 \*  
 \* TITLE: NIAMEY DEPARTMENT RURAL DEVELOPMENT INITIAL FY: 77 FINAL FY: 80 \*  
 .....

DOCS 241

RURAL DEVELOPMENT PLANS FOR THE NIAMEY DEPARTMENT, NIGER, INCLUDE THE APPLICATION OF NEW AGRICULTURAL METHODS, EXTENSION SERVICES, AND DEVELOPMENT OF CO-OPS AND FARMER MUTUALS. FARMERS MUST THEREFORE BE ABLE TO RECEIVE AND UNDERSTAND SIMPLE WRITTEN COMMUNICATIONS AND ALSO BE ABLE TO CALCULATE AND MAINTAIN NECESSARY RECORDS. HOWEVER, THE LITERACY RATE IS PRESENTLY LESS THAN 1%. THE ADULT LITERACY PROGRAM IS VERY LIMITED AND EDUCATIONAL RADIO FOR FARMER INFORMATION AND TRAINING IS UNDEUTILIZED.

STRATEGY:

3-YEAR PROJECT PROVIDES GRANT FOR OFFICE CONSTRUCTION, VEHICLES, IN-COUNTRY TRAINING, AND SUPPLIES TO IMPROVE ADULT EDUCATION. HOST GOVT WILL MANAGE PROJECT AND PROVIDE SUPERVISORY AND SUPPORT PERSONNEL, INSTRUCTORS, LAND, AND EQUIPMENT/SUPPLIES.

DOCS 242

GRANT FOR DEVELOPING A FARMER LITERACY PROGRAM AND FOR ORGANIZING VILLAGE RADIO/DISCUSSION CLUBS WITHIN THE DEPARTMENT OF NIAMEY, NIGER. THESE EDUCATIONAL ACTIVITIES ARE NECESSARY FOR SUCCESSFUL IMPLEMENTATION OF THE INTEGRATED RURAL DEVELOPMENT PROJECT (6830205, 01). 1) FARMER LITERACY PROGRAM: THE ADULT LITERACY SERVICE OF THE MINISTRY OF EDUCATION WILL LEAD THE PROGRAM TO COVER ALL OF THE NIAMEY DEPARTMENT. 26 INSTRUCTORS (12 FROM EACH COOPERATIVE) WILL RECEIVE ONE MONTH OF FUNDAMENTAL TEACHING TRAINING. EACH INSTRUCTOR WILL THEN SERVE VILLAGERS FROM 2 TO 3 VILLAGES. READING MANUALS WILL BE PRODUCED IN LOCAL LANGUAGES AND INCLUDE INFORMATION ON AGRICULTURE, HEALTH, AND LIVESTOCK. AN OFFICE WILL BE CONSTRUCTED IN EACH OF THE 3 ARRONDISSEMENTS FOR THE ARRONDISSEMENT DIRECTORS. BY THE END OF THE PROJECT, 3,000 VILLAGERS, MEN AND WOMEN, WILL HAVE BECOME FUNCTIONALLY LITERATE. 2) VILLAGE RADIO/DISCUSSION CLUBS: NIGER'S NATIONAL ASSOCIATION OF RADIO CLUBS (ARNC) WILL PRODUCE 26 HALF-HOUR RADIO-CASSETTE PROGRAMS ON TOPICS RELATING TO AREA DEVELOPMENT PLANS, INCLUDING: ORGANIZATION AND FUNCTION OF LOCAL ASSOCIATIONS (FARMER MUTUALS) AND CO-OPS, CURRENT CROP CAMPAIGNS, IMPROVING MILLET YIELDS, INFORMATION ON PRICES AND MARKETING OF CEREALS, PLANT PROTECTION, TREE NURSERIES, SOIL FERTILITY, ANIMAL TRACTION, INTRODUCTION OF VILLAGE MILLS FOR GRINDING CEREAL, NUTRITION AND HEALTH, AND THE ROLE OF WOMEN IN DEVELOPMENT. A MEMBER FROM EACH CO-OP (OFTEN THE CHAIRMAN OF THE EDUCATIONAL COMMITTEE) WILL BE TRAINED AT ARNC AS A RADIO CLUB ANIMATOR/MONITOR. HE WILL ORGANIZE THE PRESENTATION AND VILLAGE DISCUSSION OF THE CASSETTE PROGRAMS. EACH OF THE 42 CO-OPS ESTABLISHED UNDER 6830205, 01 WILL ORGANIZE A RADIO CLUB. THUS, NEARLY THE ENTIRE ADULT POPULATION WILL HAVE AN OPPORTUNITY TO PARTICIPATE IN THE SERIES OF RADIO-CASSETTE PRESENTATIONS.

DOCS 243

TO INCREASE FOOD PRODUCTION, RURAL INCOMES, AND IMPROVE RURAL STANDARDS OF LIVING WITHIN THE DEPARTMENT OF NIAMEY, NIGER.

PURPOSE: IMPROVE LEVEL OF EDUCATION OF ADULT FARMERS IN THE NIAMEY DEPARTMENT OF NIGER. 1

1) 3 ARRONDISSEMENT OFFICES CONSTRUCTED. 2) 84 LITERACY INSTRUCTORS TRAINED AND FUNCTIONING. 3) 3,000 VILLAGERS RECEIVING LITERACY TRAINING. 4) 42 RADIO CLUB MONITORS (DISCUSSION LEADERS) TRAINED AND FUNCTIONING.

DOCS 244

.....  
 \* COUNTRY/BUREAU: NIGER PROJECT: 6830204 SUB-PROJECT: 00 \*  
 \* TITLE: ENTENTE LIVESTOCK II INITIAL FY: 76 FINAL FY: 80 \*  
 .....

PROBLEM:

SAMELIAN DROUGHT REDUCED LIVESTOCK POPULATION WHILE MEAT DEMAND INCREASED. LIVESTOCK SECTOR DEVELOPMENT CANNOT KEEP PACE WITH DEMAND BECAUSE OF SHORTAGE OF TRAINED ADMINISTRATORS AND TECHNICIANS, AND LACK OF SECTOR DEVELOPMENT PLANNING CAPABILITY.

STRATEGY: ASSIST ENTENTE FUND TO PROVIDE CREDIT AND TECHNICAL ASSISTANCE TO SUB-PROJECTS. ASSIST LIVESTOCK SECTOR ADMINISTRATION TO IMPROVE DEVELOPMENT PLANNING CAPABILITY.

SUMMARY:

CAPITAL ASSISTANCE TO ENTENTE FUND FOR ADMINISTRATION AND IMPLEMENTATION OF SUB-PROJECTS, WHICH SUPPORT THE SECTORAL PROGRAMS TO INCREASE EFFICIENCY OF LIVESTOCK PRODUCTION AND ESTABLISH REGIONAL COOPERATION AND COORDINATION INSURING EFFECTIVE LIVESTOCK PRODUCTION AND MARKETING. ANALYSIS OF SECTORAL PROGRAMS, THROUGH REGIONAL MEETINGS, SERVING AS CONTINUOUS BASIS FOR POLICY AND PROGRAM REINFORCEMENT, EVALUATION AND DEVELOPMENT OF PROGRAMS INSURING BETTER UNDERSTANDING OF THE IMPORTANCE OF SMALL PRODUCERS. PROVIDE TECHNICAL ASSISTANCE, TRAINING, RESEARCH AND REGIONAL PROGRAMS TO SUPPORT SECTORAL PROGRAMS.

GOAL:

1. INCREASE THE AVAILABILITY OF REASONABLY-PRICED ANIMAL PROTEIN FOR CONSUMPTION WITHIN THE REGION. 2. IMPROVE THE STANDARD OF THOSE RURAL POOR ASSOCIATED WITH LIVESTOCK PRODUCTION.

PURPOSE: 1. INCREASE THE EFFICIENCY AND PRODUCTIVITY OF THE LIVESTOCK SECTOR IN THE ENTENTE COUNTRIES WHILE INCREASING THE STANDARD OF LIVING OF SMALL LIVESTOCK PRODUCERS. 2. FOSTER INCREASED REGIONAL COOPERATION AND COORDINATION IN LIVESTOCK PRODUCTION AND MARKETING IN THE ENTENTE STATES AND TO SUPPORT AT THE REGION A PROCESS OF SECTORAL ANALYSIS WHICH SERVES TO PROVIDE CONTINUING INFORMATION TO BE USED IN POLICY AND PROGRAM EVALUATION AND DEVELOPMENT.

SUPPORT:

DESIGN INTERVENTIONS TESTING VARIOUS MEANS TO ACHIEVE SECTORAL OBJECTIVES; FUND, IMPLEMENT, EVALUATE INTERVENTIONS; REVIEW AND SYNTHESIZE INFORMATION OF SECTORAL DEVELOPMENT PROBLEMS; FIELD RESEARCH PROVIDE CRITICAL INFORMATION RELATE SECTORAL DEVELOPMENT PROBLEMS; ANALYZE SUB-SECTORAL LIVESTOCK PRODUCTION AND MARKETING WITH POLICY RECOMMENDATIONS; PERIODIC REGIONAL MEETINGS TO DISCUSS POLICY ISSUES; TRAINING LIVESTOCK CASE; IMPLEMENTATION OF LIVESTOCK PHOTOGRAPHS.



PROBLEM: THE COMPLETION OF THE KAINJI DAM AND THE KAINJI LA  
 SUDDEN LOCKS ON THE NIGER RIVER IN NIGERIA SUBMERGED  
 OR CIRCUMVENTED THE RAPIDS ON THE RIVER AND MADE  
 RIVER NAVIGATION AND, THEREFORE, TRADE TECHNICALLY  
 FEASIBLE FROM OCEAN PORTS THROUGH TO NIAMEY, NIGER  
 DURING THE RIVER'S 7 MO HIGH-WATER PERIOD. THE  
 EXISTING HIGH-WAY BRIDGE ACROSS THE RIVER WHICH LINKS  
 GAYA, NIGER TO MALANVILLE, CAMEROON HAS ONLY A 1 METER  
 WATER CLEARANCE DURING THIS PERIOD, THUS PREVENTING  
 PASSAGE BY COMMERCIAL CRAFT & SHUTTING OFF WESTERN  
 NIGER FROM A LUCRATIVE RIVER TRADE.

STRATEGY: THREE YEAR PROJECT CONSISTS OF A GRANT PROVIDED  
 TECHNICAL ADVISORY ASSISTANCE, CONSTRUCTION OF  
 4M MATERIALS, AND EQUIPMENT TO ELEVATE A BRIDGE  
 CONSTRUCT A RIVER PORT. HOST COUNTRY PROVIDES  
 LONG-TERM MAINTENANCE.

LOAN TO THE GOVT OF NIGER PROVIDES FOR THE ELEVATION & RECONSTRUCTION OF A BRIDGE OVER THE NIGER RIVER IN THE  
 GAYA, NIGER & MALANVILLE, CAMEROON AND THE CONSTRUCTION OF A RIVER PORT IN GAYA.  
 ELEVATION OF THE BRIDGE FROM ITS PRESENT 1 METER HIGH-WATER CLEARANCE TO THE PROJ-PROPOSED 7 M CLEARANCE WILL PERMIT  
 RIVER NAVIGATION FOR 7 MONTHS OF THE YEAR (THE RIVER'S NAVIGABLE, HIGH-WATER PERIOD) FROM THE RIVER ESTUARY IN NIGERIA  
 BEYOND GAYA TO NIAMEY. TWO SPAN 16 & 810P THE 16 SPAN 2-ANE CONCRETE HIGHWAY BRIDGE WILL BE RAISED TO PEAK ELEVATION  
 7 M WITH LESSER RAISES FOR SUCCEEDING SPANS ON EACH SIDE. SPANS 1 & 5 ARE LOCATED ABOVE THE DEEPEST CHANNEL OF THE  
 RIVER AND ARE NEAR THE GAYA SIDE. A DOWNGRADE OF 3.2% WILL BE MAINTAINED AND THE ORIGINAL GRADE WILL BE REACHED AT  
 19 ON THE MALANVILLE SIDE. ON THE GAYA SIDE THE EXISTING APPROACH FILL AND ABUTMENT WILL BE RAISED. A METAL WALL WITH  
 ANCHORED TO SCREW PILES WILL BE SHEATHED AROUND THE COLUMNS OF SPANS 1, 5 & 6 AS A PROTECTIVE MEASURE AGAINST THE  
 IMPENDING RIVER TRAFFIC. THE GOV WILL MAKE AVAILABLE A FERRY TO ACCOMMODATE ROAD TRAFFIC DURING THE BRIDGE  
 RECONSTRUCTION PERIOD.

THE NEW RIVER PORT WILL BE CONSTRUCTED ON A 21.5 ACRE LEVEL & SANDY SITE APPROX 4 KMS SOUTHWEST OF GAYA. LOAN WILL FUND  
 THE CONSTRUCTION OF A 200-METER QUAY WALL; FILLING IN THE LOW, SANDY AREAS EXTENDING 100 METERS INLAND FROM THE WALL  
 THE CONSTRUCTION OF AN ACCESS ROAD, EIGHT STORAGE SPEDS, OPEN STORAGE AREAS, FENCES AND GATES, AN OFFICE BUILDING FOR  
 COMMUNICATIONS & CUSTOMS, A CORRAL FOR ANIMALS, AND INSTALLATION OF WATER SUPPLY, SANITARY, ELECTRIC POWER, NIGHT LIGHTING  
 AND FUEL FACILITIES. OPERATION AND MAINTENANCE OF THE NEW FACILITY WILL BE THE RESPONSIBILITY OF THE GAYA PORT  
 COMMISSION. TECHNICAL ADVISORY ASSISTANCE WILL BE PROVIDED DURING THE INITIAL PHASES OF THE OPERATION.  
 LOAN WILL COVER THE PREPARATION OF FINAL ENGINEERING PLANS & CONSTRUCTION CONTRACT BID DOCUMENTS, SUPERVISORY  
 ENGINEERING SERVICES DURING CONSTRUCTION, AND CONSTRUCTION SERVICES INCLUDING THE PROCUREMENT AND INSTALLATION OF  
 EQUIPMENT.

22.1 NIGER'S COMMERCIAL TRANSPORT COSTS ARE REDUCED. ; PURPOSE: COMMERCIAL NAVIGATION OF THE NIGER RIVER IS EXTENDED  
 FROM PORT HARCOURT, NIGERIA THROUGH GAYA TO NIAMEY  
 WESTERN NIGER. ;

1.2.75: 1. SPANS & APPROACHES OF THE MALANVILLE-GAYA BRIDGE ELEVATED & RECONSTRUCTED. 2. GAYA RIVER PORT CONSTRUCTED (QUAY WALL  
 STORAGE SPEDS; ACCESS ROAD; FENCE AND GATES; OFFICE BUILDING ANIMAL CORRAL AND WATER SUPPLY, SANITARY, ELECTRIC  
 POWER, LIGHTING, AND FUEL FACILITIES). ;

PROBLEM: ALTHOUGH 4 AFRICAN COUNTRIES POSSESS A WELL-PLANNED  
 ROAD NETWORK, THEY ARE PLAGUED WITH COSTLY &  
 DIFFICULT TRANSPORTATION BECAUSE OF POORLY  
 MAINTAINED ROADS. BECAUSE ROAD MAINTENANCE PERSONNEL  
 LACK BOTH KNOWLEDGE & USABLE EQUIPMENT NEEDED FOR  
 MAINTENANCE. AGR AREAS ARE OFTEN WITHOUT ACCESS TO  
 MARKETS. VEHICLE OPERATING COSTS ARE TOO HIGH, AND  
 THE POOR MAJORITY SUFFER ECONOMIC LOSSES AND HAVE  
 UNSATISFACTORY STANDARDS OF LIVING.

STRATEGY: 4-YEAR PROJECT CONSISTS OF FUNDS FOR TECHNICAL  
 ASSISTANCE (TA) TO 5 AFR NATIONS TO ESTABLISH A  
 REGIONAL TRAINING INSTITUTION (RRMTC) FOR ENTENTE  
 ROAD MAINTENANCE PERSONNEL. USAID PROVIDES FUNDS  
 CONTRACT SERVICES FOR TRAINING REGIONAL ROAD  
 MAINTENANCE TRAINING CENTER (RRMTC)  
 MANAGEMENT/INSTRUCTOR/LOGISTIC/VOCATIONAL PERSONNEL  
 FOR PARTIC TRNG, COMMODITIES & EQUIPMENT/TRNG AID  
 OTHER COSTS. AFR COUNTRIES GRADUALLY ASSUME AT LE  
 75% OF BUDGET. OTHER DONORS: FRANCE; EEC.

TECHNICAL ASSISTANCE (TA) PROVIDED TO FIVE AFRICAN ENTENTE STATES (IVORY COAST, TOGO, CAMEROON, NIGER AND UPPER VOLTAS)  
 TO ESTABLISH A REGIONAL ROAD MAINTENANCE TRAINING CENTER (RRMTC) FOR ENTENTE ROAD MAINTENANCE PERSONNEL.  
 PROJECT WILL RESULT IN COMPLETE AFRICANIZATION OF THE CENTER'S STAFF, EFFECTIVE OPERATIONAL AND BUDGETARY CONTROLS,  
 INSTALLATION OF EQUIPMENT AND ESTABLISHMENT OF A PREVENTIVE ROAD MAINTENANCE SYSTEM.  
 RRMTC WILL BE COMPOSED OF 3 REPRESENTATIVES FROM EACH ENTENTE MEMBER STATE, WITH WELL-TRAINED MANAGEMENT, INSTRUCTION  
 AND SUPPORT STAFF. WITHIN 3 YEARS OF PROJECT'S INCEPTION, PARTICIPATING AFRICAN NATIONS WILL ASSUME FINANCIAL  
 RESPONSIBILITY FOR RRMTC THROUGH COUNTRY CONTRIBUTIONS, TUITION AND OPERATING RECEIPTS. AMERICAN AND FRENCH PERSONNEL  
 WILL BE GRADUALLY REPLACED BY AFR INSTRUCTORS, ADMIN/LOGISTIC/VOCATIONAL SPECIALISTS.  
 TRAINING WILL BE EXPANDED TO INCLUDE 12-18 FRENCH LANGUAGE COURSES FOR HEAVY EQUIPMENT MECHANICS AND OPERATORS, ROAD  
 CREW FOREMEN AND CLASSES IN MACHINE TOOLS, SUPPLY MGMT, ELECTRICITY, DIESEL INJECTION AND SOILS, MECHANIC AND OPERAT  
 STURSES IN ENGLISH WILL BE GIVEN FOR ANGLORPH AFRICAN NATIONS. ABOUT 250 STUDENTS WILL BE TRAINED ANNUALLY FROM  
 CROSS-SECTIONS OF ENTENTE AND OTHER STATES. IN ADDITION TO ITS ROLE AS A SCHOOL OFFERING COURSES AND ON-THE-JOB TRNG,  
 THE RRMTC WILL SERVE AS A RESOURCE CENTER TO AFRICAN COUNTRIES TRAINING NEEDS, DEVELOP PROGRAMS, TRNG MATERIALS,  
 PUBLICATIONS AND SEMINARS ON COMMON ROAD MAINTENANCE PROBLEMS.  
 REVISED PROJ OF 3/21/75, EXTENDING PROJ 1 TO 3 YEARS TO REFINE THE MANAGEMENT SYSTEM, SIMPLIFY RECRUITING,  
 MANEUVERING AND EVALUATING OF STUDENTS, PLAN EXPANSION, STAFF AND RESOURCES OF RRMTC, FINANCIAL SUPPORT FROM ISRD AND  
 BILATERAL DONORS WILL BE EXPANDED.  
 BENEFICIARIES WILL BE AFRICAN/EUROPEAN/US TRANSPORTATION OFFICIALS AND WORKERS.  
 FUNDING IS BY PHILCO-FORD (ISRD NUTROVIC ROAD) CORPORATION,  
 OTHER DONORS: FIC (FRANCE); FED (FRANC EUROPEAN DE DEVELOPMENT); AN EEC JOINT AGENCY.

22.1 TO IMPROVE THE CAPACITY OF THE ENTENTE STATES TO MAINTAIN THEIR ROAD NETWORK. PURPOSE: ESTABLISHMENT OF A VIABLE REGIONAL TRAINING  
 INSTITUTION (RRMTC) FOR ENTENTE ROAD MAINTENANCE  
 PERSONNEL.

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WELL-TRAINED AND PERFORMING MGMT, INSTRUCTIONAL  
 SUPPORT STAFF; 250 STUDENTS TRAINED ANNUALLY;  
 PRACTICAL TRAINING PROGRAM DEVELOPED & IMPLEMENTED  
 1. REGIONAL SEMINARS ON ROAD MAINTENANCE  
 PUBLIC WORKS DEPT PERSONNEL ;

.....  
 \* COUNTRY/BUREAU: NIGER PROJECT: 4830202 SUB-PROJECT: 00 \*  
 \* TITLE: NIGER RANGE AND LIVESTOCK MGMT INITIAL FY: 76 FINAL FY: 80 \*  
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**STRATEGY:**

NIGER'S PASTORAL ZONE REPRESENTS A MAJOR NATURAL RESOURCE CONTAINING 20 MILLION HECTARES AND CARBOVING CAPACITY OF OVER MILLION LIVESTOCK UNITS IN DRY SEASON AND 2-3 TIMES THAT DURING WET SEASON. HOWEVER, THERE ARE MANY OBSTACLES TO ITS CONTINUED PRODUCTIVITY AND IMPROVEMENT. GRASSLANDS HAVE BEEN SERIOUSLY MISUSED AND ARE DEGENERATING UNDER PRESSURES OF MAN AND ANIMALS. PRODUCTIVITY IS LOW. ACCESS IS DIFFICULT AND COSTS OF MARKETING, DISTRIB. AND INSTALLATION OF FACILITIES ARE HIGH. ALSO POP IS POOR, LARGEY ILLITERATE & UNSCHOLED.

TWO-YEAR PROJECT PROVIDES GRANT, TECHNICAL ASSISTANCE, AND IN-COUNTRY AND U.S. PARTICIPANT TRAINING TO DEVELOP BASIS FOR A COMPREHENSIVE RANGE MANAGEMENT/LIVESTOCK PRODUCTION PROGRAM. USAID AL FINANCES VEHICLES AND EQUIPMENT. JON WILL PROVIDE COUNTERPART PERSONNEL, VACCINES AND AN EVALUATION STUDY TEAM.

NIGER IS PROVIDED WITH GRANT, TECH ASSIST AND TRNG TO PRESERVE AND IMPROVE PRODUCTIVITY OF ASHELIAN RANGELAND. PROJ WILL LAY BASIS FOR COMPREHENSIVE RANGE MANAGEMENT AND LIVESTOCK EXTENSION PROG. PRELIMINARY STUDIES AND PILOT INTERVENTIONS WILL BE UNDERTAKEN IN CENTRAL PASTORAL ZONE. US ADVISORS WILL WORK WITH JON OFFICE OF PASTORAL ZONE MGMT.

DETAILED ASSESSMENT OF RANGE CONDITIONS WILL BE MADE. 30 RANGE TRANSECTS AND 16 ENCLOSURES WILL BE MONITORED. RANGE CONDITIONS WILL BE CORRELATED WITH RAINFALL PATTERNS AND AN OVERLAY MAP PREPARED SHOWING CHANGES IN VEGETATION FROM 1975 TO 77. AERIAL PHOTOGRAPHY AND GROUND SURVEYS WILL BE USED FOR MAPPING AND TO DETERMINE MAJOR HABITAT TYPES AND EROSION PATTERNS. RESEEKING TRAILS WILL ALSO BE CONDUCTED.

1. WATER CATCHMENTS WILL BE CONSTRUCTED TO TEST RETENTION OF WATER IN ZONE'S NORTHERN EXTREMITY FOR LONGER PERIODS FOR MORE EFFECTIVE USE OF FORAGE. 19 HAND-OUT WELLS WILL BE IMPROVED. HERDER ASSOCS WILL BE FORMED TO PROMOTE RECOMMENDED GRAZING PRACTICES IN CATCHMENT AREAS.

FIRE DAMAGE WILL BE MONITORED AND AN ONGOING FIREBREAK CONSTRUCTION PROG STUDIED. TRIAL BURNS WILL BE MADE ON SMALL PLOTS TO MEASURE EFFECTS ON FORAGE, RATE OF REGROWTH AND RESPONSE OF VARIOUS SPECIES TO SUCCESSION AFTER BURNING. LIVESTOCK ELEMENT OF PROJ WILL INCLUDE: 1) COMPARATIVE COST-BENEFIT STUDY 2) STRENGTHENING OF EXISTING LIVESTOCK PROGS AND 3) CONSTRUCTION OF LIVESTOCK POSTS & 1) HANDLING FACILITIES. LIVESTOCK STDY WILL INVOLVE 2 GROUPS OF HERDERS - 12 HALF AS CONTROL GROUP AND HALF RECEIVING HLTH CARE/DISEASE CONTROL PROG. EXISTING LIVESTOCK PROG WILL INCLUDE GREATER VACCINATION AND PARASITE CONTROL SERVICES.

SOCIOLOGICAL STUDIES ARE PLNND TO ENSURE THAT PROJ WILL BE SOCIALLY FEASIBLE. LIVESTOCK INFO WILL BE DISSEMINATED TO HERDERS VIA CASSETTE RECORDINGS & RADIO NAINY BROADCASTS.

25 NIGERIENS WILL RECEIVE US TRNG IN LIVESTOCK EATEN AND RANGE MGMT. US ADVISORS AND SHY-TERM CONSULTANTS WILL ASSIST LOCAL HERDER ASSOCIATION TRNG PROGS.

USAID WILL ALSO FINANCE VEHICLES & EGMT. JON WILL PROVIDE COUNTERPARTS, VACCINES, & EVALUATION STDY TEAM. PRIMARY BENEFICIARIES ARE HERDER POPULATIONS IN PROJ AREA

**OBJECTIVE:** 1. IMPLEMENTATION OF SYST OF RANGE MANAGEMENT IN THE PASTORAL ZONE FOR THE PRESERVATION AND IMPROVEMENT OF THIS RESOURCE. 2. INCREASED INCOME AND WELL-BEING OF TRADITIONAL HERDERS IN THE PASTORAL ZONE.

**PURPOSE:** 1. THE PREPARATION OF A COMPRE-ENSIVE, FEASIBLE RANGE MANAGEMENT PLAN AND LIVESTOCK EXTENSION TO OPTIMIZE ANIMAL PRODUCTION IN PASTORAL ZONE. 2. THE DEVELOPMENT OF JON INSTITUTIONAL CAPACITY TO BEGIN TO CARRY OUT THE INTERVENTIONS.

**OUTPUTS:** 1. RANGE RESOURCE STUDIES: A. CARBOVING CAPACITY OF RANGE WILL BE DETERMINED AND SYST OF RANGE ASSESSMENT DEVELOPED FOR CONTROL OF GRAZING PATTERNS. B. CHANGES IN THE RANGE BETWEEN 1975-77 DETERMINED BY AERIAL PHOTO ANALYSIS. EROSION PATTERNS AND MAJOR HABITAT TYPES MAPPED. C. HERDFOLK TRIALS CONDUCTED IN 23 LOCATIONS. D. FEASIBILITY OF IMPROVING PRIVATE WELLS & CONSTRUCTION OF WATER CATCHMENTS DETERMINED. E. FIRE DAMAGE MONITORED. 2. LIVESTOCK PRODUCTION: A. FEASIBILITY OF A PACKAGE OF INTERVENTIONS TESTED. B. ANIMAL HEALTH PROG ESTABLISHED. C. LIVESTOCK AND 10 LIVESTOCK HANDLING FACILITIES CONSTRUCTED. 3. MARKETING STUDY CONDUCTED. 4. TRAINING/INSTITUTIONAL DEVELOPMENT PROGRAM ESTABLISHED.

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 \* COUNTRY/BUREAU: NIGER PROJECT: 4830201 SUB-PROJECT: 00 \*  
 \* TITLE: NIGER: CEREALS PRODUCTION PROJECT INITIAL FY: 76 FINAL FY: 80 \*  
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**STRATEGY:**

NIGER, A NET EXPORTER OF CEREALS PRIOR TO SAMEL DROUGHT, HAS BEEN FORCED TO ACCEPT EMERGENCY FOODSTUFFS. LACK OF TRANSPORT, PRECARIOUS RAINFALL, LACK OF MANAGEMENT SKILLS, ISOLATION OF FARMERS, SLOW PROGRESS TOWARD REBUILDING AND EXPANDING THE AGRICULTURAL SECTOR.

CONCENTRATE RESOURCES ON CEREAL PRODUCTION IN NATIONAL CROP PROGRAM DESIGNED TO PROVIDE INCREASED DOMESTIC CEREAL AVAILABILITY, ACHIEVE OPERATIONAL RELATIONSHIP AND CONTINUING INTERACTION WITH GOVT NIGER THROUGH WHICH AID CAN MAKE CONSTRUCTIVE CONTRIBUTION TO AGRICULTURAL AND ECONOMIC POLICIES/PROGRAMS CONDUCIVE TO CEREAL PRODUCTION.

EFFORTS WILL BE CONCENTRATED IN THE SOUTHERN PART OF NIGER, WHICH HAS HISTORICALLY SUFFICIENT RAINFALL. AN ESTIMATED 4% OF CEREAL PRODUCERS FARM IN THIS AREA. A USAID GRANT WILL PROVIDE CORE FINANCING FOR INTENSIFIED ADAPTIVE RESEARCH FOR IMPROVED MILLET: A FOUNDATION SEED FARM TO MULTIPLY SEED DEVELOPED BY RESEARCH; FIVE SEED MULTIPLICATION CENTERS WITH 1-HECTARE DEMONSTRATION PLOTS FOR PRODUCING SEED AND DEMONSTRATING CULTURAL PRACTICE PACKAGES FOR FARMERS; COOP STRUCTURE (UNCCI) EXPANSION TO NEW AREAS; IMPROVEMENT OF TRAINING CENTERS FOR EXTENSION STAFF AND FOR DEMONSTRATION FARMERS. PROJ CONTAINS BIBLIOTHQUE.

NIGER INDEPENDENT OF DONATED CEREAL SUPPLIES AND ABLE TO SUPPORT A VIABLE AND ECOLOGICALLY SECURE WAY OF LIFE FOR SAMELIAN POPULATION.

**PURPOSE:** CONSTRUCTION AND DISTRIBUTION CAPABILITY TO PROVIDE SUFFICIENT CEREALS TO FEED NIGER'S POPULATION EVEN UNDER ADVERSE WEATHER CONDITIONS. PROVIDE SUFFICIENT FOOD FOR LARGER POPULATION WITH SMALLER PLOTS OF LAND TO PEOPLE IN ECOLOGICALLY SUSTAINABLE PRODUCTION SYSTEM TO FREE LAND AND PEOPLE FOR EXPANSION AND NON-AGRICULTURAL ACTIVITIES.

**OUTPUTS:** CEREAL STORAGE SYSTEMS; IMPROVED SEED SUPPLY SYSTEM FOR COMMUNICATION BETWEEN FARMERS AND AGRICULTURAL ORGANIZATIONS; SYSTEM FOR DELIVERY OF AGRICULTURAL INPUTS; 304 ORGANIZATIONS ABLE TO RESPOND TO FARMERS' NEEDS; AGRICULTURAL CREDIT SYSTEMS; PERSONNEL TRAINED ON A CONTINUING BASIS; CONTINUOUS FLOW OF SUITABLE TECHNICAL ADVANCES.

**OBJECTIVE:**

THE 350000 SMALL FARMERS IN THE DEPARTMENT OF NIAMEY (A SAHELIAN REGION IN NIGER) HAVE A PER CAPITA INCOME OF \$50/YEAR. 90% OF THEIR CROP PRODUCTION IS LIMITED TO MILLET. THE AREA BECAME FOOD DEFICIENT IN 1975-76 DUE PRIMARILY TO LACK OF RAINFALL. PROJECT AREA IS SUBJECT TO EROSION, DECLINING SOIL FERTILITY, CROP PESTS, AND PLANT DISEASE. AGRICULTURAL PRODUCTION IS ALSO LIMITED BY TRADITIONAL CULTIVATION METHODS, ABSENCE OF COOP AND FARM CREDIT SYSTEMS, VIRTUALLY NON-EXISTENT ANIMAL TRACTION, AND NEARLY NON-EXISTENT MARKETING & EXTENSION SERVICES.

**STRATEGY:**

THREE-YEAR PROJECT PROVIDES GRANT FOR CONTRACT TECHNICAL ASSISTANCE, LOCAL PERSONNEL, LOCAL TRAINING, COMMODITIES (VEHICLES, OFFICE EQUIPMENT, AGRICULTURAL EQUIPMENT, FERTILIZER, ANIMALS, VACCINES), CONSTRUCTION OF FACILITIES, AND OPERATIONAL COSTS FOR THE INTEGRATED RURAL DEVELOPMENT OF THE NIAMEY DEPARTMENT, NIGER. HOST COUNTRY PROVIDES 25% OF PROJECT COSTS AND PROJECT MANAGEMENT.

**SUMMARY:**

GRANT FOR THE INTEGRATED RURAL DEVELOPMENT OF THE DEPARTMENT OF NIAMEY IN THE NIGER REPUBLIC. PROJECT HAS 6 COMPONENTS:  
 1) AGRICULTURAL SERVICES: GOV WILL INITIALLY SUPPLY 16 FIELD AGENTS; ANOTHER 42 AUXILIARY FIELD AGENTS WILL BE TRAINED TO EACH CLUSTER OF 4 VILLAGES. IN OFFICE COMPLEX AND A TRAINING CENTER WILL BE CONSTRUCTED IN EACH OF THE 3 ARRONDISSEMENTS (DEPARTMENT SUBDIVISIONS). EACH TRAINING CENTER WILL HAVE 30 HECTARES OF LAND PLUS FACILITIES FOR HOUSING AND TRAINING CO-OP AND MUTUAL LEADERS (SEE BELOW). 210 FARMER-DEMONSTRATORS (1 PER VILLAGE) WILL ALSO BE TRAINED AND USED IN THE CROP DEMONSTRATION PROGRAM UNDER THE GUIDANCE OF THE REGULAR AND AUXILIARY FIELD AGENTS. THE DEMONSTRATION/EXPERIMENTATION PROGRAM WILL INCLUDE IMPROVED PRACTICES OF MILLET PRODUCTION, CULTIVATION OF COMPEAS IN ROTATION WITH MILLET, ANIMAL TRACTION, LIVESTOCK PRODUCTION, AND SOIL AND WATER CONSERVATION TECHNIQUES.  
 2) CREDIT AND COOPERATIVE SERVICES: THE CREDIT AND COOPERATIVE UNION OF NIGER (UNCC) WILL TRAIN 42 CO-OP MONITORS TO WORK WITH THE 42 CO-OPS AND 210 LOCAL FARMER ASSOCIATIONS (MUTUALS) THAT ARE TO BE ESTABLISHED. 252 CO-OP LEADERS AMONG 2100 MUTUAL LEADERS WILL BE TRAINED AT THE AGRICULTURAL SERVICE TRAINING CENTERS. A CO-OP MARKETING SYSTEM AND AN AGRICULTURAL CREDIT SYSTEM WILL BE DEVELOPED. A UNCC OFFICE/WAREHOUSE COMPLEX WILL BE BUILT IN EACH OF THE 3 ARRONDISSEMENTS. 42 CO-OP MEETING CENTERS WILL BE CONSTRUCTED. 10 MILLET GRINDING MILLS AND 4 SMALL TAPIOCA/MANIOC FLOUR MILLS WILL BE TESTED AND EVALUATED AT THE CO-OP LEVEL.  
 3) LIVESTOCK SERVICES PROGRAMS: TRIAL/DEMONSTRATION PROGRAMS WILL BE CARRIED OUT FOR: 1) NON-FARM FATTENING OF CATTLE; 2) COTTAGE POULTRY-RAISING; 3) THE MARADI GOAT PROGRAM; AND 4) AN ANIMAL HEALTH PROGRAM.  
 4) VILLAGE-LEVEL LAND USE AND SOIL CONSERVATION: 42 ADDITIONAL SOIL CONSERVATION AGENTS WILL BE TRAINED TO ASSIST IN DEVELOPING VILLAGE SOIL CONSERVATION PLANS INCLUDING TREE NURSERIES AND EXPERIMENTAL FISH PONDS.  
 5) SOIL LOSS-COST IRRIGATION SCHEMES WILL BE INSTALLED AND EVALUATED.  
 6) STUDY PROGRAM: VARIOUS STUDIES OF RURAL PROBLEMS WILL LEAD TO A SECOND PHASE, COMPREHENSIVE AREA DEVELOPMENT PLAN.

**GOAL:**

TO INCREASE FOOD PRODUCTION, RURAL INCOMES AND IMPROVE RURAL STANDARDS OF LIVING WITHIN THE DEPT OF NIAMEY, NIGER.

**PURPOSE:**

TO START A PROCESS OF RURAL DEVELOPMENT BY 1) IMPROVING THE INITIAL MOTIVATION AND ORGANIZATION REQUIREMENTS AMONG THE RURAL POPULATION FOR ECONOMIC & SOCIAL DEVELOPMENT AND 2) CREATE AN INSTITUTIONAL, PHYSICAL, & TECHNICAL CAPABILITY WITHIN THE GOVERNMENT SERVICES OF THE NIAMEY DEPT TO BEGIN IMPLEMENTATION OF A COMPREHENSIVE RURAL DEVELOPMENT PLAN.

**SUPPLIES:**

1) AGRIC SERVICES STRENGTHENED THRU INFRASTRUCTURE & TRNG PROGRAMS 2) CREDIT & COOP UNION OF NIGER - COOP SERVICES DEVELOPED 3) LIVESTOCK SERVICE PROGRAMS DEVELOPED 4) VILLAGE LEVEL LAND-USE & CONSERVATION PROGRAMS DEVELOPED 5) TRIAL IRRIGATION SCHEMES INSTALLED & EVALUATED 6) BASE LINE DATA GATHERED, STUDIES COMPLETED 7) COMPREHENSIVE AREA DEVELOPMENT PROGRAM PREPARED 8) PROJECT MANAGEMENT UNIT ESTABLISHED IN CONJUNCTION WITH THE NIAMEY DEPT DEVELOPMENT COMMITTEE.

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DOCUMENT TYPE: SPECIAL EVALUATION REPORT  
TITLE: NIGER CEREALS PRODUCTION TEAM NIGER CEREALS PROJECT  
AUTHOR: BIRCHALL, J. C.  
INSTITUTION: U.S. AID  
PUBLICATION DATE: 12/12/76  
CIC REFERENCE CENTER NUMBER: 12/12/76

PUBLICATION DATE: 12/12/76  
CIC REFERENCE CENTER NUMBER:  
ORGANIZATION: CONSORTIUM FOR INTERNATIONAL DEVELOPMENT

PROJECTS AND SUB-PROJECTS EVALUATED: 483129100

483129100: EVALUATES PERFORMANCE OF CONSORTIUM FOR INTERNATIONAL DEVELOPMENT (CID) IN ASSISTING NIGER CEREALS PRODUCTION TEAM FROM 7/1/74 TO 12/11/76. CID AIMED TO HELP PROVIDE GOVT OF NIGER (GON) WITH A NATURAL COMBINATION OF THE PRODUCTION, DISTRIBUTION, AND MARKETING OF SORGHUM & MILLET. CID EVAL TEAM HELD DISCUSSIONS WITH GON OFFICIALS & STAFF MEMBERS OF USAID & NCP. NATL AGR RESEARCH INSTITUTE (INRA) IS RESPONSIBLE FOR THE DEVELOPMENT OF A PROVEN SET OF PRODUCTION INCREASING PRACTICES THROUGH VARIETAL IMPROVEMENT, FINANCED RESEARCH RELATED TO SORGHUM & MILLET, AND WORKABLE SYSTEMS FOR DELIVERY OF TECHNOLOGY TO FARMERS. EVALUATION HAS EXPRESSED A NEED FOR BETTER LIBRARY & LAB FACILITIES TO SUPPORT CEREALS RESEARCH & SOIL TESTING & ANALYSIS & FOR THE CONSTRUCTION OF SEED RESEARCH & PRODUCTION CENTER WITH PARTICULAR EMPHASIS ON WATER CONSERVATION & IRRIGATION SYSTEMS DESIGNED TO ENHANCE PRODUCTION. PERSONNEL NEED TRAINING IN NEW TECHNIQUES & DEMONSTRATION, MAINTENANCE, & REPAIR OF ANIMAL TRACTOR & OTHER TYPES OF FARM EQUIP.  
A LACK OF TRAINED MANPOWER IS A CRUCIAL PROBLEM IN THE SEED MULTIPLICATION & DISTRIBUTION COMPONENT. ACQUISITION OF EQUIP HAS BEEN SUCH A LEVEL OF SEED MULTIPLICATION CENTER HAS BEEN HINDERED BY INCREASED EXPENSES IN MATERIALS (IRRIGATION SYSTEMS), DIFFICULTIES IN OBTAINING INSECTICIDE, REQUISITE SUPPORT SERVICES IS THE ESTABLISHMENT OF A SOUND NATL SEED POLICY.  
THE TEAM FEELS THAT LEVEL OF EFFECTIVE DELIVERY SYSTEMS DEPENDS ON COORDINATING AGENCIES CONCERNED (NIGERIAN & FOREIGN AGENCIES) & COMPREHENSIVE APPROACH BY THE CID ADVISOR.  
THE NATIONAL AGRICULTURAL RESEARCH INSTITUTE (INRA) HAS SEVERAL NEEDS: READILY AVAILABLE LABORATORY & STORAGE FACILITIES (DEPENDENT ON) OPERATING THROUGH IN-SERVICE SEMINARS (ECONOMIC VIABLE) STRONGER FISCAL CONTROL IN USAID-GON POLICIES ASSURING NECESSARY INPUTS OF FERTILIZER, SEED MATERIALS, & EQUIP.  
AFTER REVIEW OF SEVERAL MEMORANDUMS, TEAM RECOMMENDS THAT USAID PURSUE PROPOSAL TO ORGANIZE VILLAGE DIESEL MILLS TO GRIND MILLET & EXTRACT PEANUT OIL, THEREBY FREEING WOMEN TO PARTICIPATE IN VILLAGE & HOUSEHOLD INDUSTRIES.

DOCUMENT TYPE: PROJECT APPRAISAL REPORT  
TITLE: NIGER CEREALS PRODUCTION TEAM  
AUTHOR: BIRCHALL, J. C.  
INSTITUTION: U.S. AID

PUBLICATION DATE: 12/24/77  
CIC REFERENCE CENTER NUMBER:  
ORGANIZATION: USAID/ITER

PROJECTS AND SUB-PROJECTS EVALUATED: 483129100

483129100: APPRAISAL OF THE NIGER CEREALS PRODUCTION TEAM PROJECT FROM 7/1/75-2/15/77. PURPOSE OF PROJECT IS TO PROVIDE THE GOVT OF NIGER WITH AN ECOLOGICALLY SUSTAINABLE AND MEASURABLE PRODUCTION AND DISTRIBUTION SYSTEM TO SERVE A LARGE POPULATION AT A SMALLER RATE PER CAPITA OF LAND CULTIVATION.  
EVALUATION RECOMMENDS THAT CONSORTIUM FOR INTERNATIONAL DEVELOPMENT (CID) TEAM CONCEPT BE REFINED, CLARIFIED AND FOR COORDINATION TO ALL AND GON TO ALLOW TEAM MEMBERS TO BECOME MORE FULLY INTEGRATED INTO THEIR RESPECTIVE AGENCIES AT THE ASSIGNMENTS. TRAINING OF SOME NIGERIAN COUNTERPARTS IS BEING CONSIDERED FOR QUALITY OF WORKMANSHIP. PERSONNEL'S LONG ASSIGNMENT OF FULL-TIME DUTY TO THE PROJECT, HOWEVER, APPEARS TO ESTABLISH A VISION AND SEED SPECIALIST COUNTERPARTS ARE BEING TRAINED.  
THERE IS A LACK OF COORDINATION AMONG THE AGENCIES AND FEDERAL DEVELOPMENT PROGRAMS CONCERNED WITH EXTENSION OF THE INCLUDING MULTIPLE TRAINING. THE CID EXTENSION ADVISOR SHOULD BE CONCERNED WITH ALL ASPECTS OF NCP ASSIGNMENTS AND SHOULD BE GIVEN AN EXPERIENCED ADMINISTRATIVE ASSISTANT TO ASSUME RESPONSIBILITY AND LOGISTIC SUPPORT.  
THE NATIONAL AGRICULTURAL RESEARCH INSTITUTE (INRA) WILL ASSIGN A FULL-TIME ADMINISTRATOR TO COORDINATE EXTENSION WITH NCP HEADQUARTERS. THE ACQUISITION OF COMMODITIES HAS BEEN DIFFICULT BECAUSE OF DELAYS IN SETTING AN APPROVAL OF SPECIFICATIONS AND IN GETTING PAPERWORK PROCESSED THROUGH INRA AND THE AMERICAN PURCHASING CENTER. PLANT CONSTRUCTION IS PROCEEDING ON SCHEDULE. FINALLY EVALUATION RECOMMENDS THE CREATION OF A NIGERIAN COOPERATIVE AND CREDIT ORGANIZATION (NCO) CENTER IN THE DEVELOPMENT OF PLANS TO MEET RISING FINANCIAL REQUIREMENTS AND ACCEPTANCE OF A NATIONAL SEED POLICY WHICH HAS BEEN DEVELOPED.

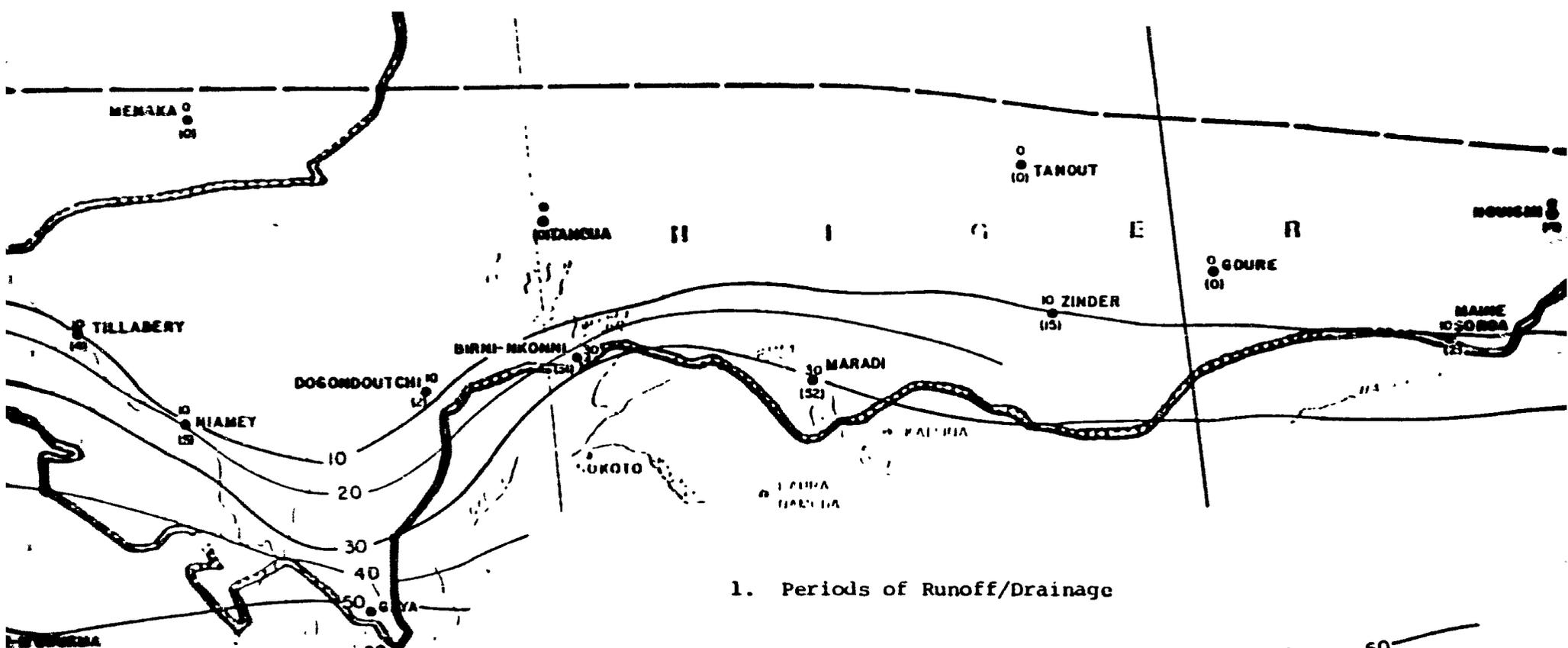
12/24/77

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## APPENDIX V

### Water Resources

1. **Periods of Runoff/Drainage**
2. **Stream Gauging Network**
3. **Annual Stream Flow on the Niger**
4. **Flow of the Niger River in Niger**
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  - a. **Flow of the Goronol River Alconqui Gauging Station**
  - b. **Flow of the Dargol River at Kakassi Gauging Station**
  - c. **Flow of the Diamangou River at Tamou Gauging Station**
  - d. **Flow of the Medrou River at Barou Gauging Station**
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  - a. **Flow of the G. Maradi at Madarounta Gauging Station**
  - b. **Flow of the Maggia at Tsernaoua Gauging Station**
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8. **Well Yields in Southern Niger**
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  - b. **Deep Aquifers**
9. **Groundwater Storage in Southern Niger**
  - a. **Shallow Aquifers**
  - b. **Deep Aquifers**
10. **Groundwater Storage and Safe Yields in Southern Niger**
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11. **Groundwater Quality**
12. **Irhazer Valley Location Map**
13. **Discharge, Drawdown, and Specific Capacity of Irhazer Valley Wells**
14. **Water Quality of Irhazer Valley Wells**
15. **Proposed and Existing Dams**
16. **Location Map for Dams**



1. Periods of Runoff/Drainage

ISOLINE OF THE DURATION (DAYS) OF RUNOFF/DRAINAGE AT THE 0,5 PROBABILITY LEVEL

TENTATIVE ISOLINE

LENGTH OF PERIOD OF RUNOFF/DRAINAGE OBSERVED (DAYS)

RAINFALL STATION

TOTAL RUNOFF / DRAINAGE DURING PERIOD CONCERNED (IN mm)

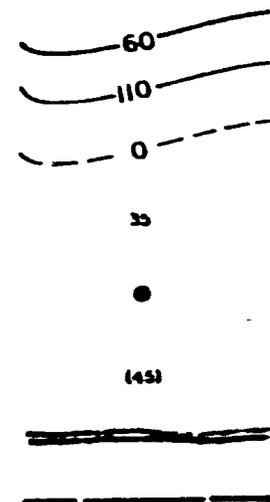
INTERNATIONAL BOUNDARIES

LIMITS OF PROJECT

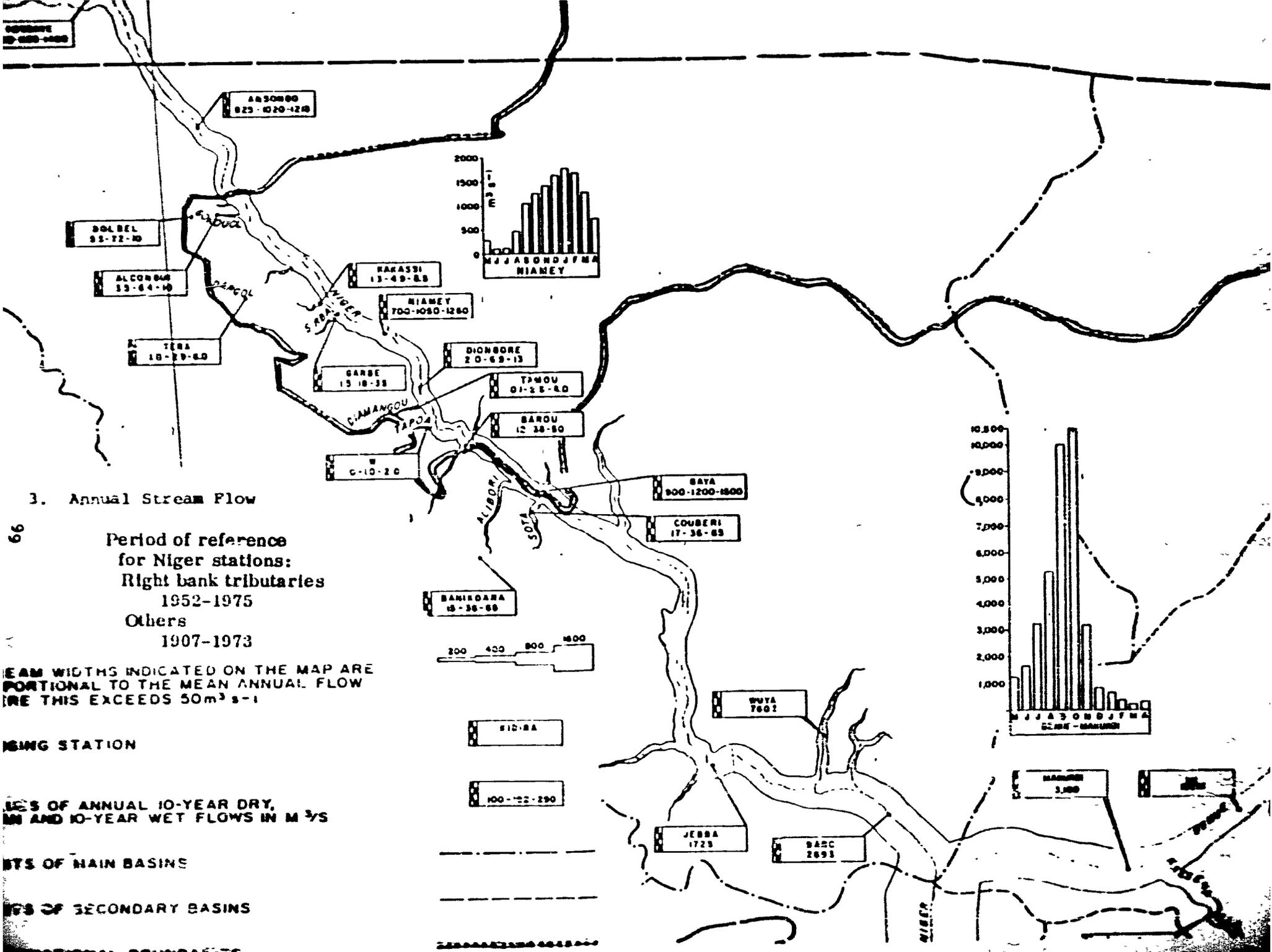
CAPITAL OF COUNTRY

OTHER CITIES

RIVERS







3. Annual Stream Flow

66

Period of reference  
for Niger stations:  
Right bank tributaries  
1952-1975  
Others  
1907-1973

MEAN WIDTHS INDICATED ON THE MAP ARE  
PROPORTIONAL TO THE MEAN ANNUAL FLOW  
(WHERE THIS EXCEEDS 50m<sup>3</sup>s<sup>-1</sup>)

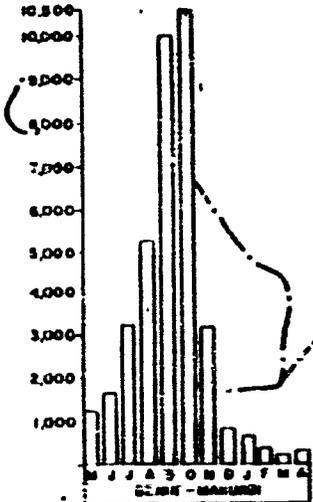
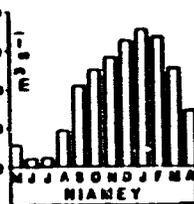
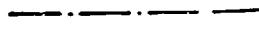
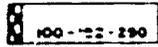
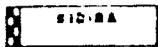
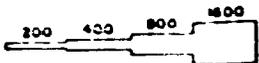
GAUGING STATION

MEANS OF ANNUAL 10-YEAR DRY,  
10-YEAR WET FLOWS IN M<sup>3</sup>S

BOUNDARIES OF MAIN BASINS

BOUNDARIES OF SECONDARY BASINS

INTERNATIONAL BOUNDARIES



Source: Niger 72

#### 4. Flow of the Niger River in Niger

##### 4a. Flow of the Niger at Niamey Gauging Station (70,000 sq. km. watershed)

WATER YEAR	AVG. AN. DISCH.	ANNUAL VOLUME	RUNOFF	SPECIFIC RUNOFF	NO. DAILY FLOOD	SPECIFIC FLOOD	AVG. MIN. DISCH.
	(M <sup>3</sup> /SEC)	(MILLION M <sup>3</sup> )		(L/SEC/CM <sup>2</sup> )	(M <sup>3</sup> /D)	(L/SEC/CM <sup>2</sup> )	
1924-29	-----	-----	-----	-----	2360.0	2.9	276.3
1929-30	1794.0	49492.7	58.	1.25	2050.0	2.9	103.0
1930-31	1641.2	39146.0	56.	1.27	1965.0	2.4	242.0
1931-32	1800.4	34387.5	49.	1.56	1965.0	2.4	-----
1932-33	-----	-----	-----	-----	-1.0	-1.0	-----
1933-34	-----	-----	-----	-----	1833.0	2.6	49.0
1934-35	961.7	19699.0	42.	1.35	1750.0	2.5	49.0
1935-36	973.4	10697.6	46.	1.39	1610.0	2.6	-----
1936-37	-----	-----	-----	-----	-1.0	-1.0	-----
1937-38	-----	-----	-----	-----	-1.0	-1.0	-----
1938-39	-----	-----	-----	-----	-1.0	-1.0	-----
1939-40	-----	-----	-----	-----	-1.0	-1.0	-----
1940-41	-----	-----	-----	-----	1440.0	2.1	77.1
1941-42	774.4	22984.4	33.	1.34	1511.0	2.2	24.0
1942-43	707.5	22311.7	32.	1.21	1429.0	2.0	19.0
1943-44	814.5	25648.7	37.	1.16	1671.7	2.5	13.7
1944-45	474.5	20014.8	29.	0.91	1494.0	2.1	14.0
1945-46	495.9	27938.2	40.	1.27	1410.0	2.4	-----
1946-47	648.4	10553.1	44.	1.34	1410.0	2.4	70.0
1947-48	715.4	22574.5	32.	1.27	1510.0	2.2	14.0
1948-49	844.5	24697.8	34.	1.21	1483.0	2.4	-----
1949-50	757.1	23874.0	34.	1.24	1413.0	2.1	14.0
1950-51	1070.0	33744.1	44.	1.53	1915.0	2.7	-----
1951-52	1113.2	35107.4	50.	1.39	1925.0	2.7	79.0
1952-53	1255.9	14975.8	34.	1.77	1940.7	2.4	171.1
1953-54	1249.7	3121.1	34.	1.79	2040.0	2.1	144.0
1954-55	1275.7	40232.0	37.	1.47	2088.3	1.9	207.7
1955-56	1324.4	61746.8	60.	1.49	2152.0	3.1	44
1956-57	1015.1	32014.2	46.	1.65	1715.0	2.5	46.1
1957-58	1106.3	34407.2	50.	1.38	2050.0	2.9	111.0
1958-59	1232.7	34470.0	34.	1.74	1993.0	2.7	45.0
1959-60	1039.5	32781.4	47.	1.40	1855.0	2.7	19.0
1960-61	1019.0	32137.9	46.	1.46	1840.0	2.7	-----
1961-62	944.4	29915.3	41.	1.55	1775.1	2.5	75.0
1962-63	1095.1	36337.9	49.	1.54	2050.0	2.9	-----
1963-64	967.3	30503.8	44.	1.34	1855.0	2.7	46.1
1964-65	1175.3	37971.4	53.	1.69	2077.0	3.0	41.0
1965-66	1113.1	35107.4	50.	1.39	1945.0	2.9	11.0
1966-67	964.7	29776.4	43.	1.35	1968.7	2.4	11
1967-68	1275.1	38821.4	55.	1.74	2130.0	3.1	11.0
1968-69	987.8	31152.3	43.	1.61	1925.0	2.7	79
1969-70	-----	-----	-----	-----	2185.0	3.4	77.0
1970-71	815.1	25707.0	37.	1.16	1825.0	2.6	16.0
1971-72	744.7	24476.1	36.	1.11	1840.0	2.4	14.1
1972-73	-----	-----	-----	-----	1700.0	1.4	-----
1973-74	644.5	14412.1	27.	0.96	1812.0	1.9	14
1974-75	661.3	26775.3	38.	1.21	1910.0	2.2	2.5
1975-76	944.4	23992.0	43.	1.30	2062.0	2.9	5.7
1976-77	-----	-----	-----	-----	-1.0	-1.0	-----

##### 4b. Flow of the Niger at Gaya Gauging Station (1,000,000 sq. km. watershed)

WATER YEAR	AVG. AN. DISCH.	ANNUAL VOLUME	RUNOFF	SPECIFIC RUNOFF	NO. DAILY FLOOD	SPECIFIC FLOOD	AVG. MIN. DISCH.
	(M <sup>3</sup> /SEC)	(MILLION M <sup>3</sup> )		(L/SEC/CM <sup>2</sup> )	(M <sup>3</sup> /D)	(L/SEC/CM <sup>2</sup> )	
1959-60	-----	-----	-----	-----	2210.0	2.9	-----
1960-61	-----	-----	-----	-----	2110.0	2.7	-----
1961-62	1464.1	40371.0	44.	1.44	2340.0	2.6	41
1962-63	1455.7	45930.3	48.	1.47	2404.0	2.7	141.0
1963-64	1477.3	21319.3	11.	1.47	1977.0	1.9	14.0
1964-65	1467.7	16250.3	16.	1.47	1770.0	2.1	274
1965-66	1325.3	11797.7	12.	1.41	1770.0	2.1	-----
1966-67	1244.0	37444.0	41.	1.41	1765.0	2.1	50.1
1967-68	1224.0	14753.1	19.	1.21	1770.0	2.0	10.0
1968-69	1147.1	14653.3	17.	1.46	2042.0	2.1	-----
1969-70	1110.0	12871.4	11.	1.46	1970.0	1.9	51.7
1970-71	1110.0	11775.1	11.	1.46	2090.0	2.2	116.0
1971-72	1070.0	11141.4	11.	1.46	1970.0	1.9	263.0
1972-73	1114.5	11224.4	11.	1.31	2240.0	2.3	-----
1973-74	1250.3	19677.7	19.	1.74	1970.0	1.9	-----
1974-75	1410.0	14613.9	11.	1.46	2090.0	2.1	-----
1975-76	1400.0	14613.9	11.	1.46	2090.0	2.1	-----
1976-77	1165.3	34976.4	35.	1.40	2490.0	2.2	-----
1977-78	1165.3	34976.4	35.	1.40	2490.0	2.2	46.0
1978-79	1170.0	17632.0	19.	1.27	2075.0	2.0	100.0
1979-80	133.2	19124.7	19.	0.96	1800.0	1.9	47.5
1980-81	644.0	27190.1	27.	0.87	1910.0	1.9	48.0
1981-82	-----	-----	-----	-----	1.0	-1.0	-----
1982-83	-----	-----	-----	-----	1179.0	1.5	19.0
1983-84	647.1	26775.3	27.	0.95	1890.0	1.9	4.0
1984-85	679.1	26417.0	19.	0.94	1897.0	1.9	10.0
1985-86	-----	-----	-----	-----	-1.0	-1.0	-----

Source: Inter African Committee for Hydraulic Studies (CIAHS). 1979. Vol. 3

### 5. Flow of Selected Niger Tributaries in Niger

#### 5a. Flow of the Goronol River Aicongui Gauging Station (44850 sq. km. watershed)

WATER YEAR	AVG. AN. DISCH.	ANNUAL VOLUME	RUNOFF	SPECIFIC RUNOFF	MAX DAILY FLOOD	SPECIFIC FLOOD	AVG. MIN. DISCH.
	(M <sup>3</sup> /SEC)	(KILOMILLION)		(L./SQ.KM/2)	(M <sup>3</sup> /D)	(L./SQ.KM/2)	
1947-48	3.1	100.6	2.	0.07	28.0	0.8	0.8
1948-49	2.4	75.1	6.	0.20	-1.0	-1.0	0.0
1949-50	6.5	213.2	2.	0.11	75.0	1.7	3.0
1950-51	---	---	---	---	-1.0	-1.0	0.0
1951-52	7.5	230.7	5.	0.17	100.0	2.2	0.0
1952-53	2.9	90.3	2.	0.07	31.0	0.7	0.0
1953-54	1.9	58.1	1.	0.05	11.0	0.7	3.0
1954-55	7.0	212.0	1.	0.17	74.2	1.6	0.0
1955-56	3.8	121.9	1.	0.09	25.9	0.6	0.0
1956-57	7.0	212.3	3.	0.17	106.0	2.3	0.0
1957-58	5.9	189.2	6.	0.13	93.0	2.0	0.0
1958-59	6.1	190.0	1.	0.09	27.9	0.6	0.0
1959-60	12.0	369.9	9.	0.26	70.0	1.6	0.0
1960-61	7.7	231.6	6.	0.18	65.3	1.5	2.3
1961-62	6.2	185.7	6.	0.14	68.2	1.5	2.3
1962-63	6.0	183.1	1.	0.10	28.9	0.6	0.0
1963-64	6.3	193.6	6.	0.17	41.2	1.9	2.3
1964-65	6.7	201.1	6.	0.21	55.6	2.1	2.3
1965-66	7.5	228.0	6.	0.18	62.0	2.1	2.3

#### 5b. Flow of the Dargol River at Kakassi Gauging Station (6940 sq. km. watershed)

WATER YEAR	AVG. AN. DISCH.	ANNUAL VOLUME	RUNOFF	SPECIFIC RUNOFF	MAX DAILY FLOOD	SPECIFIC FLOOD	AVG. MIN. DISCH.
	(M <sup>3</sup> /SEC)	(KILOMILLION)		(L./SQ.KM/2)	(M <sup>3</sup> /D)	(L./SQ.KM/2)	
1947-48	2.6	79.3	11.	2.36	35.0	6.3	0.0
1948-49	5.5	174.7	25.	6.86	111.3	16.3	3.0
1949-50	5.7	162.5	26.	3.92	76.0	11.0	0.0
1950-51	2.3	68.0	9.	0.10	22.0	3.2	6.0
1951-52	---	---	---	---	-1.0	-1.0	0.0
1952-53	6.7	190.1	22.	2.79	75.1	10.9	0.0
1953-54	6.7	189.6	21.	2.69	44.1	6.6	0.0
1954-55	12.5	366.1	56.	1.92	162.2	23.2	1.0
1955-56	5.5	175.2	25.	6.86	111.3	16.3	0.0
1956-57	5.7	162.5	26.	3.92	76.0	11.0	0.0
1957-58	---	---	---	---	-1.0	-1.0	0.0
1958-59	2.3	68.0	9.	0.10	22.0	3.2	6.0
1959-60	1.9	58.1	1.	0.05	11.0	0.7	3.0
1960-61	7.0	212.0	1.	0.17	74.2	1.6	0.0
1961-62	3.8	121.9	1.	0.09	25.9	0.6	0.0
1962-63	7.0	212.3	3.	0.17	106.0	2.3	0.0
1963-64	5.9	189.2	6.	0.13	93.0	2.0	0.0
1964-65	6.1	190.0	1.	0.09	27.9	0.6	0.0
1965-66	12.0	369.9	9.	0.26	70.0	1.6	0.0
1966-67	7.7	231.6	6.	0.18	65.3	1.5	2.3
1967-68	6.2	185.7	6.	0.14	68.2	1.5	2.3
1968-69	6.0	183.1	1.	0.10	28.9	0.6	0.0
1969-70	6.3	193.6	6.	0.17	41.2	1.9	2.3
1970-71	6.7	201.1	6.	0.21	55.6	2.1	2.3
1971-72	7.5	228.0	6.	0.18	62.0	2.1	2.3

#### 5c. Flow of the Diamangou River at Tamou Gauging Station (4030 sq. km. watershed)

WATER YEAR	AVG. AN. DISCH.	ANNUAL VOLUME	RUNOFF	SPECIFIC RUNOFF	MAX DAILY FLOOD	SPECIFIC FLOOD	AVG. MIN. DISCH.
	(M <sup>3</sup> /SEC)	(KILOMILLION)		(L./SQ.KM/2)	(M <sup>3</sup> /D)	(L./SQ.KM/2)	
1947-48	---	---	---	---	---	---	---
1948-49	1.0	37.5	10.	0.45	70.6	19.0	0.0
1949-50	6.9	219.6	56.	1.73	17.0	6.6	0.0
1950-51	1.0	37.7	6.	0.75	61.1	20.1	0.0
1951-52	2.3	61.7	21.	0.75	16.6	3.0	0.0
1952-53	2.6	66.1	21.	0.72	16.6	7.1	0.0
1953-54	0.6	16.1	6.	0.60	15.1	0.1	0.0
1954-55	2.3	72.5	18.	0.11	30.7	2.6	0.0
1955-56	---	---	---	---	---	---	---
1956-57	---	---	---	---	---	---	---
1957-58	0.5	16.0	6.	0.11	107.0	25.1	0.0
1958-59	6.1	182.1	15.	1.06	6.0	2.2	0.0
1959-60	1.1	100.0	25.	0.76	6.4	12.0	0.0
1960-61	6.3	67.7	17.	0.33	6.4	15.2	0.0

#### 5d. Flow of the Medrou River at Barou Gauging Station (10,500 sq. km. watershed)

GAUGING STATION/STATION DE JAUAGEAGE..... BAROU  
 DISTRICT/COMMUNE..... BAROU  
 COUNTRY/PAYS..... NIGER  
 DISTRICT/COMMUNE..... BAROU  
 DISTRICT/COMMUNE..... BAROU  
 AREA OF WATERSHED/STATION/STATION..... 11500.0

#### 11. RESEARCH/RECHERCHES

WATER YEAR	AVG. AN. DISCH.	ANNUAL VOLUME	RUNOFF	SPECIFIC RUNOFF	MAX DAILY FLOOD	SPECIFIC FLOOD	AVG. MIN. DISCH.
	(M <sup>3</sup> /SEC)	(KILOMILLION)		(L./SQ.KM/2)	(M <sup>3</sup> /D)	(L./SQ.KM/2)	
1961-62	22.2	700.0	67.	2.19	178.0	17.0	0.0
1962-63	31.6	1028.5	155.	6.99	485.0	30.0	0.0
1963-64	---	---	---	---	---	---	---
1964-65	37.7	1171.1	112.	1.36	211.0	20.5	0.0
1965-66	---	---	---	---	---	---	---
1966-67	---	---	---	---	---	---	---
1967-68	---	---	---	---	---	---	---
1968-69	42.1	1310.5	127.	6.02	769.0	45.0	0.0
1969-70	60.5	1836.9	182.	5.77	750.5	26.6	0.0
1970-71	---	---	---	---	---	---	---
1971-72	31.1	676.3	66.	2.06	156.0	16.0	0.0
1972-73	---	---	---	---	---	---	---
1973-74	19.5	626.7	6	1.29	80.0	1.6	0.0
1974-75	25.1	780.1	76.	2.81	-1.0	-1.0	3.6
1975-76	21.9	691.9	66.	2.09	172.0	1.2	3.6

BEST AVAILABLE COPY

## 6. Flow of Streams in South-Central Niger

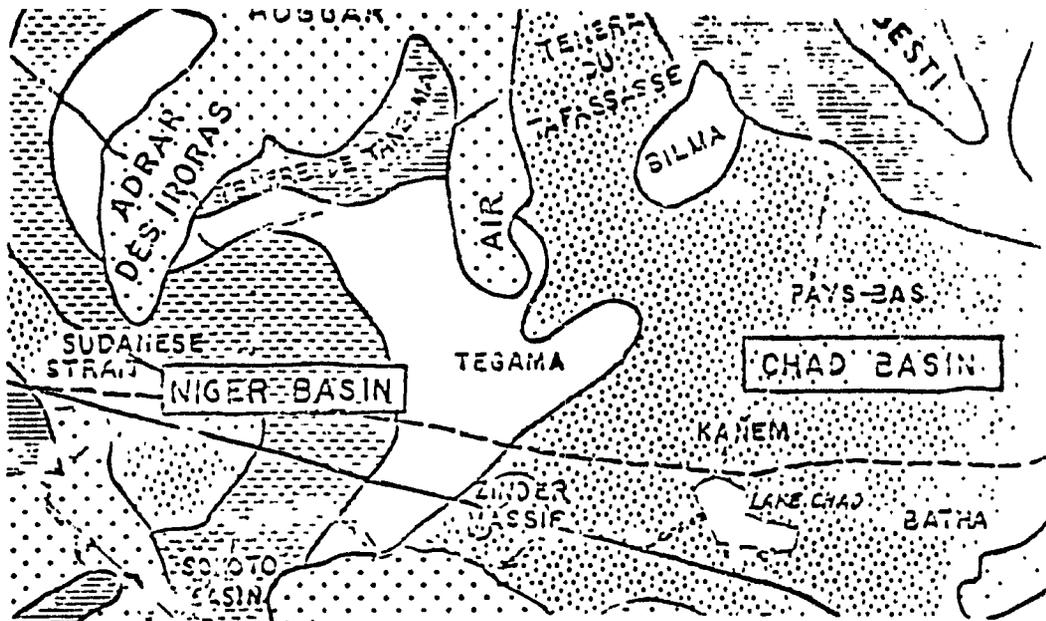
### 6a. Flow of the G. Maradi at Madarounta Gauging Station (5400 sq. km. watershed)

WATER YEAR	Avg. An. Disch.	ANNUAL VOLUME	RUNOFF	SPECIFIC RUNOFF	MAX DAILY FLOOD	SPECIFIC FLOOD	100 YRS DISCH.
	(M <sup>3</sup> /SEC)	(MILLION M <sup>3</sup> )	(COEFFICIENT)	(L/S/KM <sup>2</sup> )	(M <sup>3</sup> /D)	(L/S/KM <sup>2</sup> )	(M <sup>3</sup> /S)
1954-57	---	---	---	---	119.0	20.6	0.7
1957-58	3.3	106.8	10.	0.41	75.0	17.6	2.0
1958-59	6.0	191.3	35.	1.12	221.3	60.7	2.2
1959-60	---	---	---	---	40.7	16.4	---
1960-61	13.5	427.8	76.	2.51	453.7	69.3	2.4
1961-62	5.2	162.2	19.	0.40	195.0	16.1	2.1
1962-63	4.8	146.1	27.	0.76	350.0	46.8	2.1
1963-64	10.7	315.8	58.	1.05	254.0	47.0	2.1
1964-65	4.2	131.7	25.	0.79	174.0	16.3	2.0
1965-66	4.1	132.6	25.	0.76	195.0	16.6	2.0
1966-67	5.6	207.0	49.	1.57	200.0	17.0	2.0
1967-68	2.6	78.2	14.	0.45	117.0	21.7	2.0
1968-69	3.9	122.0	23.	0.72	159.0	29.1	2.0
1969-70	10.7	319.4	61.	1.09	411.3	26.4	2.0
1970-71	6.9	195.1	29.	0.81	270.0	5	2.0
1971-72	2.7	85.1	16.	0.50	115.0	21.1	2.0

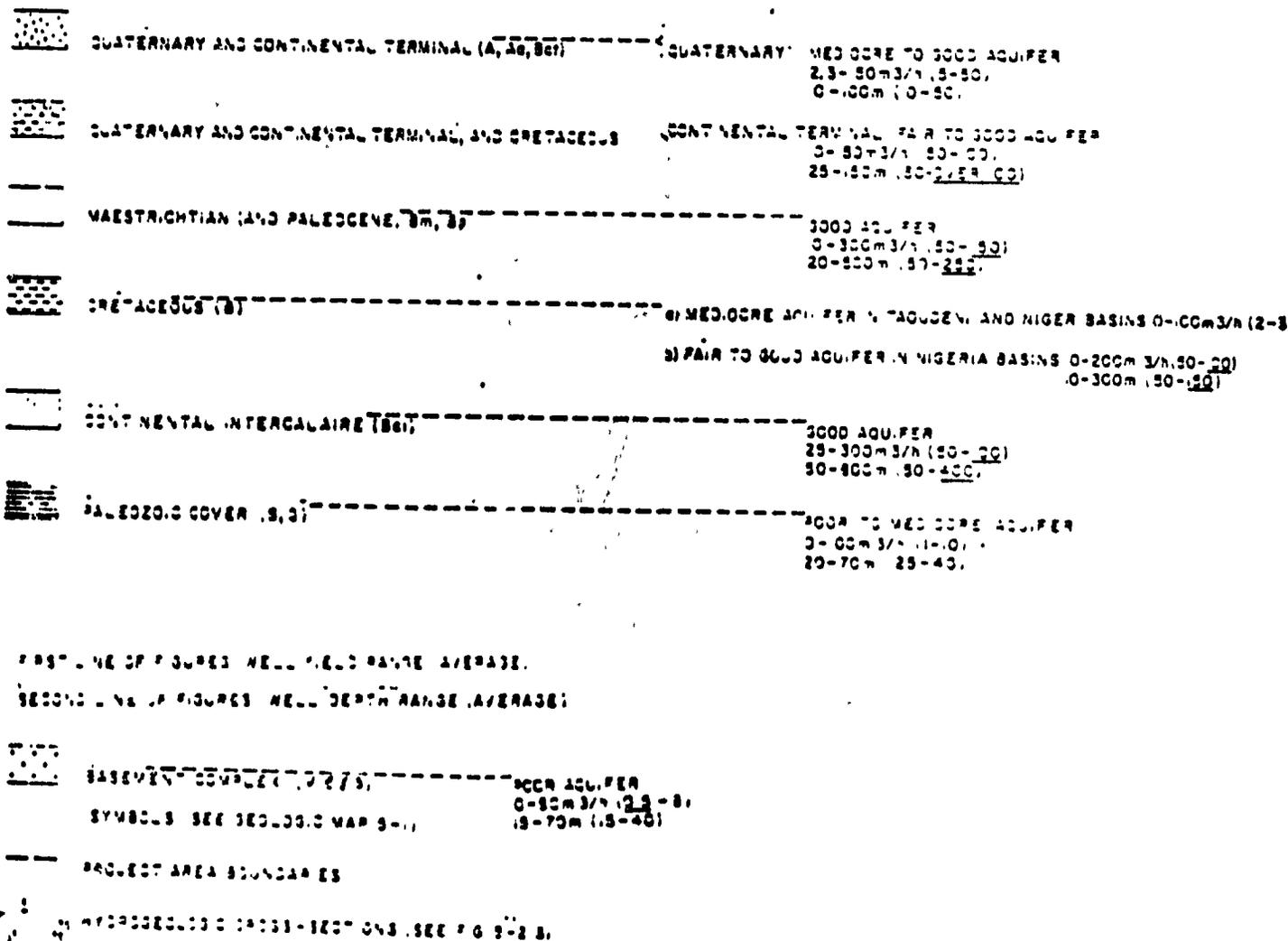
### 6b. Flow of the Maggia at Tsernaoua Gauging Station (2525 sq. km. watershed)

WATER YEAR	Avg. An. Disch.	ANNUAL VOLUME	RUNOFF	SPECIFIC RUNOFF	MAX DAILY FLOOD	SPECIFIC FLOOD	100 YRS DISCH.
	(M <sup>3</sup> /SEC)	(MILLION M <sup>3</sup> )	(COEFFICIENT)	(L/S/KM <sup>2</sup> )	(M <sup>3</sup> /D)	(L/S/KM <sup>2</sup> )	(M <sup>3</sup> /S)
1960-61	0.2	7.3	5.	0.09	11.8	11.9	---
1961-62	1.2	38.5	15.	0.19	77.6	16.7	---
1962-63	2.4	76.9	31.	0.46	111.3	4.5	---
1963-64	2.6	84.2	34.	0.49	111.9	11.7	---
1964-65	1.6	52.6	21.	0.19	72.5	11.0	---
1965-66	---	---	---	---	---	---	---
1966-67	1.2	38.7	16.	0.48	71.5	11.7	---
1967-68	2.7	86.7	35.	1.11	76.0	22.7	---
1968-69	1.9	61.6	25.	0.63	76.0	11.0	---
1969-70	1.6	51.6	21.	0.62	74.0	11.5	---
1970-71	5.0	156.0	61.	2.05	168.0	14.4	---

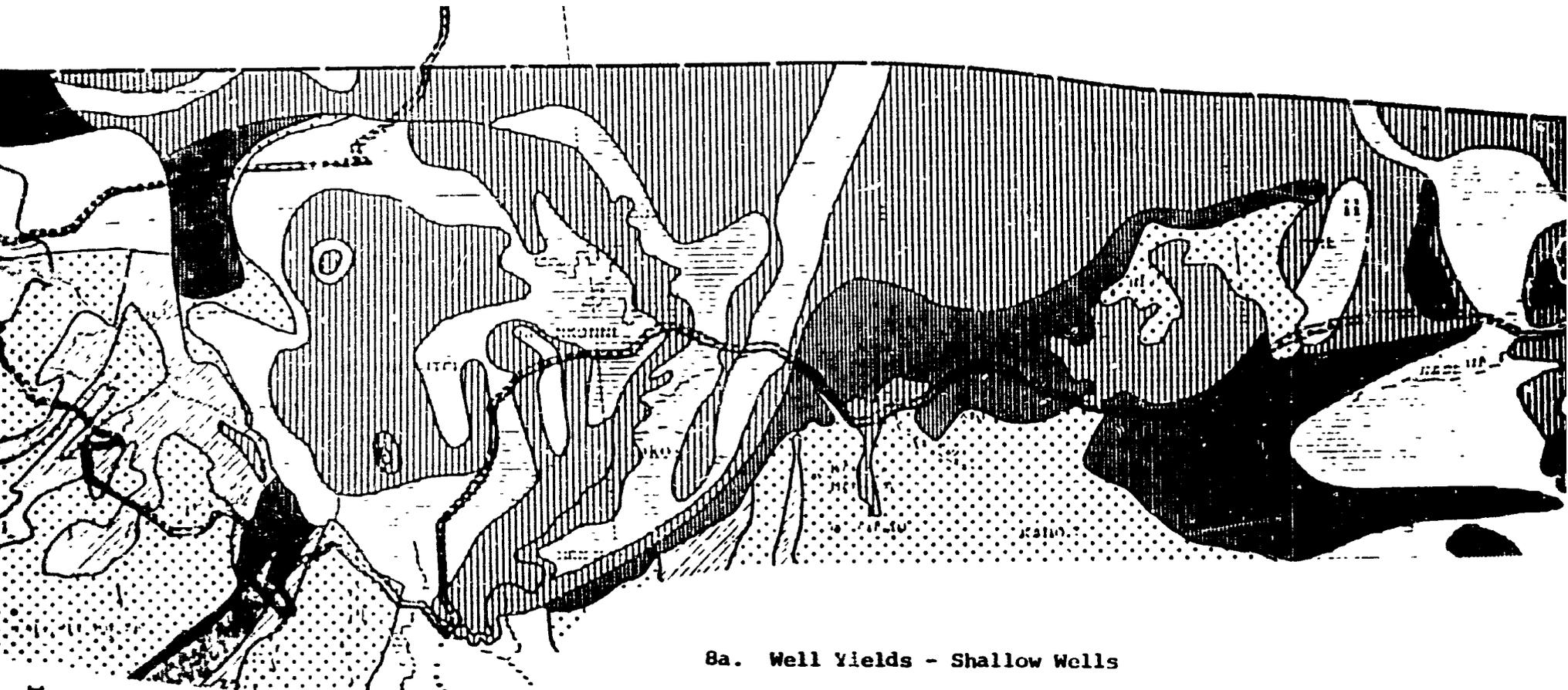
Source: Inter African Committee for Hydraulic Studies (CIAH). 1979. Vol. 3.



7. Hydrogeologic Sketchmap

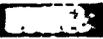
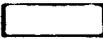


Source: Inter African Committee for Hydraulic Studies (CIAH). 1979. Vol. 1.



8a. Well Yields - Shallow Wells

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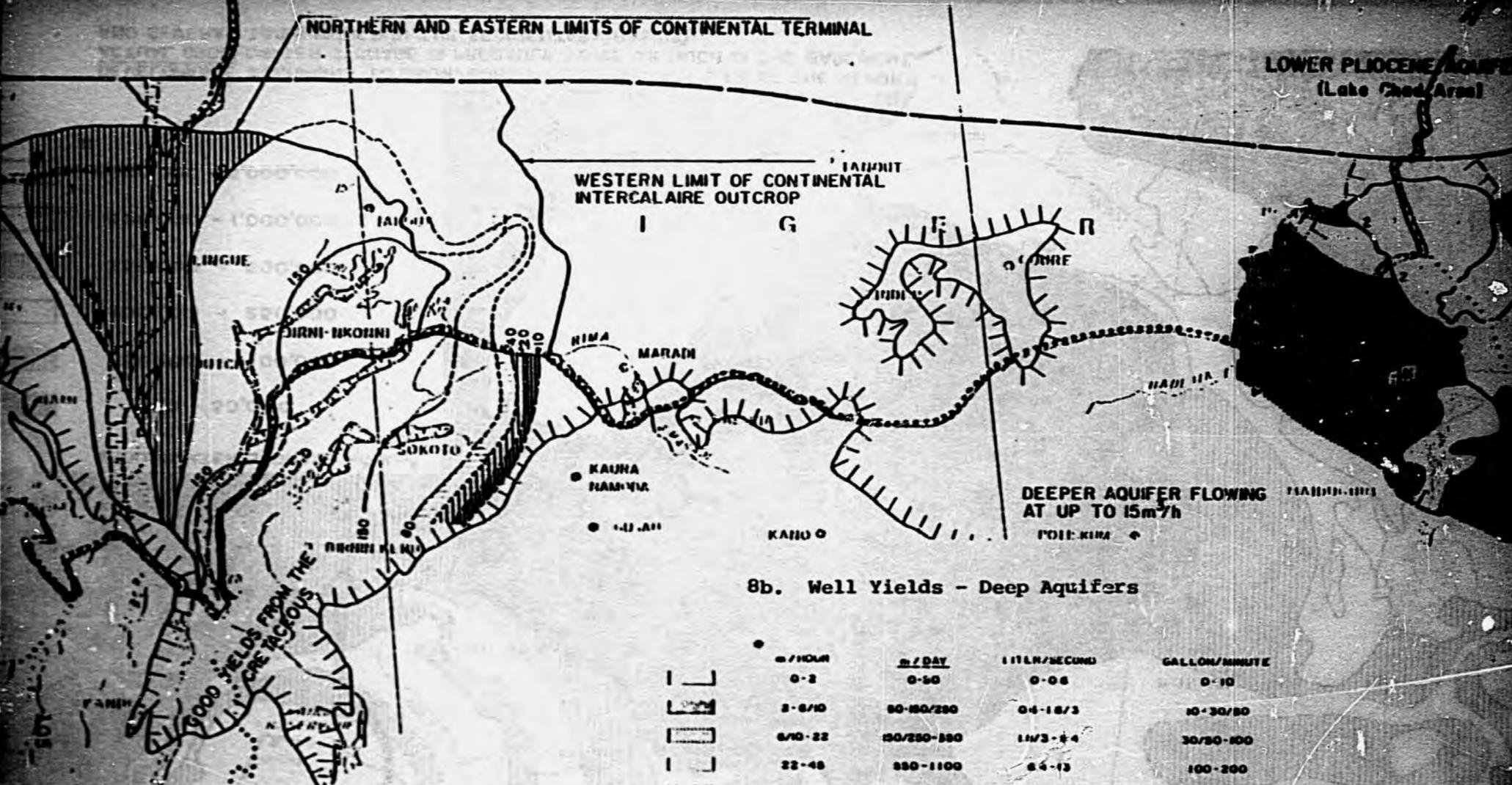
	m / HOUR	m / DAY	LITER / SECOND	GALLON / MINUTE
	0 - 1	0 - 25	0 - 0.3	0 - 4.5
	1 - 2	25 - 50	0.3 - 0.6	4.5 - 10
	2 - 6	50 - 150	0.6 - 1.8	10 - 30
	6 - 25	150 - 650	1.8 - 7.5	30 - 120
	25 - 90	650 - 2200	7.5 - 25	120 - 400
	> 90	> 2200	> 25	> 400
	0 - 6	0 - 150	0 - 1.8	0 - 30
	2 - 25	50 - 650	0.6 - 7.5	10 - 120

Source: Inter African Committee for Hydraulic Studies (CIAHS). 1979. Vol. 2.

NORTHERN AND EASTERN LIMITS OF CONTINENTAL TERMINAL

LOWER PLIOCENE BASIN  
(Lake Chad Area)

WESTERN LIMIT OF CONTINENTAL  
INTERCALAIRE OUTCROP



DEEPER AQUIFER FLOWING  
AT UP TO 15m<sup>2</sup>/h

8b. Well Yields - Deep Aquifers

m <sup>3</sup> /HOUR	m <sup>3</sup> /DAY	LITER/SECOND	GALLON/MINUTE
0-2	0-50	0-0.6	0-10
2-6/10	50-150/250	0.6-1.6/3	10-30/50
6/10-22	150/250-550	1.6/3-4.4	30/50-100
22-45	550-1100	4.4-13	100-200
45-85	1100-2000	13-28	200-400
85-145	2000-3500	28-70	400-650
145-250	3500-6000	40-70	650-1100
>250	>6000	>70	>1100

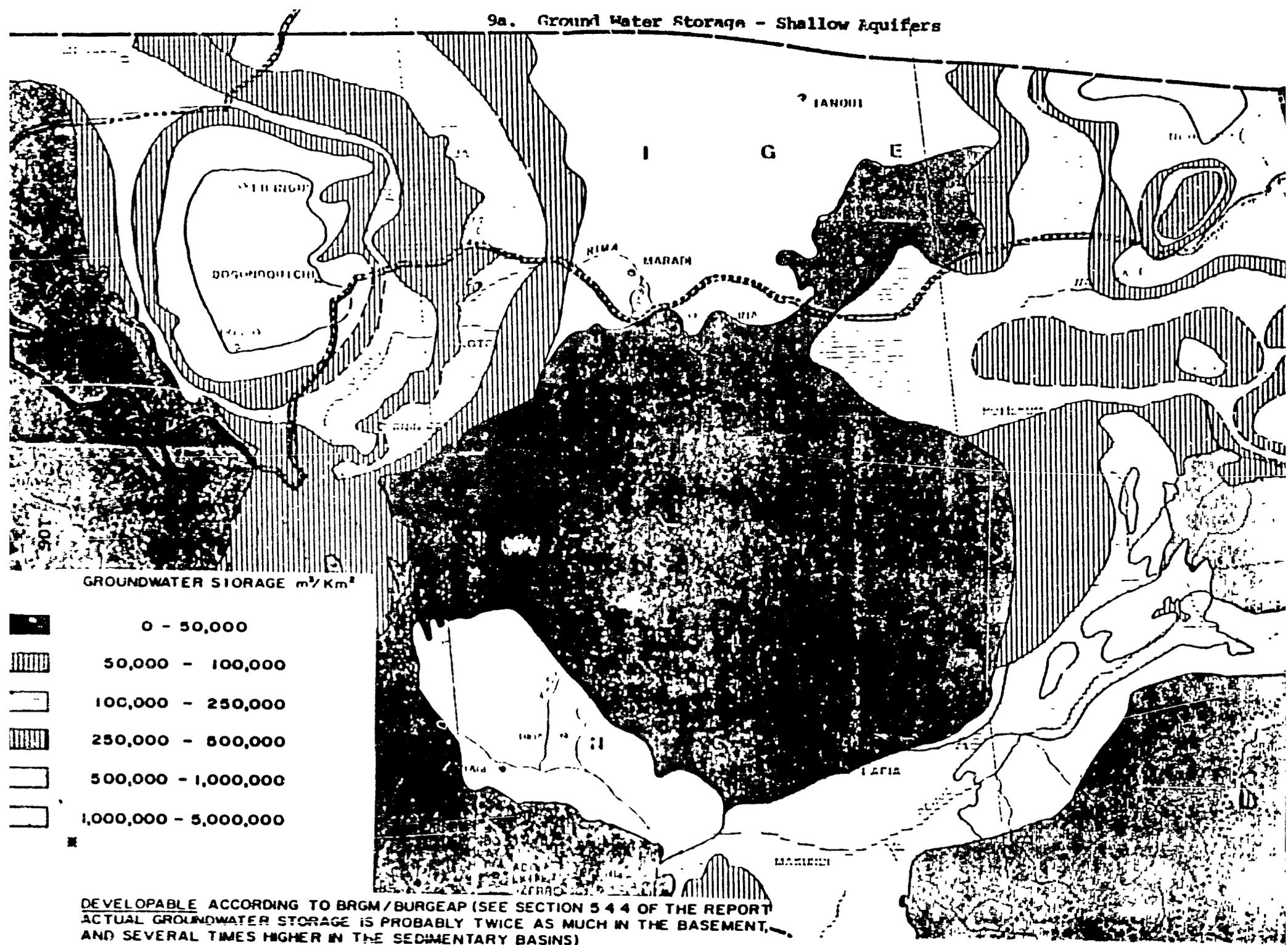
NOTE:  
ON THE MAP ALL THE FIGURES ARE IN m<sup>3</sup>/HOUR  
MATCHED WITH UNLITIAN  
UNKNOWN, OR NO DEEP AQUIFER EXCEPT IF MAPPED OTHERWISE

Source: Inter African Committee for Hydraulic Studies (CIAHS). 1979. Vol. 2.

NOTE: IN THE CHAD BASIN, ONLY SEVERAL DEEP AQUIFERS ARE MAPPED (DEEP AQUIFERS IN THE CONTINENTAL INTERCALAIRE) ARE NOT WELL KNOWN BUT SHOULD PROVIDE GOOD YIELDS

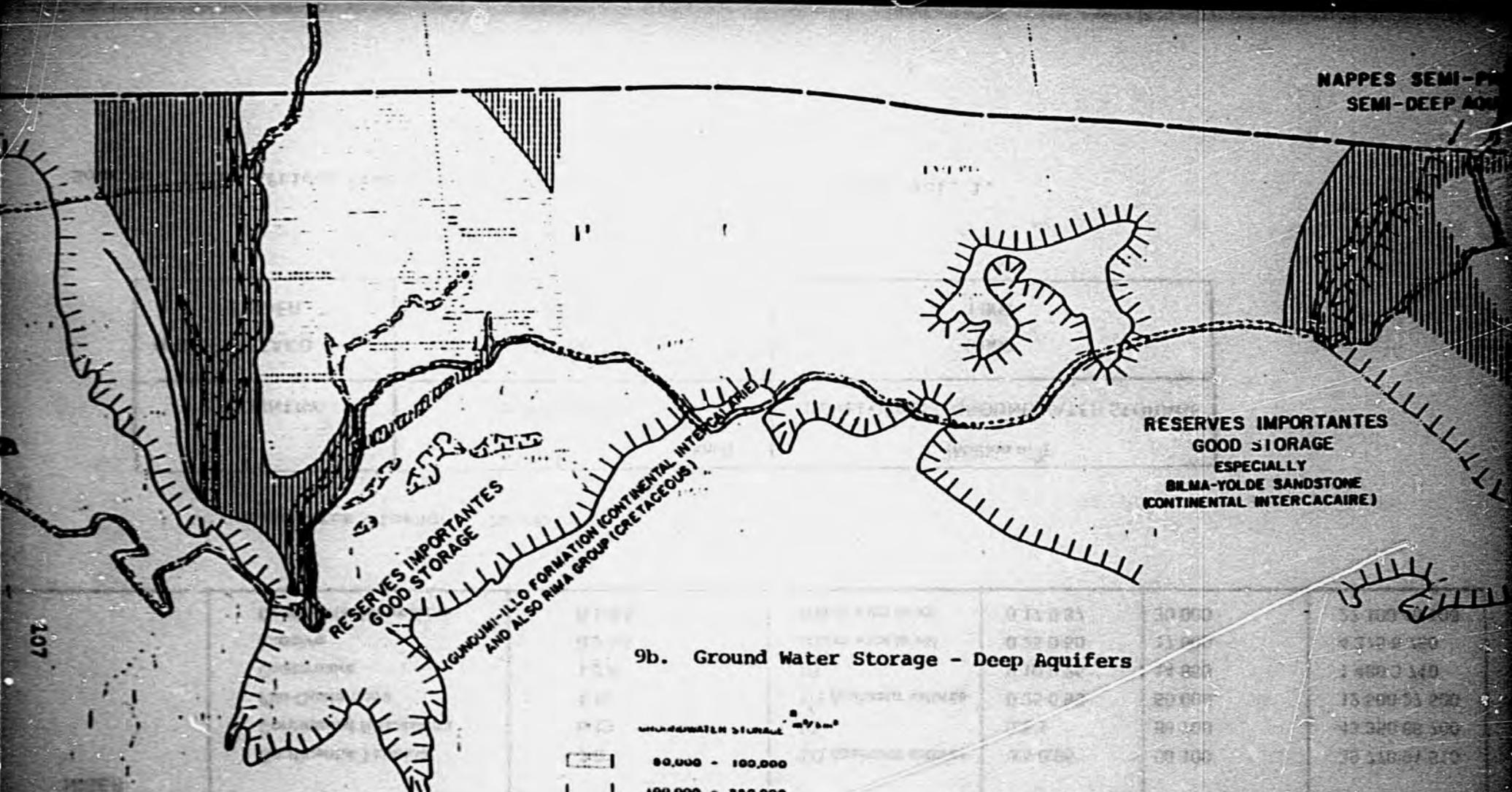
NO DEEP AQUIFERS GENERALLY, BASEMENT AREAS  
1975 OF SEDIMENTARY BASINS WITH DEEP AND SHALLOW AQUIFERS

9a. Ground Water Storage - Shallow Aquifers



DEVELOPABLE ACCORDING TO BRGM/BURGEAP (SEE SECTION 5.4.4 OF THE REPORT  
 ACTUAL GROUNDWATER STORAGE IS PROBABLY TWICE AS MUCH IN THE BASEMENT,  
 AND SEVERAL TIMES HIGHER IN THE SEDIMENTARY BASINS)

NAPPES SEMI-PA  
SEMI-DEEP AQ



RESERVES IMPORTANTES  
GOOD STORAGE  
ESPECIALLY  
BILMA-YOLDE SANDSTONE  
(CONTINENTAL INTERCALAIRE)

RESERVES IMPORTANTES  
GOOD STORAGE  
GOUNJIMI-ILO FORMATION (CRETACEOUS)  
AND ALSO RIMA GROUP (CRETACEOUS)

9b. Ground Water Storage - Deep Aquifers

UNDERWATER STORAGE

- 80,000 - 100,000
- 100,000 - 280,000
- 280,000 - 800,000
- 800,000 - 1,000,000
- 1,000,000 - 3,000,000

NOTE  
PLAINLY KNOWN, OR NO DEEP AQUIFERS EXCEPT IF MAPPED OTHERWISE

IN THE LACU CHAD BASIN, ONLY SEMI-DEEP AQUIFERS ARE MAPPED DEEP AQUIFERS (CONTINENTAL INTERCALAIRE) ARE NOT WELL KNOWN BUT SHOULD HAVE A GOOD STORAGE

- NO DEEP AQUIFERS (IN REALITY, BASEMENT AREAS)
- LIMITS OF SEDIMENTARY BASINS WITH DEEP (AND SHALLOW) AQUIFERS
- INSIDE OF SEDIMENTARY BASIN
- LIMIT OF ANTESIAN ZONE

SOURCE: Inter African Committee for  
Hydraulic Studies (CIAH).  
1979. Vol. 2.

207

## 10. Groundwater Storage and Safe Yield in Southern Niger

### 10a. Groundwater Storage - Sedimentary Basins

COUNTRY	FORMATION	(10 <sup>-2</sup> ) STORAGE COEFFICIENT	(m) DRAWDOWN	(Million m <sup>3</sup> /km <sup>2</sup> ) DEVELOPABLE GROUNDWATER STORAGE	(km <sup>2</sup> ) MAPPED AREA	(Million m <sup>3</sup> ) VOLUME OF DEVELOPABLE GROUNDWATER STORAGE
NIGER	Continental Terminal	1-8	1/3 épaisseur saturée	0.4-0.95	96 100	39 770-91 510
	Continental Intercalaire	5-10	10	0.5-1	86 700	43 350-86 700
	Plio-Quaternaire	1-10	1/3 épaisseur saturée	0.25-0.55	50 000	12 500-27 500
	Quaternaire	1-2.5	10	0.10-0.25	14 850	1 480-3 710
	Pliocène	0.2-0.8	100 m sous le sol	0.25-0.50	17 500	4 375-8 750
	Continental Intercalaire	0.1-0.5	100 m sous le sol	0.17-0.37	30 000	22 100-48 100

### Groundwater Storage - Basement

COUNTRY	(km <sup>2</sup> ) MAPPED AREA	(Million m <sup>3</sup> ) DEVELOPABLE GROUNDWATER STORAGE
NIGER, LIPTAKO	50 000	5 000
ZINDER	10 000	1 000

Source: Inter African Committee for Hydraulic Studies (CIAHS). 1979. Vol. 1.

10. Groundwater Storage and Safe Yields in Southern Niger

10b. Safe Yield - Sedimentary Basins

BASIN	COUNTRY	FORMATION	AVERAGE INFILTRATION (mm/yr)	MAPPED AREA	SAFE YIELD (Million m <sup>3</sup> /yr)
NIGER	<u>Niger</u>				
Niger		Continental Terminal	13	96 100	1 220
Tegama, Damegou, Manga		Continental Intercalaire, Terminal et Plio-Quaternaire	3	136 000	408
Koramas		Quaternaire	127	14 850	1 890

Safe Yield - Basement

COUNTRY	INFILTRATION (mm/yr)	MAPPED AREA	SAFE YIELD (Million m <sup>3</sup> /year)
NIGER, LIPTAKO	3	50 000	150
ZINDER	3	10 000	30

Source: Inter African Committee for Hydraulic Studies (CIAHS). 1979. Vol. 1.

11. Groundwater Quality in Selected Sedimentary Aquifers (mg/l)

City	Ca	Mg	Na	K	Cl	SO <sub>4</sub>	HCO <sub>3</sub>	NO <sub>3</sub>	Fe	TDS	pH
Abidjan	10-200	2,5-11,5	10,0-100	3,5-6,0	1,0-1,5	1,0-1,5	1,0-7,0			80-300	
Accra	2-20	1,2-1,5	10,5-20,0	2,0-10,5	17,7-73,4	4,0-20,0	2,0-2,5			20-70	7-8,5
Agadez	4,0-10,0	0,1-5,0	2,4-30	0,2-25,0	2-15,3	3-5,3	3-2,5	0,1-2,0		60-100	6,0-7,0
Algiers	0-100	0-10	2-200	7,2-13	1-30		3-1,7	1,0-10,0	0,0-1,0	10-100	7
Antananarivo	20	1	100	10	7,5		0,2			100	7,0

Source: Inter African Committee for Hydraulic Studies (CIAHS) 1979. Vol. 1.

13. Ithassar Valley Location



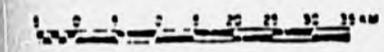
ASAS-ARMIT

TESUJODA IN TESSA MA

TESUJODA IN TAGAIT

TESUJODA IN ADRAH

IN GALL



- Drainage Channel
- Crystalline Bedrock
- Road
- AGADES ○ Town
- IN GALL ○ Village
- ASAS-ARMIT ○ Settlement

- Artesian exploratory borehole
- Non-artesian exploratory borehole
- Exploratory borehole
- Artesian cased water well
- Non-artesian cased water well
- Dig well tapping Aquifer formation
- Dig well located on a fault
- Tunnel
- Fault line

SCALE 1:100,000



Source: Schreuder, P.J. 1973.

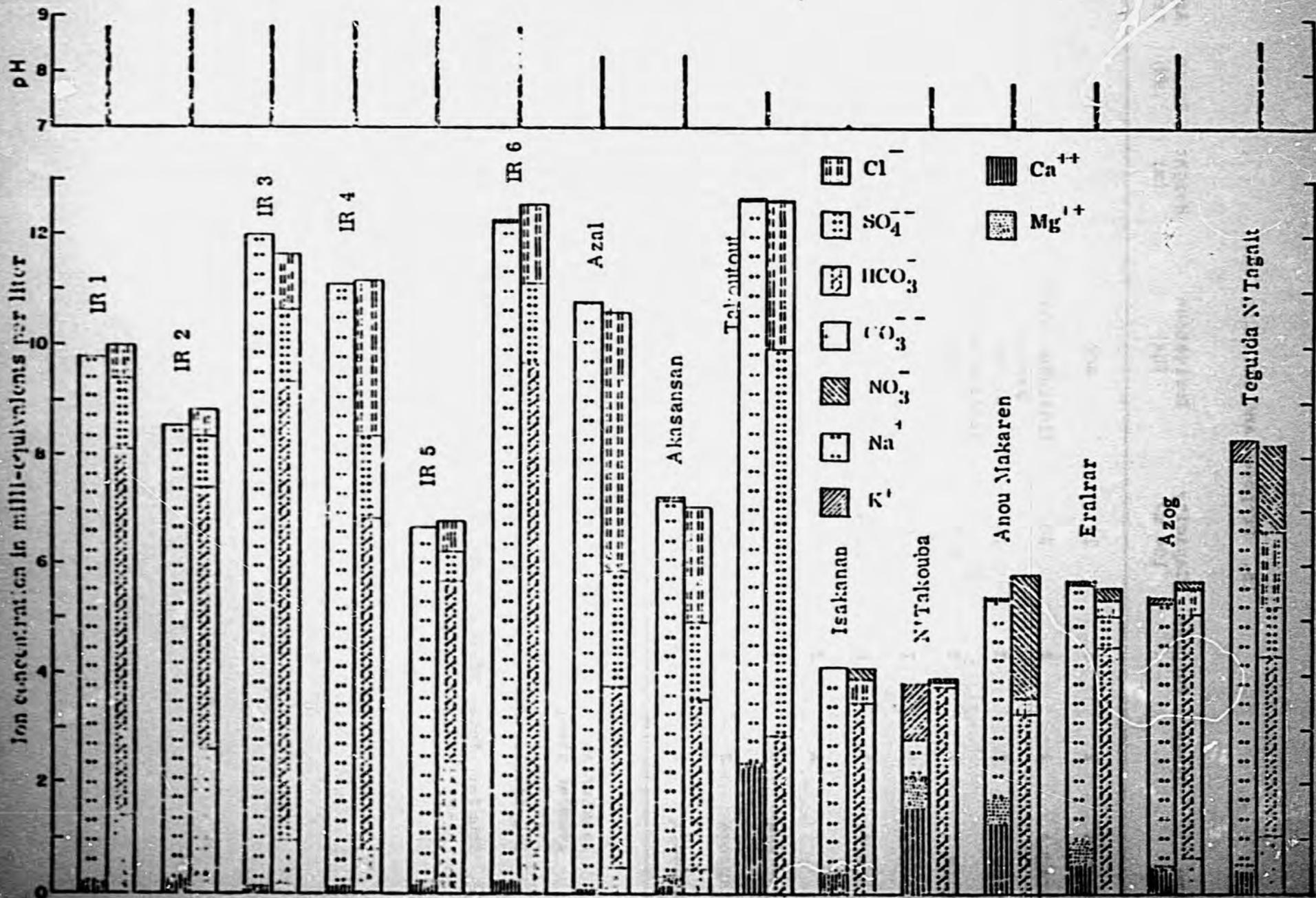
13. Discharge, Draw down, and Specific Capacity of Inhazer Valley Wells

Well Number	Discharge (m <sup>3</sup> /hr)	Discharge (gpm)	Drawdown <sup>a</sup> / (m)	Drawdown <sup>a</sup> / (ft)	Specific Capacity (m <sup>3</sup> /hr)	Specific Capacity gpm/ft
IR1	5.9	26	56.46	185.2	0.10	0.14
IR2	11.3	50	27.61	90.6	0.41	0.55
IR3	52.8	232	2.51	8.2	21.04	28.29
IR4	17.6	77	6.56	21.5	2.68	3.60
IR5	30.4	134	6.68	21.9	4.55	6.12
IR6	11.8	52	46.48	152.5	0.25	0.34
IR7	11.3	50	1.2	3.9	9.42	12.82
IR8	11.3	50	24.83	81.5	0.46	0.61
AbsoK Anouar	3.2	14	39.00	128.0	0.08	0.11
Akasansan	80.0	352	16.42	53.9	4.87	6.53
Assouas	21.4	94	28.00	91.9	0.76	1.02
Azal	76.6	337	7.07	23.2	10.83	14.53
In Gitene	20.30	89	6.80	22.3	2.98	3.99
Isakanan	4.8	21	27.12	90.0	0.18	0.23
N'Takouba	76.0	335	21.22	69.6	3.58	4.91
Takoutout	65.4	288	26.50	86.9	2.47	3.31
Tamerat	46.60	205	14.00	45.9	3.33	4.47

<sup>a</sup>After 48 hours of pumping.

Source: Schreuder, P.J. 1973.

14. Water Quality of Irhazer Valley Wells

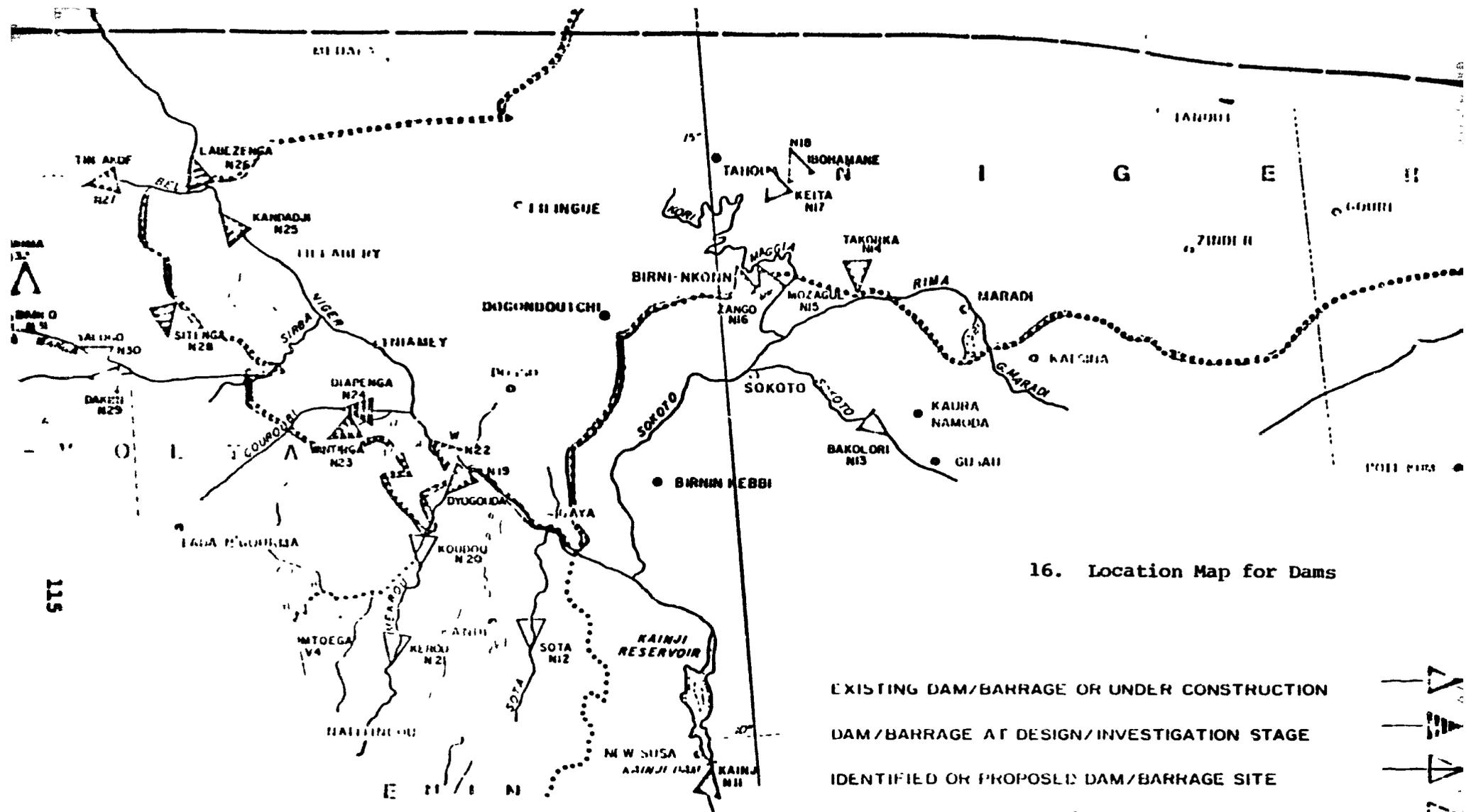


### 15. Proposed and Existing Dams

Name	Stage	Purpose	Capacity 10 <sup>6</sup> m <sup>3</sup>	Irrigation (ha)	Height (m)	Power (MW)	Annual Production (GWh)
Takorka	2	I	11	400			
Mozaque	2	I	30	(included with Zango)			
Zango	2	I	10	10,000 (including Mozaque)			
Keita	1	I	6.5	200			
Ibohamane	1	I	6	900			
Dyogouda	2	E	1,040		26-43	26	15
W	2	E			10-15	84	526
Wintirga	2	I	5.2				
Diapenga	2	I	15	230	7.5		
Kandadji	2	I,E	12,000	80,000	30	200	1,000

1=existing  
 2=under study  
 I=Irrigation  
 E=Hydroelectric

Source: Inter African Committee for Hydraulic Studies. 1979. Vol. 5.



16. Location Map for Dams

- EXISTING DAM/BARRAGE OR UNDER CONSTRUCTION
- DAM/BARRAGE AT DESIGN/INVESTIGATION STAGE
- IDENTIFIED OR PROPOSED DAM/BARRAGE SITE
- STATUS OF DAM NOT KNOWN

- NAME OF DAM SITE
- REFERENCE NUMBER

- INTERNATIONAL BOUNDARIES
- LIMITS OF PROJECT
- CAPITAL OF COUNTRY
- OTHER CITIES

Source: Inter African Committee for Hydraulic Studies  
1979. Vol. 5.

## APPENDIX VI

### Environmental Legislation

- A. Water
- B. Soils
- C. Flora
- D. Fauna
- E. Minerals
- F. Hazardous Substances
- G. Public Health

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Sources: Caponera, D. A. 1978.  
Christy, L. C. 1971.  
International Digest of Health Legislation. 1971.  
International Digest of Health Legislation. 1976.  
Johnson, H. and J. Johnson. 1977.  
U. S. Environmental Protection Agency. 1976.

## Appendix VI

### Environmental Legislation

#### A. Water

1. Colonial legislation for former French West Africa is still in force unless specifically superceded by more recent legislation.
  - a. The Civil Code (Articles 640-645) governs use of non-public water.
  - b. The Decree of 14 April 1904 concerns the protection of public health.
  - c. The Decree of 5 March 1921 concerns the status of water. Users of public water must apply to the proper administrative agency. Discharge of refuse, domestic wastes, etc. into any public water is prohibited.
  - d. The Decree of 21 March 1928 concerns the status of water.
  - e. The Decree of 29 September 1928 governs the public domain and compulsory servitudes and defines public domain of surface waters as including navigable waterways and their overflow; springs and non-navigable watercourses and overflow area; ponds, lakes to highwater mark, and artificial water courses (canals, etc.) if built with public money.
  - f. The Decree of 4 July 1935 (Article 30) concerns the status of forests.
  - g. The Decree of 30 October 1935 concerns the protection of drinking water.
  - h. Decree No. 52-679 of 3 June 1952 amends Articles 1 and 2 of the Decree of 29 September 1928, defining all groundwater as part of public domain.
  - i. Decree No. 55-490 of 5 May 1955 supplements the Decree of 29 September 1928.
  - j. Order No. 9929 of 15 December 1955 of the Ministry of Public Works concerns conditions of implementation of Decree No. 55-490 of 5 May 1955 supplementing the Decree of 29 September 1928. Protected areas are established around urban drinking water supplies. Groundwater use may be regulated or prohibited for any reason of public interest.
2. Agreement of 5 February 1952 concerns the management of the Electricity, Water and Ice Service at Niamey.
3. Law No. 61-8 of 29 May 1961 concerns the prospecting, exploration, exploitation, possession, movement, trade and processing of mineral and fossil substances, including water, in the territory of the Republic of the Niger.
4. Law No. 63-31 of 7 May 1963 creates a public institution for the exploitation of underground water in the Republic of the Niger (OFEDES).

5. Law No. 63-37 of 10 July 1963 amends Article 7 of Law No. 63-31 of 7 May 1963 (OFEDES).
6. Decree No. 64-019 MER/MTP/MFAE of 3 January 1964 concerns the statute of the Underground Water Board (OFEDES).
7. Convention and statute of 21 May 1964 concerns the development of the Chad Basin. Signatory states undertake to refrain from taking measures which will adversely affect the size of water loss, the shape of the annual hydrograph and limnograph, or the biological characteristics of fauna or flora of the Chad Basin. Land use projects which can affect these factors are covered, as are domestic and agricultural water use.
8. Decree No. 65-016 PRN of 20 February 1965 creates and organizes the Water Commission.
9. Law No. 66-032 of 21 May 1966 amends Article 2 of Law No. 63-61 of 7 May 1963 creating a public institution responsible for the exploitation of underground water in the Republic of the Niger (OFEDES).
10. Decree No. 63-235 concerns navigation and economic cooperation between the States of the Niger Basin, Niamey, 24-26 October 1963.
11. Agreement made concerning the Niger River Commission and navigation and transport on the Niger River, Niamey, 25 November 1964, forbidding the pollution of water of the Niger or any tributaries or alteration of the biological characteristics of fauna or flora without prior warning and consultation with the Niger River Commission.
12. Decree No. 67-143 PRN/MER of 25 September 1967 regulates the opening of pumping stations situated in grazing areas.
13. Decree No. 69-43 MTP/T/M/U of 2 January 1969 sets up a Water and Electricity Committee.
14. Cahier des charges of 9 July 1971 concerns the operation on a concession basis of public drinking-water supply facilities by the Electricity Company of the Niger. Water must be of such quality to satisfy the public health service and hygiene and environmental health regulations.
15. Decree No. 70-281 institutes a commission to study regulations on river navigation.
16. Decree No. 72-130 PRN of 26 September 1972 defines the functions of the Minister of Mines, Geology and Water.

## B. Soils

1. Colonial Decree of 7 July 1935 (Article 30) on the status of forests regulates forest clearance so as to control soil erosion.
2. Decree No. 70-265 PRN/DIR-CAB, 11 Dec. 1970 entrusts forest and soil conservation to the Ministry of Rural Economy.

## C. Flora

1. Colonial Decree of 4 July, 1935 (Article 30) on the status of forests denies private owners of forest and woodland the right to clear the land if it would jeopardize protection of soils against erosion and flooding.
2. Decree 206 of 1960 sets the conditions for importation into Niger of any vegetable or other matter which could introduce organisms detrimental to agricultural crops.
3. Decree 63 of 1965 ratifies Niger's membership in the Organization Commune de Lutte Antiacridienne et de Lutte Antiaviaire.
4. Decree No. 70-265 PRN/DIR-CAB, 11 Dec. 1970 entrusts forest and soil conservation to the Ministry of Rural Economy.

## D. Fauna

1. Colonial Decree of 18 Nov. 1947, modified by decree of 21 Dec. 1954 concerns protection.
2. Colonial Decree of 27 April, 1954 concerns protection of wildlife reserves and National Parks.
3. Law 28 of 1962 regulates hunting, protection of fauna, and lists protected species.
4. Decree 122 of 1964 prohibits marketing or export of products from wild animals.
5. Decree 101 of 1966 restricts hunting of birds to use of traditional weapons only.
6. Act 19 of 1970 issues the stockbreeding code prohibiting unnecessary ill-treatment of any animal and lists measures to prevent outbreak, arrest the spread of and eliminate animal diseases.
7. Law 17 of 1971 regulates fishing and protects fisheries and fish.

## E. Minerals

1. Law No. 61-8 of 29 May 1961 is the Mining Law.

2. Decree 219 of 1961 fixes regulations in Law No. 61-8 of 1961.
3. Decree 63 of 1969 grants a type "A" permit to the French commission of atomic energy.
4. Decree 133 of 1969 modifies Decree 158 of 1961, regarding creation of a council of mines and providing for its composition.
5. Decree 134 of 1969 amends Decree 23 of 1968 pertaining to the institution of a fiscal scheme of enterprises for research and exploitation of physical or chemical minerals of uranium.

**F. Hazardous Substances**

1. Law No. 66-033 of 24 May 1966 concerns dangerous, unhealthy or troublesome establishments. Manufacturing establishments, workshops, factories, warehouses, construction sites and any other industrial or commercial establishments constituting a source of danger or inconvenience, whether to the safety, hygiene or amenity of the neighbourhood or to public health, or to agriculture, are placed under the surveillance of the administrative authorities under the conditions laid down by this Law.
2. Decree 8 of 1968 establishes guidelines for application of plant protection legislation.
3. Decree No. 69-99/MER of 30 May 1969 prescribes additional provisions governing the possession and use of poisons for plant protection purposes. The manufacture, conversion, extraction, preparation, possession offer, distribution, brokerage, purchase, sale, import and export of substances classified in Schedule C annexed to the Decree of 2 April 1951 (laying down the composition of Part II of the Poisons Schedules) and, in general, all agricultural, industrial and commercial operations involving these substances, are prohibited, except if a licence is held. The latter is non-transferable and is issued by the Minister of Rural Economy.
4. Order No. 005 MER/AG of 19 May 1970 of the Ministry of Rural Economy, pursuant to the provisions of Decree No. 69-99/MER of 30 May 1969, establishes the list of plant protection products and specialities recognized as necessary for use in the control of crop pests. These products and specialities are classified as follows: I. insecticides and acaricides; II. fungicides; III. herbicides, defoliant and shrub control agents; IV. miscellaneous pesticides (rodenticides, nematocides, wetting agents).
5. Decree 98 of 1970 relates to transport by land and management of dangerous or infectious materials.

**G. Public Health**

1. Order No. 11/MS/AS of 11 June 1969 prescribes the duties of the physicians in charge of departmental hygiene and mobile medical units.
2. Decree No. 74-8 PRN of 4 January 1974 establishes and organizes a National Committee for the Coordination of the Onchocerciasis Control Activities.
3. Decree No. 74-81 PCMS/MSP/AS of 10 May 1974 prescribes the duties of the Minister of Public Health and Social Affairs.

## Appendix VII

### Governmental and Other Organizations

1. Principal Government Officials and U. S. Officials in Niger
2. Ministry of Rural Development Organization
3. Functions of Selected Ministry of Rural Development
4. Functions of other Governmental Organizations
5. International Organizations
6. Selected U. S. Non-Governmental Non-Profit Organizations Involved in Niger

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Sources: Arid Lands Natural Resources Committee. 1979.  
Bergquist, W. E.. 1978.  
Boeckm, E.. et al. 1974.  
CILSS. undated.  
Caponera, D. A. 1978.  
Committee on Environment and Development. 1980.  
Europa Publications. 1979.  
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Quan, C. 1976.  
Sierra Club. 1976.  
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UNESCO. 1966.  
United Nations Environment Program. 1979.  
U. S. Dept. of State. 1980.  
U. S. AID. 1975.  
U. S. AID. 1979.  
U. S. AID. 1980b.

1. Principle Government Officials and U. S. Officials in Niger

A. Principal Government Officials

President of the Republic, Head of the Supreme Military Council-Lt. Col. Seyni Kountche

Ministers

Finance-Intendent Lt. Col. Militaire Moussa Tondi

Postal Affairs and Telecommunications-Lt. Col. Sory Mamadou Diallo

National Education-Major Moussa Sala

Youth, Sports, and Culture-Major Moumouni Djermakoye Adamou

Interior-Capt. Tandja Mamadou

Plan-Dr. Annou Mahamane

Mines and Hydraulics-Mounkeila Arouna

Economic Affairs, Commerce, and Industry-Mai Maigana

Justice-Alou Harouna

Public Works, Transport and Urbanism-Moussa Bako

Rural Development-Brah Mamane

Public Health and Social Affairs-Yahaya Toundara

Higher Education and Research-Garba Sidikou

Foreign Affairs and Cooperation-Daouda Diallo

Information-Mahamadou Halilou

Civil Service and Labor-Mayaki Issoufou

Secretary of State for Foreign Affairs and Cooperation-Hamid Algabit

Secretary of State for the Interior-Abdou Mallam Moussa

Director General of President's Cabinet-Jean Poisson

Secretary General of the Government-Boubadar Abdou Adamou

Rector of the University-Dr. Abdou Moumouni Dioffo

Prefectorial Assignments

Niamey-Maigary Amballam

Maradi-Capt. Amadou Seyni

Tahoua-Major Adamou Arouna

Agadez-Major Abdou Ide

Zinder-Major Bagnou Beido

Dosso-Major Ibrahim Hassane

Diffa-Capt. Dandi Abarchi

Ambassador to the United States-Andre Wright

Ambassador to the United Nations-Ide Oumarou

B. Principal U. S. Officials

Ambassador-James K. Bishop

Deputy Chief of Mission-Peter R. Chaveas

Director, U. S. AID-Jay P. Johnson

Economic/Commercial Officer-David Thatcher

Director, Joint Administrative Office-Edward Pohl

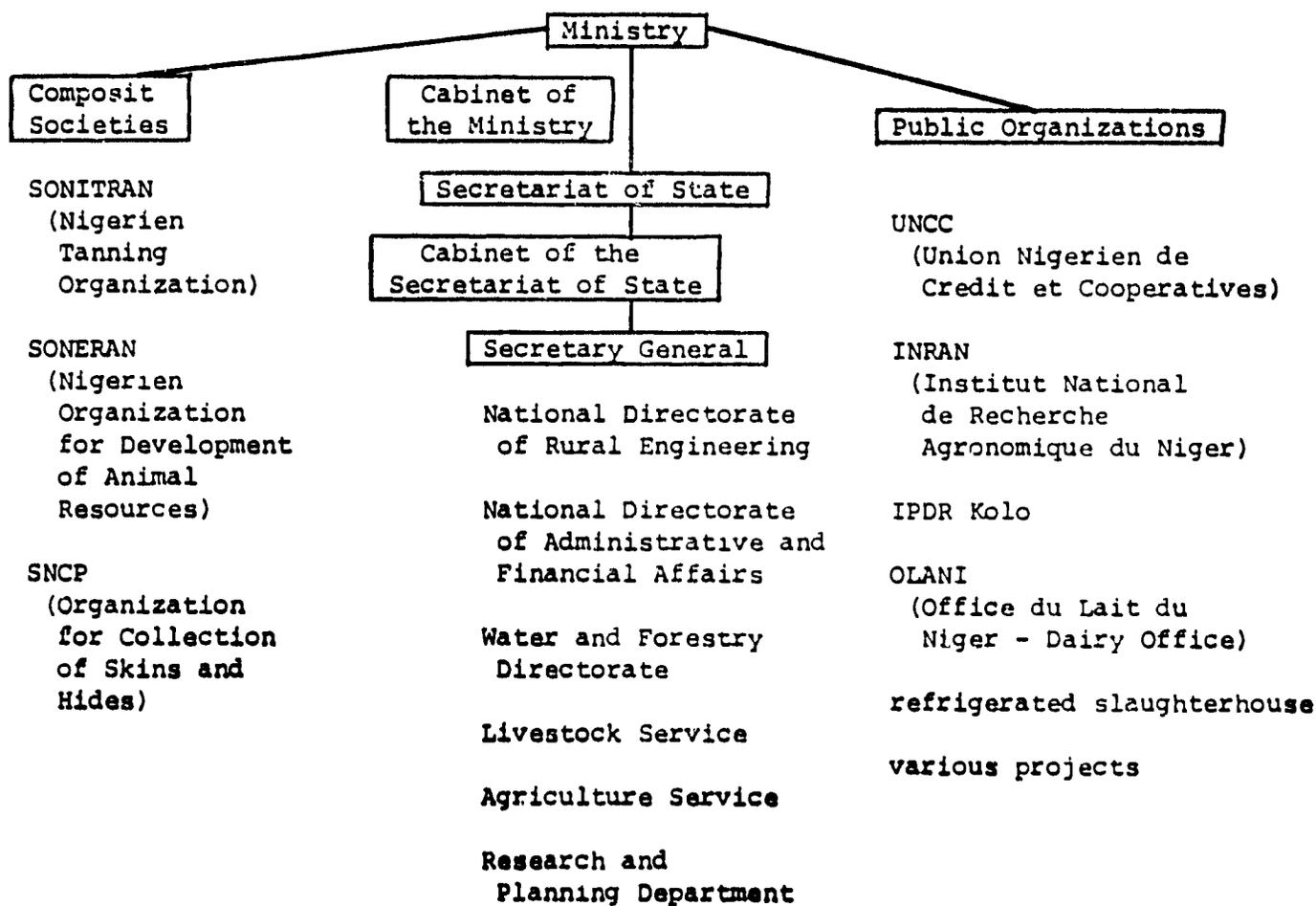
Public Affairs Officer (USICA)-William R. Barr

Peace Corps Director-Phyllis Dichter

The mailing address of the U. S. Embassy in Niger is B. P. 201, Niamey.

Source: U. S. Department of State. 1980.

## 2. Ministry of Rural Development Organization



Source: Niger, Ministère du Développement Rural, Direction de l'Agriculture. 1978.

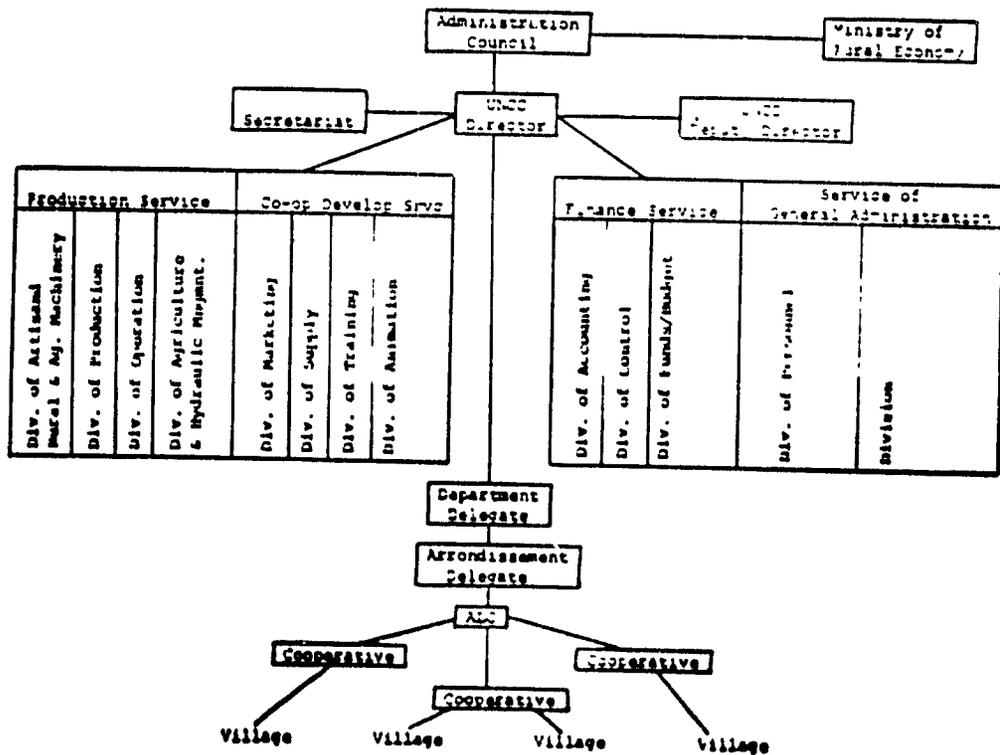
### 3. Functions of Selected Ministry of Rural Development Departments.

#### A. Union Nigerien de Credit et Cooperatives (UNCC)

##### 1. Goals and duties:

to promote establishment of cooperatives  
 to assist coops in marketing  
 to provide farming inputs and technical assistance  
 to manage irrigation schemes

##### 2. UNCC Organization Chart



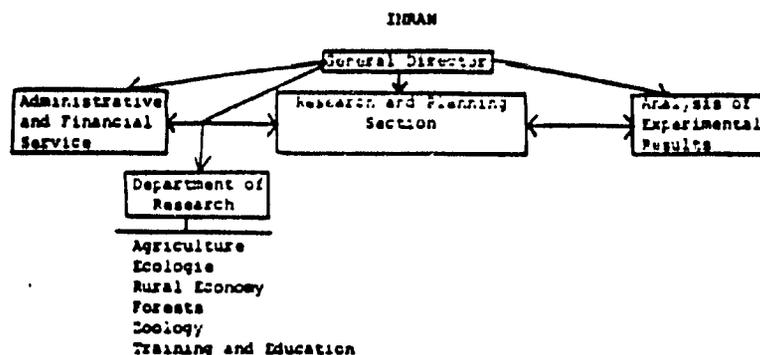
Source: Quan, C. 1976.

\*if a director is stated, the source is Europa Publications, 1979.  
 A governmental reorganization was carried out in late 1979, so that directors may have changed.

**B. Institute National de Recherche Agronomique du Niger**  
 B. P. 150  
 Niamey

also:

INRAN-Forestry  
 B. P. 225  
 Niamey



Source: Niger, Ministère du Développement Rural, Direction de l'Agriculture. 1978.

**C. Water and Forestry Directorate**

goals and duties: to protect the natural habitat in the areas of forestry, hunting, fishing

**D. Livestock Service**

1. Goals and duties: control of animal diseases; supervision of sales and inspections of meat, hides; compile statistics on the livestock sector

2. Station Sahélienne Experimentale de Toukounous  
 Service d'Elevage du Niger  
 Toukounous/Filingue

Goals and duties: selection and breeding of Zebu Azaouak cattle and distribution of selected bulls to improve the local heterogeneous breed

**E. Agriculture Service**

Goals and duties: to improve agricultural methods, provide protection against disease and pests, carry out agricultural research, aid in implementation of research, and compile agricultural statistics.

#### 4. Functions of Other Governmental Organizations\*

##### A. Ministry of Mines and Hydrology

1. Office des Eaux du Sous-Sol (OFEDES)  
B.P. 734  
Niamey

government office for the maintenance and development of wells and boreholes in the country

2. Service of Mines and Hydrology  
conducts minerals research

3. Office National des Ressources Minières (ONAREM)  
B.P. 210  
Niamey

government office for the prospecting, exploitation and development of trade in all minerals

##### B. Ministry of Public Works, Transport, and Urbanism

1. The Water Commission

responsible for determining water policy, coordinating projects of various government offices, evaluating projects and legislation concerning water

- a. The Technical Water Committee

evaluate implementation problems regarding water and electricity in urban, industrial, and mining zones.

##### C. Ministry of Planning

1. Provincial Planning Service SDP

elaborates and coordinates planning on departmental level

collection and organization of data and information on natural resources, the economy, and social conditions for use by other services to assist their activities

2. Animation Service

supports other services, especially the health service; demonstrates principles of hygiene, sanitation, and nutrition in villages.

\*see note on part 3 of this appendix

D. Ministry of Finance

1. Direction du Service Topographique et du Cadastre  
B. P. 250  
Niamey

E. Independent or undetermined agencies

1. Bureau de Recherches Geologiques et Minieres  
B. P. 458  
Niamey
2. Institut de Recherches d'Agronomie et Cultures Vivriers (IRAT)

Part of a wider network of French sponsored research stations in West Africa, in Niger IRAT is one of the main agents of agricultural research. A station at Tarna (Near Maradi) focuses on dryland farming; one at Koio (near Niamey) on irrigated agriculture.

major fields of research:

climatology  
soils and soil fertility  
irrigation  
plant breeding  
cultural practices for a number of crops

3. Institut de Recherches sur les Fruits et Agrumes (IRFA)  
B. P. 886  
Niamey
4. Laboratoire Veterinaire de Niamey
5. Office de la Recherche Scientifique et Technique OutreMer  
B. P. 11416  
Niamey

hydrology, archaeology, geophysics

6. Office des Produits Vivriers du Niger OPVN  
B. P. 474  
Niamey

government office for developing agricultural and food production

7. Office National de L'Energie Solaire ONERSOL  
B. P. 614  
Niamey

government office for building and commercial exploitation of solar-powered machinery

8. Societe Nationale des Grands Travaux du Niger  
B. P. 625  
Niamey

public building and engineering projects; cap. 529m. francs CFA

9. Station Avicole et Centre d'Elevage Caprin  
Maradi; f. 1961; Dir. Hassane Baza; publ. Report (annual).

F. Universities and Colleges

1. Universite De Niamey  
B. P. 237  
Niamey

Constituent Institutes:

Ecole des Sciences  
Ecole des Lettres  
Ecole de Pedagogie  
Institut de Recherche pour l'Enseignement des Mathematiques  
Ecole Superieure d'Agronomie  
Ecole des Sciences de la Sante  
Institut de Recherches en Sciences Humaines

Insitut de Recherches en Sciences Humaines IRSH  
B. P. 318  
Universite de Niamey  
Niamey

f. 1976 as successor to Centre Nigerien de Recherches en Sciences  
Humaines

library of 8,000 vols.

5 sections : archaeology, history, sociology, linguistics,  
audio-visual

publs. Etudes Nigeriennes, Mu Kaara Sani (3 a year)

2. Ecole Nationale d'Administration du Niger  
B. P. 542  
Niamey

library of 18,000 vols.

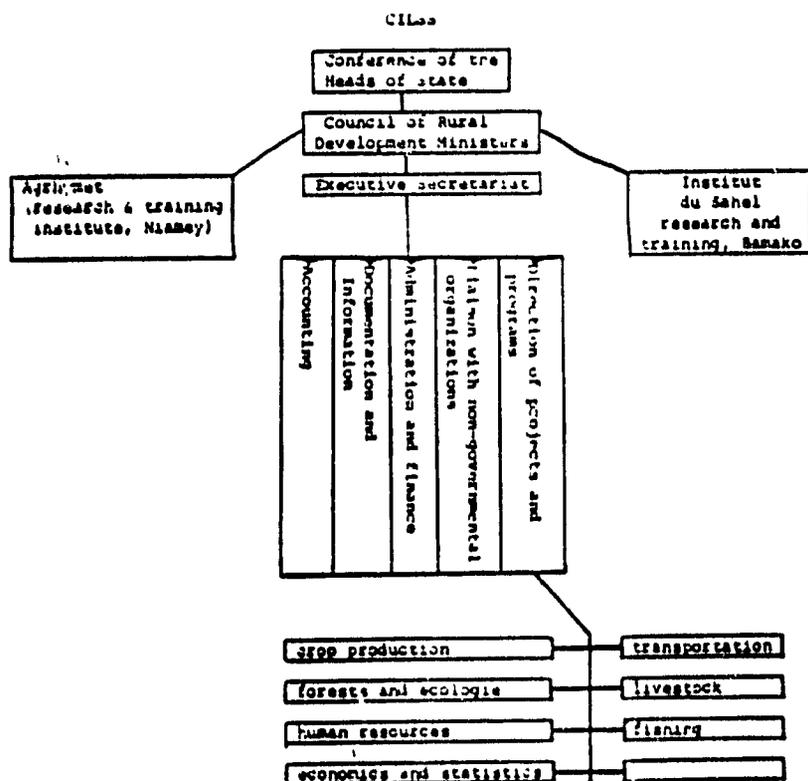
## 5. International Organizations

Niger is a member of several organizations which are directly concerned with various environmental problems.

### A. CILSS (Comite Inter-Etats de lutte contre la Secheresse au Sahel) and its support organization, Club du Sahel

CILSS members: Cape Verde Islands, Chad, Gambia, Mali, Mauritania, Niger, Senegal, Upper Volta

Club de Sahel: not statutory membership. Open to all countries and organizations interested in development of the region encompassed by CILSS states.



Source: CILSS. undated.

- B. Lake Chad Basin Commission  
(Cameroon, Chad, Niger, Nigeria)  
(of section 2.2.4)
- C. Liptako-Gourma Region Integrated Development Authority (Mali, Niger, Upper Volta)

The Authority is charged with promoting regional development of mineral, energy, water, agricultural, grazing, and fishery resources in the contiguous parts of these three states.

- D. Niger River Commission  
(Cameroon, Chad, Benin, Guinea, Ivory Coast, Mali, Niger, Nigeria, Upper Volta)
- E. Organization commune de lutte antiacridienne et de lutte antiaviaire  
(Cameroon, Chad, Benin, Ivory Coast, Mali, Mauritania, Niger, Senegal Upper Volta)

The organization is charged with control of insect pests and granivorous birds (particularly the desert locust and Quelea quelea) and with carrying out supporting research.

- F. Organization Internationale contre de Criquet Migrateur African  
(21 African states including Niger)

OICMA is charged with control of and research on the African migratory locust. It focuses on, but is not limited to, the major outbreak area on the Niger River.

- G. Organization de coordination et de cooperation pour la lutte contre les granches endemies  
(Benin, Ivory Coast, Mali, Mauritania, Niger, Senegal, Togo, Upper Volta)

This West African organization is responsible for research on and implementation of programs to control the major endemic diseases of the area.

- H. Inter African Committee for Hydraulic Studies  
(most African states including Niger)

- I. Mission permanente de cooperation  
B. P. 494  
Niamey

Center for administering bilateral aid from France according to the cooperation agreements signed in 1961 and re-negotiated in 1977

- J. Mission ORSTOM au Niger (ORSTOM Mission in Niger)  
B. P. 223  
Niamey, Niger

Niger mission of the French Office de la Recherche Scientifique et Technique Outre-Mer (Office of Scientific and Technical Research Overseas). Hydrological studies.

In addition, numerous other countries and organizations provide assistance to Niger and/or maintain offices or projects in the Niger, including:

- African Development Bank
- EEC
- FAO
- IBRD
- OPEC
- UNDP
- Algeria
- Belgium
- Canada
- China
- Germany (West)
- Japan
- Netherlands
- Saudi Arabia
- Switzerland
- USA

6. Selected U. S. Non-governmental Non-Profit Organizations Involved in Niger.

**Africare**

works in areas of development planning, drought relief, agricultural and livestock projects, health programs

**Care, Inc**

work in agricultural production, improving water sources, fisheries

**Catholic Relief Services**

technical training projects, small scale water storage projects

**Church World Service**

date palm production in Air, fisheries, well restoration projects. Participate in reforestation, dune control, projects, health programs

**Sudan Interior Mission, Inc.**

maintains a farm center at Maradi which aids farmers, offers training, carries out rural development projects (particularly well construction, irrigation, water conservation). Health programs

**United Methodist Committee on Relief.**

agricultural projects, reforestation, health programs

## Appendix VIII

### Bibliography

1. General Bibliographic Sources for Africa
2. Geography and Climate
3. Geology, Minerals, and Soils
4. Agriculture and Agricultural Land Use
5. Pastoralism and Range Use
6. Water Resources and Management
7. Flora and Fauna
8. Public Health and Nutrition
9. Social Aspects
10. Development

## 1. General Bibliographic Sources for Africa

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- A: geomorphology.
- B: biogeography and climatology.
- C: economic geography.
- D: social geography and cartography.
- E: sedimentology.
- F: regional and community planning.
- G: remote sensing and cartography.

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