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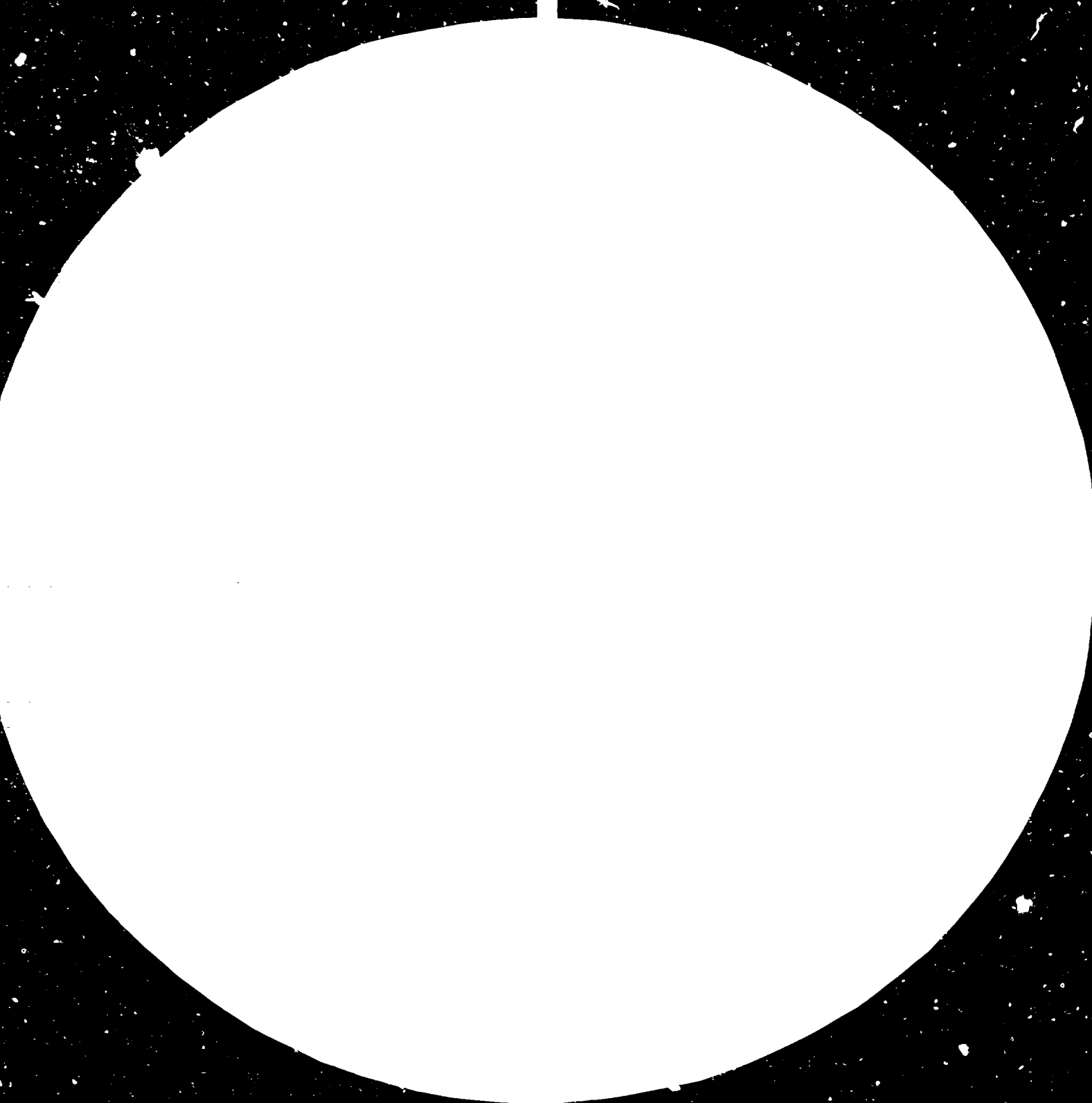

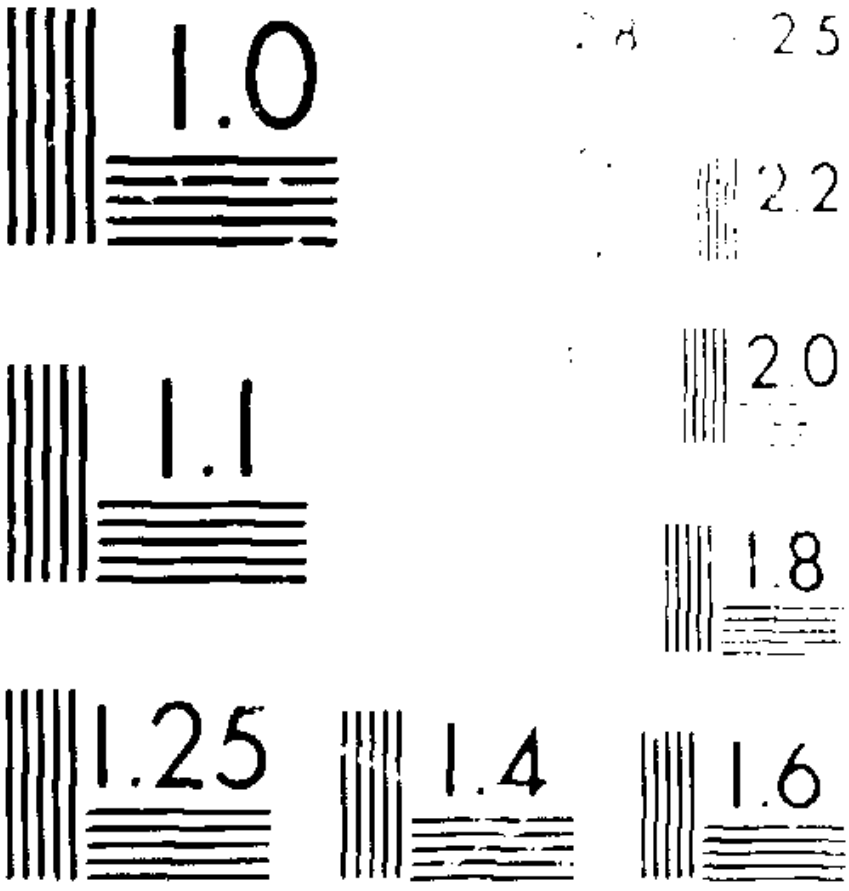
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DP/ID/SER.A/381
10 September 1982
ENGLISH
Original : FRENCH

ASSISTANCE TO THE NIGERIA-NIGER
COMMISSION FOR ECONOMIC CO-OPERATION

DP/RAF/77/020

Technical report on a plan of action for the valorization of the three basins common to Niger and Nigeria *

Prepared for the Nigeria-Niger Commission for Economic Co-operation by the United Nations Industrial Development Organization, acting as executing agency for the United Nations Development Programme.

Based on the work of O. Berney and J.M. Segers, UNIDO Experts

United Nations Industrial Development Organization
Vienna

* This document has been translated from an unedited original.

V. 82-30261

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LIST OF ORGANIZATIONS AND ABBREVIATIONS

ABN	Authorité du Bassin du Niger
ABU	Ahmadu Bello University, Samaru-Zaria
ADP	Agricultural Development Project (Nigeria)
ADRAO	Association pour le Développement de la Riziculture en Afrique de l'Ouest
AERLS	Agricultural Extension and Research Liaison Service, ABU, Samaru-Zaria
AFVB	Association Française des Volontaires du Progrès
AGRIS	Agricultural Sciences and Technology International Information System
APMEPU	Agricultural Projects Monitoring, Evaluation and Planning Unit, Kaduna
BEPRO	Bureau des Projets (Ministère du Développement Rural, Niger)
CARIS	Current Agricultural Research Information System
CBLT	Commission du Bassin du Lac Tchad
CDARMA	Centre de Développement de l'Artisanat Rural et du Machinisme Agricole (Niger)
CIDA	Canadian International Development Agency
CILSS	Comité Inter-Etats de Lutte contre la Sécheresse du Sahel
DRS	Défense et Restauration des Sols
DTCD	Department of Technical Cooperation for Development (United Nations)
EDF	European Development Fund
ESA	Ecole Supérieure d'Agronomie, Université de Niamey
FACU	Federal Agricultural Coordination Unit (FMA, Nigeria)
FASU	Federal Agricultural Support Unit (FMA, Nigeria)
FMA	Federal Ministry of Agriculture (Nigeria)
GTZ	Gesellschaft für Technische Zusammenarbeit (Fed. Rep. of Germany)
IAR	Institute for Agricultural Research, ABU, Samaru-Zaria
ICRISAT	International Crop Research Institute for the Semi-Arid Tropics (India)
IFSTD	Interim Fund for Science and Technology for Development
IGN	Institut Géographique National (France)
IITA	International Institute of Tropical Agriculture, Ibadan
INRAN	Institut National de Recherche Agronomique au Niger
IPDR	Institut Pratique de Développement Rural, Kolo (Niger)

IRAT	Institut de Recherche Agronomique Tropicale (France)
IRDB	International Reconstruction and Development Bank
JN-NCC	Joint Nigerian-Niger Cooperation Commission (Commission Mixte Nigéro-Nigériane de Coopération)
MESR	Ministère de l'Enseignement Supérieur et de la Recherche (Niger)
MMH	Ministère des Mines et de l'Hydraulique
NAFPP	National Accelerated Food Production Project (Nigeria)
NAPRI	National Animal Production Research Institute, ABU, Samaru-Zaria
OAU	Organization for African Unity
OCLALAV	Office Commun pour la Lutte Anti-acridienne et la Lutte Anti-aviaire
OFEDES	Office des Eaux du Sous-sol
ONAHA	Office National des Aménagements Hydro-agricoles (Niger)
PADIS	Pan-African Development Information System
RESADOC	Réseau de Documentation, CILSS
SRBDA	Sokoto-Rima River Basin Development Authority
SSB	Single side-band
TCP	Technical Cooperation Programme (FAO)
UNCC	Union Nigérienne de Crédit et de Coopération
UNEF	United Nations Equipment Fund
USAID	United States Agency for International Development

SUMMARY AND CONCLUSIONS

The Sudano-Sahelian zone, which extends both sides of the frontier between Niger and Nigeria, is a homogeneous region from the climatic, human and agricultural points of view. It offers the possibility of joint development, to the profit of the populations, orientated essentially towards the rational and harmonious utilization of the surface and subterranean water resources and of the soils. The natural environment is particularly fragile, and it has become rapidly degraded over the last 15 years under the joint effects of the drought and of population pressures.

Conscious of these problems, and subsequent to an initial study carried out in the Komadougou-Yobe basin to the east of these two countries, the Governments of Niger and Nigeria, through the Joint Nigerian-Niger Cooperation Commission (JN-NCC) decided to pursue this work in the region located to the west of this basin (1).

Chapter 1 of the present report summarizes the terms of reference of the mission which took place in August-September 1981. A comparative analysis of the development strategies and of the current projects in the two countries is set out in Chapter 2. Chapter 3 describes the physical characteristics of the three catchment areas retained for actions of the first priority, namely those of Maggia-Lamido, Goulbi de Maradi-Gada and El Fadama-Tagwai River.

Chapter 4 deals with the context within which the present project falls, that is to say the legal framework in respect of the utilization of water in basins shared by the two countries, of the existing agronomic research and of the technical documentation necessary for the implementation of development projects.

The project, under the full title "Production of a Plan of Action for the development of the three basins shared by Niger and Nigeria", consists of four components :

1. the reinforcement of the planning structures;

2. the study and inventory of the water and soil resources;

3. the study of legal questions;

4. the organization of the documentation.

These are described in Chapter 5.

Two restricted projects would supplement this principal project: they consist of consultation on the protection of the environment and on the development of agricultural machinery. These are described in Chapter 6.

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(1) Study initially entitled "Study of the water resources of seven shared basins".

Carrying out these study projects, programmed over a period of 30 months, would make it possible to produce the following :

- an exhaustive inventory of the hydrological and pedological resources and potentialities of these regions, in order to fill in the existing gaps;

- a strategy of harmonious and balanced development for the two countries in this region;

- a programme of actions comprising the pre-investment and feasibility studies necessary for this regional development.

The formulation wishes to take this opportunity to thank all those who have contributed, by their concern and their interest, to the preparation of the present document: the representatives of the JN-NCC, of all the national departments visited during the mission to Niger and Nigeria, of the FAO and of the UNDP.

1. INTRODUCTION

The Joint Nigerian-Niger Cooperation Commission* was granted, in 1971, "general and exclusive competence to seek, in all fields, the means to coordinate and harmonize the economies of the two countries with a view to increasing and making more effective their cooperation. The Commission was also required to put forward to the two countries, being the parties to the present Agreement, those measures and projects which were likely to promote harmonious and balanced cooperation between the two countries."

Within the framework of this competence the Commission was given a mandate to put forward a plan for the utilization of the joint resources of underground and surface water. To this end it organized in 1980 and 1981 two missions designed to prepare, in the first mission, a study of the Kamadougou-Yobé basin and, in the second, a study of seven other joint basins.

The present report gives an account of this second mission.

The first report and the analyses made by the second mission lead to the conclusion that whilst the development of the frontier region needs to be centred on planning the hydraulic resources it cannot be limited to this. For this reason the project which is proposed takes into account the whole of the regional strategy and reflects, in its components parts, the priorities which it is felt need to be established if the Commission is to be able to carry out effectively the task which has been entrusted to it. It should lead to the formulation of a plan of action for developing the whole of the frontier region.

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* Commission Mixte Nigéro-Nigérienne de Coopération

2. THE REGION OF THE THREE BASINS IN THE DEVELOPMENT STRATEGIES

The "zone of the present project" is integrated into a much larger regional context. Whilst the three basins which we have studied occupy a total surface area of 20,000 km^2 they belong to a relatively homogeneous socio-economic region of about 150,000 km^2. One can neither dissociate the development of the valleys from that of the plateaux, nor envisage the separate development of the joint basins from the rest of this region which is traversed by other major valleys (Tarka, southern limit of the Goulbi N'Kaba, Rima River and the left bank of the Hadejia River, to list only the largest).

The plan of action for the development of the basins must therefore be based on an analysis of all the potentialities and constraints which characterize the whole of the frontier region and will therefore, in effect, be a plan for the development of the whole of the latter. It must however be emphsized that the development programmes which are formulated in the plan of action are of the pilot type inasfar as they are given a certain measure of priority due to the concentration of the population in these zones and also the major resources which they represent.

In the following pages we will analyse, in order, the general situation of the region and the present policies for the valorization of its potentialities. This analysis will lead to the identifaction of the fields of study, research and achievements in respect of which the Formulation Mission recommends the intervention of the Joint Nigerian-Niger Cooperation Commission. We conclude with a formulation of the terms of reference of the Master Plan.

2.1. The national development plans

Like the great majority of African countries the two States have chosen a policy of planned development. In Niger this planning is centralized whilst entrusting a large part of the methods and procedures to the regions (Départements) to the extent that they have to intervene in the process of drawing up the plan and also participate in a responsible manner in its execution. In Nigeria planning operates at two levels: the Federal State and the Federated States, each of these having its own Plan. The local governments are also required to formulate their own programmes with the support of the competent administrators of their State.

It was felt to be of value to set out in parallel the principal components of the national plans. It will be noted that, in both cases, a reading of the documents leads to some confusion between the objectives (self-sufficiency, equilibrium, etc.) and the means for arriving at the objectives (technological development, productivity, training, etc.).

NIGERIA

a. Period

Drafting of the Fourth Plan, 1981-85, has been delayed.

b. Major orientations and objectives (1)

- improvements in the living conditions of the people, and more specifically :
  - an increase in the mean real income;
  - a more equitable distribution of resources between individuals and between socio-economic groups;
  - a reduction in the levels of unemployment and of under-employment:
- an increase in the availability of skilled labour:
- extension of the economic base:
- balanced development (sectoral and regional):
- greater participation of citizens in the ownership and management of productive enterprises:
- greater self-sufficiency and the optimal utilization of human and material resources:
- the development of technology:
- greater productivity:
- greater discipline, more application to work and a cleaner environment:

The following will be given priority : agricultural production and the converting of its products, training and employment and the development of economic infrastructures.

(1) In Nigeria these are the orientations fixed by the central authority: each State may modulate these on the basis of its own situation.

NIGER

a. Period

The 1979-83 Plan is now being carried out.

b. Major orientations and objectives (1)

- the achievement of self-sufficiency in foodstuffs;
- implementation of a Development Society (participation of all);
- the achievement of economic independence.

This leads to four main strategy options which are, in order of priority :

- the modernization of agriculture and stock-raising;
- growth;
- construction of the future (by hydraulic and communications infrastructures, management of the territory, scientific and technical research, training and cultural development);
- the equitable distribution of the fruits of growth.

NIGERIA

c. The problems

The capital expenditure forecast for the 5-year period (public investments) is 70.5 billion Naire, including 28b financed by the States. Private sector participation is 11.5b Naire. The forecast is divided up as follows, in millions Naire :

	Public	Private
- Rural development, inc. cooperatives	9,012	1,800
- Industries, Mines, Energy	16,327	4,300
- Human resources, health (social services, inc. scientific research)	12,923	-
- Transport and communications	12,707	800
- Development of the environment and administrative infrastructures	17,572	2,400
- Commerce and Financial	1,735	2,200
TOTAL:	70,276	11,500

d. The rural sector

Nigerian forecasts for public investments in the rural sector are 9,012 million Naire, divided up as follows :

- Agriculture	5,438
- Cooperatives	184
- Development of hydraulic resources and Irrigation	2,255
- Stock-raising	672
- Forestry	292
- Fishing	171
TOTAL:	9,012

Of this total ₦ 5.4b or 62% will be covered by the Federal Government, ₦ 2.988b or 33% by the States and ₦ 439m or 5% by Local Governments. In total the investments devoted to the rural sector are of the order of 12.52% of the total forecast for the public sector.

One interesting figure should be noted: per capita public investment in Nigeria is about $460 over the period, whereas in Niger it is $265 ($500 if the private and semi-private sectors are added).

March 1982 : US$1 = 300.00 CFA Francs
US$1 = 0.637 Naire (₦)

NIGER

Forecasts for public investments total 385 billion CFA Francs, supplemented by 343b CFAF private and semi-private, and divided up as follows :

	Public	Private or semi-private
- Rural development	117	-
- Industries, Mines, Energy	70	305
- Human resources, health	85	1
- Infrastructures and Communications	68	31
- Other infrastructures	31	-
- Commerce and Services	14	6
TOTAL:	385	343

The programmes for the rural sector are divided up as follows :

- Agriculture	65
- Research	4.5
- Hydraulics	24.5
- Stock-raising	18.5
- Water and forests	4.5
TOTAL:	117.5

These represent 30% of all public investments.
From this rapid survey can be seen the major constraint operating on Niger, namely the relatively low dynamism of its private sector. If one deducts from the private investments the 220b forecast for the mining companies (mostly foreign) the contribution of the private sector is limited. In addition the Plan does not quantify the effort demanded of the peasants for the acquisition of the inputs required by the major projects.
In Nigeria the role of the private sector in the national economy is, however, considerable, and the Government relies on it. It may be asked why it was not more precisely quantified in the "Outline" of the Fourth Plan.

2.2. Regional development and rural development

We will now look at the development strategies at regional level which specially concern the rural sector.

2.2.1. In Niger

In the preface to the Plan Colonel Seyni Kountche emphasizes that "planning (in Niger) is not to be seen as an exercise which takes place solely at the level of abstract entities. It is, on the contrary, intimately implicated in national realities by the desire for an effective reorganization which will give to each geographical zone equivalent possibilities for economic and social progress and solutions which are adapted to its real potentialities and its specific problems."

This result has been achieved by the effective participation of the regions (départements) in the preparation of the Plan. The central planning departments have based their work on the proposals formulated by the regions, that is to say by the Regional Technical Committees (now the Regional Development Committees) presided over by the Prefects and encouraged by the Regional Planning Departments. Book III of the Plan, devoted to Regional Development, accounts for nearly 40% of the total document in terms of volume. An in-depth analysis of regional problems has made it possible to arrive at a specific programme for each region. Today the procedures for implementing the "Development Society" have an important place in regional authorities down to the levels nearest to the populations.

This desire arises from the finding enunciated several times during the evaluation of the plans and projects formerly put into effect: this is the inadequate participation of the population, and especially that of the rural environment. The behaviour of this population is analysed in greater detail below (2.4.) in respect of the special case of the frontier region.

The general situation of agriculture in Niger is a matter for concern, even within the whole Sahel region, and despite the policy of resolute development formulated by the Government. Sixty years ago 10% of the cultivatable land fed a population of less than 2 millions; in 1980 5 million inhabitants of Niger already occupy 40% of the land, and by the end of the century it will be necessary to utilize practically three-quarters of the land to satisfy the needs of a population estimated at 9 millions. Urban development, together with emigration, could modify food needs, but the trend towards over-exploitation of soil resources is difficult to reverse.

In general the food crop equilibrium is an uncertain one, and the deficit runs the risk of becoming structural.

The priority given to agriculture is, therefore, a legitimate one. But it also comes up against bottlenecks which it will be difficult to overcome.

One of the most serious of these consists of the lack of teaching staff to apply the techniques of dissemination which are now taking place. It is also necessary to cite the inadequate liaison between research and dissemination and an inefficient organization of the market for agricultural products, and also that of the inputs. The "technological packets" offered to the peasants are often too general to be adapted to their specific needs which are, in reality, highly variable from one region to another and even from one soil to another (1).

To this should be added the lack of accuracy of the available data for making a valid analysis of the situation. It is estimated that the cereal production is really only two-thirds of that of the official statistics - at the present time this production represents only slightly more than half of the total agricultural production in terms of value (2). Animal numbers are not accurately known, either in total or composition, and the same applies to pastoral and forestry resources.

If it is intended to regard the development of irrigated cultivation as a concrete way to salvation, on the land, then the programmes devoted to it are limited and, in addition, research can only offer very little support for its improvement at the present time.

2.2.2. In Nigeria

The development strategy is necessarily decentralized since this is a Federal State. Each of the Federated States has a population which, in the north of the country, is as large as the whole population of Niger (5.4 million in Sokoto, 4.1 million in Kaduna). Each of the States has its own planning department (Ministry of Planning) and also encourages the Local Governments to draw up their own development programmes.

The number of technicians in the technical ministries is often very limited in regard to the tasks entrusted to them (about 15 technical staff for Planning Division at Sokoto).

A problem which is inherent in the present development system of Nigeria consists of the multiplicity of organizations for development which are more or less independent from one another. The Federal Ministers and the Governments have their own programmes, running parallel with those of the regional authorities for the utilization of the basins and of the large and mainly autonomous rural development projects.

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(1) For example the non-validity of companion crop systems, condemned by the development projects, has never been demonstrated and, on the contrary, research carried out on this has shown its interest.

(2) An exercise in estimating soil utilization from aerial photographs carried out in the Dosso region has shown that, in certain areas, the actual cultivated area was twice that of the official estimations: in other areas it was only half.

As an example of this rural development in the state of Sokoto involves the following authorities :

- The Federal Minister for Agriculture;
- The Minister for Agriculture and Natural Resources;
- The Minister for Rural Development and Cooperatives;
- The Development Authority for the Sokoto Rima Basin;
- The Rural Development Programme for the State of Sokoto.

There is no official coordination structure covering these various institutions, to which should be added the water departments.

By contrast the Federal Minister for Agriculture has created a Federal Agricultural Coordination Unit (FACU) which supervises four Federal Agricultural Support Units (FASU), one of which will be installed at Kano. However the competence of these Units is limited to the projects of the Minister.

One should also note the creation of an Agricultural Projects Monitoring, Evaluation and Planning Unit (APMEPU) based at Kaduna. Finally a zonal office of the Department of Rural Development will be established at Kano.

In addition to this network of organizations responsible to the Federal Minister for Agriculture there are eleven authorities for the development of the basins, three of these being in the frontier zone. These are Sokoto-Rima, Hadejia-Jama'are (Kano) and Chad (Maiduguri): the latter is not to be confused with the Commission for the Basin of Lake Tchad, based at N'Djamena.

The climatic constraints which bear heavily on Nigerian agriculture are clearly less serious than those which handicap its neighbour. However over the whole of Nigeria there are the problems posed by the extremely rapid urbanizacion which deprives the country of an important part of its labour force. The Nigerian peasant reacts to his present difficulties like his neighbour to the North; he increases the areas which he cultivates rather than intensify his production systems.

The result is an increasingly serious deficit in food production: over 15 years this has only increased by 1% a year (the production of millet has actually fallen by 1% a year). It has beer estimated that in less than 10 years the structural deficit will reach 40% of the demand. It is to obviate this risk that the Federal Government launched the "Green Revolution" on which it has based great hopes.

Meanwhile the natural - and well known - economic consequence of this growing deficit has been the frightening increase in agricultural prices and a rapid increase in imports of foodstuffs; this situation is the principal cause of the high rate of inflation in the country.

Previous development programmes have attempted to resolve the crisis by means of massive investments in major hydro-agricultural schemes. These have not produced the expected results, 90% of the production coming from the small peasants who have just been able to survive without any improvement being made to this sector. However some pilot trials have been undertaken since 1974 and these will result in a major programme of agricultural development.

The permeability of the frontier, inevitable in the light of a highly homogeneous socio-economic environment, has direct effects on the Nigerian economy. Conscious of this fact the two governments are attempting to make the trading flows official and even to develop them (e.g. in onions, cattle, etc.)

2.3. The situation in the three basins

The region with which we are dealing here extends, broadly speaking, from the 4th to the 10th lines of longitude, with a depth of about 100 km on each side of the frontier. With a total population estimated at 9.5 million inhabitants this is one of the most densely populated regions of the West African sub-continent. In Nigeria only the south-west and the left bank of the Niger river over its last 300 km are more densely populated. In Niger the southern parts of the regions of Tahoua, Maradi and Zinder account for 36% of the total population of the country.

It is not surprising therefore to observe, in this region, rapid changes in the ecosystem in the direction of rapid degradation. This process is of long standing, and has simply been aggravated by the drought.

The reaction of the peasant class is not an intensification of the systems of production but an increasing extension of the consumption of the land capital. The disappearance of fallow land, a reduction and over-exploitation of pasturage and the destruction of the vegetable cover are the most dramatic consequences of this. It is estimated that, by the end of the century, the level of utilization of arable land will be 100%. Since the degradation of the soil obviously results in falling yields and of per capita production the population finds another manifestation of reduced resources in the exodus which seriously affects the labour potential in Nigeria; this is also considerable in Niger.

Multidisciplinary research has recently been carried out in the Maradi region: its conclusions confirm the findings which have been made by all observers of the land :

"The intensity of exploitation of the geographical space poses, in an acute manner, the problem of the equilibrium of the natural environment and its resources. This is particularly serious in the case of sandy soils which are the ones most utilized. Under the effect of clearing, but also of pasturage and of its removal for domestic purposes (building, heating), the natural vegetation has been considerably degraded. The soil itself, cultivated with increasingly short fallow periods increasingly spaced out and receiving only inadequate additions of organic manure, shows decreasing fertility and increasing liability to suffer wind erosion."

"In certain sectors of high density, which are subject to high pastoral usage, over-pasturing has as its effect an increase in the erodability of the soil by the combined action of trampling and the absence of vegetable protection. In places it is possible to observe the phenomena of glazing and of sterilization of the soil."

"This regressive evolution of the natural resources (soils and vegetation) under the influence of too intense exploitation has reached such a degree in certain sectors that it now constitutes a serious matter of concern for the peasants."

Objective analytical methods and this expression of the concern of the peasants combine to demonstrate an increasing lack of equilibrium between the natural resources and the systems for exploiting the environment.

This is undoubtedly one of the most detailed scientific studies which has been carried out on the region and one may reasonably assume that its observations are valid for the whole of the latter.

All these phenomena of degradation obviously result in falling yields. On this subject it is possible to believe that the official estimations made by the technical departments are too optimistic. In place of a mean cereal yield of the order of 450 kg/ha a figure of 300 kg/ha would be more realistic - and accurate but ad hoc studies have shown that the yields may fall to less than 100 kg/ha taken over the whole of a village.

The situations are, however, much more heterogeneous than is generally believed, both from the point of view of production and also of the socio-economic situations which arise from them. The concept of "mean exploitation" to which reference is frequently made must be treated with great caution; the availability of land, the yields, the production per worker and the available surplus can vary over enormous ranges (from one to four or one to five) for the same soil.

2.4. Rural development projects

Niger and Nigeria, as we have shown, give the rural sector a priviledged place in their plans and their development programmes.

In Nigeria the approach to rural development is "integrated and multi-disciplinary, taking into account the major factors affecting the well-being of the rural population." The promotion of agriculture is accompanied by specific measures to improve the environment, such as service routes, supplies of drinking water, storage infrastructures, etc.

In Niger also the dissemination of methods for improving and safeguarding the land capital goes hand in hand with the utilization of insufficiently worked land and better organization of the infrastructures (credit, marketing, storage, etc.).

In order to achieve these objectives major integrated development projects have been implemented in both countries: "productivity" projects in Niger, agricultural development projects (ADP) in Nigeria. It is in this way that the whole of the frontier region is covered by such projects or will be so covered. These projects involve the whole of each State in Nigeria and each region in Niger (with the exception, at the present moment, of Tahoua where the Maggia valley is not directly affected but where a very large irrigated area is being developed).

The magnitude of the resources budgetted for the coming years is a measure of the problems to be solved and is evidence of a genuine desire to solve them.

Rural development projects

(Recent realizations and five-year forecasts) (in $ millions)

NIGER		NIGERIA	
Tahoua	7	Gusau (Sokoto)	48
Maradi	61	Sokoto (1)	165
Zinder	19	Funtua (Kaduna)	60
Diffa	6 (2)	Kaduna (1)	223
		Gombe (Kano)	48
		Kano	229
		Borno	157
Total for Niger	$93m	Total for Nigeria	$930m

However, in implementing this "project by project" strategy one comes up against serious constraints. This strategy assumes firstly the reinforcement - if not the effective creation - of the leadership of the peasant world. The resources in personnel are insufficient, particularly at middle level and for local management. Some trials have been carried out in areas on self-management, but the methods are scarcely developed as yet, and the results remain limited.

The governments find themselves torn between the need to act very rapidly ("to fix as the first objective to move rapidly so as to offset the uncertainties of the future", as it is expressed in the Niger Plan) and the limited capacity to transform the structures of the rural world. The conservatism of the latter is well known; it evolves slowly, and not in the direction which is desired, as is shown by the increasingly extensive practices in agricultural systems. The peasant world, which is also very fragmented, receives the "technological packets" which are presented to it with reserve and distrust.

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(1) In the case of Nigeria these are forecasts drawn up in 1979 by the World Bank: after evaluation the Sokota and Kaduna ADP were estimated at $500m and $511m respectively.

(2) Niger: forecasts in the Plan, but a more recent evaluation estimates the cost of the Diffa project at more than $30m.

It has been possible to show that the latter, drawn up outside the country, are not in harmony with the social system. They stand at a distance from the present know-how of the peasants - which is suited to the conditions of their survival - and are in fact based on doubtful agronomic data: as examples one can cite the attempts to convince the peasants to abandon companion cropping, or the selection of young men without social authority to put into effect village self-management or local management (1).

One also observes blockages in the process of development. The results of the massive investments granted (as, for example, the enormous sums granted to the major irrigation projects in Nigeria), remain largely below the forecasts and leave largely to one side the immense mass of small peasants - when they do not make them marginal.

From an examination of the principal projects (to which should be added the ad hoc actions not listed here but affecting more particularly the stock-raising and forestry sectors) it can be seen that the frontier zone is completely covered by the programmes contained in the Fourth Plan.

2.4.1. In Niger

It should be noted that the regional projects are devoted essentially to increasing agricultural production (irrigated and depending on rain) but also include all the operations of stock-raising, re-afforestation and soil re-establishment.

The list of projects affecting the frontier zone is given in Annex 5. It gives some information on the following projects :

	Forecast sum (US$ millions)	External Participation	Dates of Execution
Cereals project :			
Phase 1		US	1977-80
Phase 2	11.9	US	1981-85
East-Central Stock-raising	16.7	AID	1979-85
Re-afforestation	5.3	AID	1979-81
Productivity :			
Pilot phase	2.8	GTZ	1980-83
Phase 1	4.0	GTZ	1983-
Konni area	32.0	Arab Fund	1978-82
Maggia areas			Continuous
Galmi areas		GTZ	
Mares Konni		FED	1982 (2)
C' Darma Tahoua	2.0	UNO	1979

(1) See, on this subject, and in addition to the Bordeaux University study already cited, the very complete study carried out by the World Bank on North Nigeria "Adoption of Farm Technology in Northern Nigeria".

(2) Study.

	Forecast sum (US$ millions)	External Participation	Dates of Execution
Maradi Rural Development :			
Phase 1	13.2	AID	1976-80
Phase 2	47.5	AID/FIDA/CCCE	1981-85
Zinder Rural Development :			
Phase 1	2.1 (1)	FED	1973-76
Phase 2	8.0	FED	1977-80
Phase 3	8.8	FED	1981-83

2.4.2. In Nigeria

The dramatic degradation of agricultural production caused the Federal Government to initiate in 1974 a vast programme of integrated agricultural development projects. This programme commenced with nine pilot projects, each limited to only a part of certain States. Two of these involved the frontier States which concern us, namely Sokoto (Gusau) and Kaduna (Funtua).

The success of these projects led to the preparation of new and vaster agricultural development projects, covering the whole of certain States, namely Kano, Kaduna and Sokoto. Finally zones of "accelerated development" were delineated, and in these the State was responsible for instituting the basic development infrastructures, namely a programme of rural tracks and centres for the distribution of inputs.

The following principal projects are described in Annex 5 :

- Sokoto agricultural development;
- Kaduna agricultural development;
- Gada Valley development;
- Lake Kalmalo irrigation area.

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(1) Amount of the external participation.

2.5. The possibilities of intervention and the plan of action for rural development

Analysis of the present situation and the results of previous or current programmes, although pessimistic, does not lead to a finding of powerlessness. Observers agree on the measures likely to at least halt the regressive process. It is first necessary to stabilize the productive system before speaking about any real "development" of it.

The analyses made by the mission are in line with the observations made by other missions - such as that to Komadougou-Yobé - together with the evaluations of certain projects in the region and the studies carried out by research workers.

It is possible to identify four groups of constraints which weigh on the Sudano-Sahelian region which is common to Niger and Nigeria. The factors which compose these, a summary of the remedies required to overcome them and an inventory of the instruments needed are set out in Table 1.

These constraints are :

- the accelerated degradation of the environment,
- the failure of the present programmes to meet the needs,
- the under-employment of water resources,
- certain politico-administrative structures.

The means to be utilized come simultaneously from the technical and socio-economic fields.

From the technical point of view :

- the development and orientation of research so that it is better suited to the needs of the development programmes,
- the intensification of production by the application of the results of research work,
- the intensive utilization of surface and subterranean water resources.

However the technical constraints are not the most serious ones. In general the recipes are known, and it is mainly their application which is a brake on their use (it will be noted that in certain particular fields technical knowledge appears to be insufficient: the cultivation of short-cycle varieties which are at the same time adapted to the climatic risks and are accepted by the consumers, irrigated crops, etc.).

It is in the socio-economic field that the greatest effort must be made :

- the participation of the mass of the producers: political participation, direct participation in the preparation and implementation of the programmes, increased encouragement resulting from the valorization of the products,
- the training of producers and managers,
- the development of supporting infrastructures (credit, marketing, storage),
- the in-depth knowledge of physical and human resources,
- the coordination of the development institutions.

It would seem therefore that the search for solutions is to be found more at an institutional level that at a technical level. One may take as an example the development, judged to be too slow, of the programmes for utilizing water resources. This utilization is regarded by all as the only route to opening up broader perspectives for solving the problem of the saturation of the land and of the recovery of production. However this utilization comes up against the absence of a well trained and specialized manager class, the difficulty of ensuring the motivated and continuing participation of the peasants (which is even more essertial here), and the lack of links between research and its dissemination. The paradox which is created by programmes of this type is that, at the same time, they offer a vast field of action but assume the multiplication of small operations side by side with projects of the largest scope. But the small operations require as much work for their identification, realization and management as the major projects.

It is undoubtedly this which explains why the major projects now being put into effect are all more or less cast in the same mould. They call on well known recipes for dissemination and management in relatively limited fields, despite the range of their material resources.

They are centred essentially on crops reliant on rain. Furthermore they tend to constitute, within the region, a series of sub-regional entities between which no strategic liaison exists at the present time. The creation of the monitoring and evaluation unit (APMEPU) within the Nigerian Federal Ministry for Agriculture is a happy augury of cooperation. The creation of a Projects Office (BEPRO) within the Niger Ministry for Rural Development is along the same lines. However these organizations remain administratively limited to the competences of the departments to which they are responsible.

It seems therefore that the Joint Nigerian-Niger Cooperation Commission (CMN-NC) could intervene effectively in the direction of coordinating the regional development strategies.

However, in the present state of institutions and procedures, it would be utopian to attempt to formulate a "super-project" for the development of the region, and the recommendadtions set out below are limited to a first stage which, although less ambitious, is nonetheless fundamental.

This stage will comprise a series of sectoral and institutional interventions having as their general principle that of accustoming the various operators in the development programmes to working together (1). The reinforcement of the planning structures within the Committee itself will be accompanied by :

- an exhaustive inventory of joint surface and subterranean water resources;
- the formulation of the legal and institutional framework within which the plan of action is to be drafted;
- the creation of a documentation and information centre, in particular to provide for the better mutual information of research workers.

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(1) More than 40 major operators (not counting governmental technical departments) are involved in development activities in the region (see Annex 3).

These are interventions in the fields of studies and of institutions. On an experimental basis two programmes for specific realizations are put forward: a project for the defence of the environment and a programme for the wider dissemination of agricultural equipment.

The formulation of the projects making it possible to realize these interventions is set out in Chapters 5 and 6. Their execution should result, at the end of the next two years, in the formulation of a plan of action for development, the terms of reference for which are sketched out below.

Within the Nigerian-Niger frontier region the catchment areas studied by the present formulation mission may themselves be considered as pilot development zones. The traditional productive systems (essentially agriculture dependent on rainfall and transhumant stock-raising) will be converted to ensure the integrated exploitation of all the resources, whilst at the same time re-establishing an ecological equilibrium which is, at the present time, jeopardized.

This exploitation will largely be based on the efficient utilization of the water resources. This assumes the complete re-planning of the soil.

The plan of action will be based on the data collected either directly by the technical team or during the various studies carried out in other connections. The content of this plan is specified in Chapter 5, in the terms of reference of the actual project.

3. THE THREE SHARED BASINS

3.1. Definition of the study zone (Map 1)

The original formulation of the terms of reference of the present study takes into account a "project for the valorization of the seven basins shared by Niger and Nigeria", that is to say, from West to East, the following basins :

1. Tombo Bouya
2. Maggia
3. Goulbi de Maradi
4. Goulbi de Gabi
5. El Fadama
6. Tagwai (1)
7. Koramas

After consulting the topographical maps of Niger and Nigeria and site visits the zone covered by the present project for studies finally consisted of three shared basins.

1. Udah River: situated entirely in Nigeria, the surface waters of which infiltrate totally before reaching the frontier. The Tombo Bouya River, which continues into Niger and which is shown on the IGN maps, does not exist on the ground, and the inhabitants of its assumed zone do not know of it. Given the relatively negligible importance of this basin in the development strategy for the region the mission recommends that it be excluded from the zone of the project.

2. La Maggia in Niger, which is known under the name of the Lamido River in Nigeria, flows into the Kalmalo lake near the frontier on Nigerian territory. This lake has no outlet but only a succession of elongated lakes and marshy areas without any visible surface flow, up to the confluence with the Rima River.

3.-4. La Gada River: occupies the catchment area in Nigeria upstream of the Goulbi de Maradi which, after flowing for 130 km through Niger re-crosses the frontier before flowing in a few kilometres into the Rima River. The Goulbi de Gabi is a tributary on the left bank of the above system, with its source in Nigeria and flowing into the main river on Nigerian territory a few kilometres from the frontier.

5.-6. The following adjacent basin consists of the two main tributaries of the Goulbi N'Kaba: firstly the Tagwai River with its two main tributaries the Kaita and Yeska forms the Nigerian upstream course of the El Fadama; secondly the Sabke River (Nigeria) flows into the May Farou in Niger. Below their junction this latter and the El Fadama form the Goulbi N'Kaba from which all the surface waters infiltrate into the alluvia after a course of some forty kilometres.

7. The Koramas are formed by the two branches Korama de Matameye and the Tapkin Gada Kwaya. After they join the downstream Korama infiltrates totally into the dune formations up to the Niger village of Malawa. There is no surface flow into Nigeria, but a subterranean flow probably rejoins the alluvia of the Tomas River, an intermittent tributary of the Komadougou-Yobé.

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(1) In some documents this is spelt "Tagwal".

As with the Udah River- Tombo Bouya system the mission recommends that the Koramas be excluded from the zone of the project, since this basin does not play any joint role between the two countries.

The catchment areas 1 to 6 as set out above form part of the hydrological system of the Niger River, whereas 7 belongs to the Lake Tchad basin.

In conclusion, therefore, the mission recommends that the zone in which the interventions of the JN-NCC should be concentrated is limited to the following three basins:

No.	Name of the catchment area	Niger	Nigeria	Total
A.	SURFACE AREA OF THE CATCHMENT AREAS (km^2)			
1.	Maggia-Lamido	2,290	760	3,050
2.	Gada-Goulbi de Maradi	5,360	4,400	9,760
3.	Tagwai-El Fadama	2,190	6,200	8,390
	TOTAL :	9,840	11,360	21,200
B.	MAXIMUM LENGTH OF PRINCIPAL WATERWAY (km)			
1.	Maggia-Lamido	130	72	202
2.	Gada-Goulbi de Maradi	125	115	240
3.	Tagwai-El Fadama	43	90	133
	TOTAL :	298	277	575

Information concerning the hydrology, hydrogeology, existing or future development plans, etc., was collected by the mission and covers the zone of the project with varying degrees of detail and with different accuracy from one basin to another and particularly from one country to another, the information being much more centralized and accessible in Niger than in Nigeria.

The study zone of the basin of the Maggia to that of the Tagwai-El Fadama extends, from West to East, for a distance of about 380 km (from longitude 5° to 8°30' E.). The extreme North-South extent of 230 km lies between latitudes 12°20' and 14°30' N. The basins on Niger territory consist of valleys cut into the lateritic plateaux of the plane topography. In Nigeria the upstream basin of the Gada River and Tagwai River systems is situated in the Zamfara massif, the undulating topography of which is formed by eroded hills. The altitude of the basins lies between 250 and 600 metres.

3.1.1. Climate (Table 2)

i) Rainfall

The study zone of the three basins falls between the 400 mm isohyet in the North (Niger) and the 800 mm isohyet in the South (Nigeria). The frontier effectively follows the 600 mm isohyet. The climate in the Niger part is thus of the Sahelian type whereas that of the Nigerian part is of the Sudan type. The interannual distribution is similar throughout the whole of the zone. The dry season, which extends from October to the end of May, may however experience some sporadic sudden showers, particularly in the South. The dry season ends when the hot winds from the South-West, which are relatively humid, penetrate into the zone. The rainy season begins to establish itself rapidly with a rainfall maximum in August, generally the only month when the rainfall is greater than the evaporation. The total duration of the rainy season increases from 90 days in the North to 120 days in the South (Katsina). A factor which is certainly more important for agriculture than the total rainfall is its more or less regular distribution during the rainy season. It may happen that there is a series of heavy rains, separated by hot and dry periods resulting in the death of plants at the start of the vegetative cycle. Downpours of a continuous nature are however rare, and more than 100 mm of rain may fall over a period of a few hours.

ii) Evaporation and Temperature

The annual evaporation falls from about 3000 mm in the North to about 2000 mm in the South. The maximum is in March-April and the minimum in August when the relative humidity is at its highest.

The mean temperature is around 27°. The coldest month is January, with 22°, and the hottest May with 33°. During the dry season the dominant wind is the very dry Harmattan which blows towards the South-West and comes from the Sahara. During the rainy season the winds swing round to the North-East (monsoon).

3.1.2. Hydrology

None of the watercourses in the study zone flows continuously, and the period of flow is also intermittent with time (saw-tooth hydrogram) and also often along its course. The flow generally starts in May-June and ends towards the end of October. The upstream area of the catchment areas, whether in Niger (Maggia) or in Nigeria (Gada and Tagwai) consists of a well-defined hydrographic system which becomes progressively degraded downstream in the form of large zones of spreading or infiltration, and evaporation becomes preponderant. The bed may disappear completely for some distance (Maggia and El Fadama), eventually re-appearing further downstream over limited lengths in the form of pools and lakes. The interaction between surface and subterranean water is therefore preponderant in the downstream part of the basins where the subterranean water resources in the alluvia are generally considerable. This configuration of the catchment areas implies that the surface flowrate of these watercourses decreases from upstream to downstream as the degradation of the hydrographic system becomes more accentuated.

3.1.3. Generalized regional aquifers

The information of a general type on the underlying aquifers in the project zone is taken from the "Atlas des Eaux Souterrains du Niger"* produced by the BRGM in 1978. Two aquifers of considerable extent are concerned with part of the project zone and terminate at an angle on the precambrian bed or on the impermeable primary formations which overlay it to the South of the Niger-Nigeria frontier.

However the most important resources of subterranean water, and the ones which are most easily mobilizable for hydro-agricultural purposes, are contained in the recent alluvia covering the valleys of the watercourses in the study zone. A description of these alluvial layers is given individually for each basin in the continuation of this chapter.

i) The Intercalary Continental or Hamadien is an important continental series composed of sandstones, clayey sandstones, sands and clays which underlies almost the whole of the project area. Its thickness decreases to the South from a maximum of 200 - 300 metres to zero at the limit of the outcrop of the precambrian bed along a line passing to the South of Sokoto, half-way between Madarounfa and the frontier, descending to Katsina and rising again to the North of Daura.

The Intercalary Continental outcrops in the East of the project zone, starting from a North-South line which approximately follows the boundary between the regions of Tahoua and Maradi. The low permeability is of the order of 0.01 to 1.0 m/day and the phreatic level is between 10 and 50 metres below the topographic level. In this outcrop zone this series does not present any very interesting potentialities.

To the East of the outcrop the Intercalary Continental is confined or semi-confined by the layers of the Cretaceous or Palaeocene which partially isolate it from the underlying Terminal Continental. The bed is therefore under load, and its hydraulic characteristics are improved with a permeability of the order of 5 m/day. However the roof of this aquifer falls off rapidly to the West up to a depth of 600 - 700 metres, which again makes it not very propitious for hydro-agricultural exploitation.

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* Atlas of Subterranean Waters in Niger.

The general direction of the generalized flow of the water layer is from the North-East to the South-West; the slope of the piezometric surface is of the order of 0.05%.

ii) The Terminal Continental is formed from a complex series of sandstones, clays, sand and silts laid down in discontinuity, both laterally and in depth. The water-bearing layers fill the North-South synclinal axis passing through Dogan-Doutchi and extending to the East up to the limit of the outcrop of the beds forming the roof of the Intercalary Continental.

The Terminal Continental forms a multi-layer, the water layer of which may be locally under pressure. In depth the sandy levels, which may be formed of well graded and washed sands, form natural drains of considerable horizontal extent and of high permeability, making it possible to obtain high flowrates.

This layer, in the project zone, is only present under the Maggia-Lamido basin. The superficial layers contained in the alluvia of this valley drain into the Terminal Continental.

3.1.4. Water consumption

In relation to the hydro-agricultural developments an attempt was made to obtain a rough estimate of the volumes of water consumed annually so as to allow a comparison of this figure with the few figures available on the water flowrates. It is however evident that the latter do not represent the total availability of water since they already take into account the consumption of all the developments previously constructed, and that water conservation measures to reduce evaporation would make it possible to increase considerably the volumes available, whilst finally the considerable resources of subterranean water are not taken into account.

In the absence of measurements of water consumption in the existing areas the annual irrigation usage of 15,000 m^3/ha, that is to say 10,000 m^3/ha for the dry season crops and 5,000 m^3/ha for additional irrigation during the rainy season, is generally put forward by the technical departments concerned. This usage is taken into account uniformly for all the irrigated areas.

The surface area of the plots irrigated in the dry season by wells and shadoofs in the bed of the watercourses is broadly estimated as being a continuous strip of 40 metres width along the main bed. The water consumption is estimated as 10,000 m^3/ha.

The water consumption for human and animal use is estimated to be negligible as compared with the irrigation needs (excepting the pumping stations for supplying the larger Nigerian towns).

The above data are applied in the estimates of water consumption in each of the three basins described in paragraphs 3.2. to 3.4.

3.1.5. Administrative limits and population

Table 3 summarizes the data concerning the population of the frontier region, whilst Tables 4 and 5 give the details for each of the basins.

In both countries the basins are amongst the mostly densely populated zones. The total population of the basins is slightly in excess of 2 million, divided up as follows :

	Niger		Nigeria		Total	
	Area km^2	Popn. 1000's	Area km^2	Popn. 1000's	Area km^2	Popn. 1000's
Maggia-Lamido	2,290	167	760	154	3,050	321
Gada-Goulbis de Maradi and Gabi	5,360	314	4,400	489	9,760	803
Tagwai-El Fadama	2,190	120	6,200	843	8,390	963
TOTALS	9,840	601	11,360	1,486	21,200	2,087

Whilst the mean population density in the region is 66 per square kilometre and for all the basins is 98, one finds locally densities which are much higher, often in excess of 200 persons/km^2 as in the valley which extends downstream of the Lamido River or in the Goulbi upstream of Maradi.

The great majority of the population are of the Hausa race. In Niger 15% of the region consists of nomads, mostly Peulh. No valid figures are available for Nigeria, but it is known that nomads there are relatively even more numerous. The trend for the shepherds to become sedentarized is very noticeable and they already constitute a considerable minority within the sedentary agricultural population.

The presence of this evolving population constitutes an element which will have to be taken into account later in the analysis of those socio-economic factors which will determine the regional development policy.

3.2. The Maggia-Lamido basin (Map 2)

3.2.1. Hydrographic system

The Maggia basin consists of a system of valleys cut into by numerous tributaries of pronounced slope - called "koris" - in a lateritic plateau of plane topography. These koris flow into the main marshy alluvial valley where the principal watercourse, describing many meanders, frequently changes its bed after the floods. After about a hundred kilometres the hydrographic system becomes progressively degraded until it only forms a succession of pools and spreading zones without any strictly defined surface flow. Downstream of Birni N'Konni the Maggia (or Lamido) becomes reconcentrated to feed the Kalmalo on Nigerian territory near the frontier. A straight flood plain about 60 km long joins the lake at the Rima River. This plain is cut into over practically all its length by a fossil bed of variable width where, according to appearances, the permanent lakes which feed it are supplied solely by the phreatic layer.

3.2.2. Administrative limits

The valley of the Maggia concerns the three districts of the Tahoua Region through which it runs: Bouza, Madaoua and Birni N'Konni, and is characterized by intensive exploitation and a very high population density of between 50 and 80 persons per square kilometre (see Table 4).

In Nigeria the basin covers the West of the Local Government of Gwadabawa which is again characterized by a very high population density of 129 persons per square kilometre, the highest in the State of Sokoto.

3.2.3. Flow patterns

The pattern of flow of the Maggia is characterized by an intermittent surface flow from July to September. The specific flowrates (very high in the small koris) fall from upstream to downstream, becoming zero after the Kalmalo Lake. As a result the annual volume of water carried by the Maggia increases in the upstream part of the basin to a maximum, and then falls to zero as the basin becomes degraded. This characteristic is in fact common to all the basins which are considered in this study. The reduction in the surface flow is probably compensated for by the intense evaporation in the pools and marshy areas, and also by considerable infiltration into the underlying aquifers. The proportion of these various items in the hydrological balance sheet is not known at the present time.

Three gauging stations located only in Niger (Map 2) are operated and the annual flow volumes (in Mm^3) are given in Table 6. The Tsernawa station is located just upstream of the degraded zone of the basin where the bed is still relatively well-defined. The two following stations (Tierassa and Birni N'Konno) are located respectively 10 km and 12 km downstream in the spreading zone and show a considerable reduction in the volume of surface flow: for the four years when measurements have been carried out at the three stations (1972 to 1975) the volume still flowing at Tierassa and Birni N'Konni was only 57% and 45%, respectively. According to the data collected by Nedeco the evaporation from the Kalmalo Lake, situated 13 km downstream, would be 30 to 40 Mm^3 per year; this would effectively correspond to the mean surface make-up, in this way confirming the absence of surface flow downstream of the Kalmalo Lake and up to the Rima River.

3.2.4. Alluvial layers

The alluvia of the Maggia have been studied in Niger by the use of a mechanical drill, followed by pumping tests. The alluvia of this valley are of the sandy-clay type with a mean depth of 15 to 20 metres. The borings have shown that the sand and washed gravel reservoirs are individualized. The permeabilities are high, of the order of 10 to 50 m/day. However tests have shown that pumping was being carried out in reservoirs of reduced extension, the limits of which were rapidly reached by the depression cone.

The constant presence of the upper cretaceous bedrock, with salt and gypsum, results in relatively high salt contents of between 500 and 1200 mg/litre.

The renewable resources (recharge) are estimated at 5 Mm^3/year, the supply coming essentially from the minor bed and the floodable zones. Given the limited lateral extension of these alluvial aquifers the borehole flowrates which could be expected should be limited so as not to exhaust the phreatic layer locally.

No systematic study has been carried out on the Nigerian part, consisting of a vast flood plain where the phreatic level is located in the proximity of the topographic level.

3.2.5. Hydro-agricultural developments and water supplies

The Maggia-Lamido basin includes the greatest number of irrigation areas of the three basins in the project zone. It also includes, in Niger, the largest dams so far constructed.

Niger is putting into service two major constructions which should allow the valorization of the Birni N'Konni areas (2600 ha). A series of small areas have been, or will be, developed in this valley for intensive working. In Nigeria a major programme for the valorization of the Kalmalo Lake zone was implemented in 1978. An area of 270 ha has been equipped, but the abnormally low level of the Kalmalo Lake has not made it possible to irrigate all the area which has been developed. At 25 km downstream of the lake the Tugan Tudu spring irrigates 120 ha by gravity, and a small area of 30 ha is supplied by boreholes. The Kware Lake supplies 5 Mm^3 for drinking water supplies for Sokoto.

Table 7 gives the list of the existing and future developments, together with the potentialities which have been identified. It will be seen that the existing consumption of 53 Mm^3 is similar to the mean flowrate at Tsernawa of 72 Mm^3. It is judged improbable that the total needs of about 190 Mm^3 for the complete implementation of the hydro-agricultural potentialities could ever be met: according to the estimate the total virtual water resources (1) of the Maggia basin in Niger alone is 188 Mm^3 and this, extrapolated pro rata to the total surface area, gives a figure of about 160 Mm^3.

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(1) Volume of flow mobilized "on site", and hence with evaporation and infiltration deducted.

3.3. Gada - Goulbi de Maradi (Map 3)

3.3.1. Hydrographic system

The Gada River system, the upstream part of the hydrographic system, is situated in the eruptive massif of Zamfara in Nigeria. Due to the nature of the substratum, which is impermeable and difficult to erode, the hydrographic system is highly developed, consisting of tributaries which flow in all directions.

The quasi-uniform geology is formed from massive igneous rocks from the precambrian bedrock and also locally from sedimentary rocks in practically horizontal strata without major faults. The slopes are high in this region since the maximum deflection from the level between the line of dividing of the waters and the bed of the river at the frontier is of the order of 350 m over a length of about 90 km. Shortly after the frontier the bed of the Goulbi de Maradi (the prolongation of the Gada River in Niger) is hollowed out in the Intercalary Continental formations which outcrop in this zone, and is fed by only one important tributary, the Goulbi de Gabi, the catchment area of which, with an area of some 720 km^2, also begins in Nigeria. The Goulbi de Gabi flows into the Madarounfa Lake which has a surface area varying, from the dry season to the rainy season, from 100 to 700 ha. This is linked with the Goulbi de Maradi by a natural channel in which the direction of flow may be reversed according to the respective levels of the lake and the Goulbi de Maradi.

Downstream of the lake the major bed is enlarged from about 1 to 3 km, whilst meanders of the minor bed appear in the alluvia in the zones of spreading. After about 120 km on Niger territory, where the greater part of the surface waters infiltrate, the Goulbi de Maradi again enters Nigeria where it flows into the Rima River some kilometres from the frontier.

3.3.2. Administrative limits

The source of the Gada River is in the Local Government of Dutsin Ma. with about 100 inhabitants/km^2 it is one of the most densely populated areas of the State of Kaduna, and the population increases even more downstream, in the Local Government of Katsina.

The population is equally large beyond the frontier; of the order of 50 inhabitants/km^2 upstream of Madarounfa, both on the Goulbi de Maradi and on the Goulbi de Gabi. But between the Madarounfa Lake and the capital of the Region it borders on 200 persons per km^2 and remains very high (65/km^2) between Maradi and the frontier. It is not surprising therefore to find, throughout the whole of the basin, a considerable rate of exploitation of the soil. The almost complete disappearance of fallow land and over-pasturing characterize the zone on both sides of the frontier. For many years now the peasants have cultivated fadamas on the lake shores (see Table 5).

3.3.3. Flow patterns

The flow takes place between June and October, at first intermittent and then generally continuous.

Five gauging stations have been installed on the Gada-Goulbi de Maradi and one on the Goulbi de Gabi. The annual flow volumes measured at these stations are given in Table 8 from upstream to downstream. The differences observed from one station to another do not follow a single process from one year to another (downstream increase or decrease in the volumes carried). It is therefore possible that the existing data suffer from a wide margin of error due to the difficulty in carrying out accurate gauging in the beds of alluvial rivers with a moving bed, resulting in instability with time in the height-flowrate relationship. For example the measurements of the annual volumes flowing at the neighbouring stations of Jibyia and Nielloua, 4 km apart and on opposite sides of the frontier, show considerable and non-systematic differences from one year to another (see Table 8). Similarly the surface areas of the catchment area intercepted at each station do not agree, that determined by the upstream station being greater than that of the downstream station.

The study programme on surface waters implemented by the technical departments of the two countries under the aegis of the JN-NCC is particularly concerned with the operation of the Nielloua and Jibiya stations so as to make the hydrometric data compatible.

3.3.4. Alluvial layers

The alluvia which fill the major bed are differentiated, and fossil beds, consisting of sands and well-washed pebbles from the crystalline massif of the basin upstream of the watercourse, form channels within the clayey or sandy-clayey alluvia. The thickness is about thirty metres, and pumping trials have shown very high permeabilities of the order of 5 to 50 m/day and a specific flowrate of 1 to 25 m^3/h.m.

The phreatic layer is situated at a level which depends essentially on the recharging from the floods: situated at a depth of 3 to 5 metres near the frontier it dips to between 14 and 18 metres at Guidam Roumji where the whole of the flood has infiltrated upstream. The quality of the subterranean water is average, with salt concentrations of the order of 300 mg/litre. It should be noted that the Goulbi de Maradi alluvial layer is in continuity with the regional layer of the Intercalary Continental in which the Goulbi has carved out its bed. Possible exchanges therefore exist between these two aquifers.

The annual recharge of the goulbi de Maradi is estimated by the SCET as being between 19 and 38 Mm^3/year.

3.3.5. Existing and future developments (Table 9)

On the Nigerian side an ambitious project for supplies of drinking water for the province of Katsina, associated with irrigation areas, has been placed under the competence of the Sokoto-Rima River Basin Development Authority. It comprises the construction of 5 dams with a total capacity of 244 Mm^3 on the Gada River or its major tributaries. Realization of this programme is planned for the next 15 years (1980 to 1995), and it has been approved by the SRRBDA in collaboration with the Ministers for Agriculture and the Water Boards of the States of Sokoto and Kaduna. However the very considerable reductions in the budgets in the present Five-Year Plan (1981-1985) makes it already possible to forecast that the realization of part of this programme risks being deferred.

In Niger, and apart from the traditional irrigation of market gardens by wells and shadoofs, the Maradi productivity project has begun the construction of irrigation areas over 210 ha by pumping from the alluvial layer, and the objective is to develop from 1000 to 1200 ha over the next four years. Other developments based on dams and pumping from the Madarounfa lake have been studied to various degrees during the sixties. In particular two projects for building dams are being studied on both sides of the frontier, about thirty kilometres apart: these are at Jibiya in Nigeria (142 Mm^3) and Kountoumi in Niger (100 Mm^3). At the present time the joint study which the two countries are carrying out involves determining the annual volume of flow; this will make it possible to determine the respective capacities of the two dams.

By comparing Tables 8 and 9 it can be seen that, at the present time, the available water resources are largely underexploited but that, on the other hand, the utilization of the identified potentialities of irrigatable land largely exceeds them.

3.4. Tagwai - El Fadama (Map 4)

3.4.1. Hydrographic system

The Nigerian part of the Tagwai - El Fadama basin is separated into two independent sub-basins: to the west the Tagwai (which shares a watershed with the Gada - Goulbi de Maradi system) and prolonged in Niger by the El Fadama. To the east the Sabke is a tributary of the May Farou which runs along the frontier on the Niger side. The meeting of the El Fadama and the May Farou, about sixty kilometres from the frontier, then flows into the valley of the Goulbi N'Kaba where all the water infiltrates. This dry fossil valley follows a course which is the arc of a circle concentric with the Goulbi de Maradi, and then recrosses the frontier to join the Rima River.

In Nigeria the upstream stretch of the Tagwai River flows across the undulating plains of the precambrian bed (eruptive massif of Zamfara), the downstream part and the whole of the basin of the Sabke River having cut into the sedimentary Cretaceous plains. The principal valleys are well marked, and a dense system of tributaries falls perpendicularly to the principal bed. Near the frontier the density of the tributaries diminishes and in Niger there are none apart from the May Farou which rises near Matameye in the Zinder Region.

3.4.2. Administrative limits

The basins of the Tagwai and of the Sabke River fall within the Local Governments of Mani and Daura. As in the whole of the North zone of the State of Kaduna (Katsina) there is a high population density (from 100 to more than 150 persons/km^2). The May Farou rises in the Local Government of Daura (see Table 5).

In Niger the El Fadama crosses the canton of Gazaoua (district of Aguié) whilst the May Farou runs along the southern part of the canton of Korgom after rising to the south of Matameye. The useful course of the El Fadama then runs for about forty kilometres through the district of Tessaoua. Whilst the population is smaller on the Niger side the density is still high, being of the order of 50 inhabitants/km^2.

3.4.3. Flow patterns

The pattern of flow of the Tagwai - El Fadama branch is similar to that of the Gada - Goulbi de Marada system: intermittent flow generally starting in June, becoming continuous as the rainy season becomes established. The minor bed floods at the start of the rainy season in successive reaches, linking the pools and limited by natural banks of some tens of centimetres which act as sills: the bed is filled by the successive overflows from these upstream and downstream pools until the flowrate is sufficient to result in a more or less continuous flow during the rainy season.

On the contrary the May Farou branch exhibits continuous flow and is flooded in the rainy season. However the inhabitants of the region have noted a reduction in the flowrate during the last decade; they attribute this to the construction of dams in Nigeria, to the extent that the spates which are attenuated in this way scarcely reach the meeting of the El Fadama and the May Farou.

Apart from those measuring stations installed within the framework of the project for evaluating the surface water resources, carried out by the Department of Water Resources of the Ministry for Water, there are no previous recordings on Niger territory. In Nigeria there are some sparse data such as the total volume of flow of 45 Mm^3 in 1974, a relatively rainy year, at the slipway of the Ajiwa dam on the Tagwai, the intercepted catchment area of which is 1920 km^2.

3.4.4. Alluvial layers

Upstream of the bridge of Yetaoua this section of the system has been studied by borings with a mechanical drill. The May Farou, which receives on its left bank the tributaries coming from Nigeria, experiences annual spates which maintain, up to Yetaoua, an outcropping layer which has fallen since 1973 subsequent to the building of dams in Nigeria.

To the east of the 8th degree of longitude the clayey alluvia are not very thick, and the layer shows considerable inter-annual fluctuations. They cannot here be used for agricultural purposes. However to the east of this line of longitude the May Farou flows into large south-north channels coming from Nigeria, cut into the older Quaternary and the Intercalary Continental and filled with fine to coarse sands, gravel and pebbles to a depth of more than 30 metres.

To the west of the May Farou the El Fadama has an independent alluvial track which is a function of the dune-type topography. It does not correspond, as in the case of the Goulbi de Maradi, to a cut channel filled with gravelly alluvia.

Downstream of the El Fadama - May Farou confluence the piezometric surface falls and appears to rejoin that of the phreatic layers of the Intercalary Continental. Further downstream, in the valley of the Goulbi N'Kaba, the alluvial layers contain only small and localized water layers. However several wells utilize the Intercalary Continental in this zone.

3.4.5. Existing and future developments

In Nigeria the mission was not able to obtain the complete list and the characteristics of the existing developments, nor the programme of hydraulic developments which fall under the general direction of the Sokoto - Rima River Basin Development Authority (SRRBDA) at Katsina. Only the following dams were visited by the mission :

i. AJIWA (21 Mm^3) on the Tagwai, for water supplies to Katsina (8.5 Mm^3 per year, to be raised to 18.3 Mm^3 per year in 1985); an irrigated area of 200 ha is annexed to this. The construction dates from 1974.

ii. DABERAM, on the Sabke River, principally for stock-raising and the irrigation of an area of 120 ha.

iii. BEILLA, some kilometres downstream of Daberam, is a site favourable for the construction of a dyke.

iv. KOZA, near Daura, was built in 1974 for watering cattle.

v. In the regions of DAURA and MANJ there are a series of small areas, totalling more than 300 ha, some constructed spontaneously by the peasants, others by the Ministry for Agriculture.

It is known that the Daberam and Koza dams suffered damage during the seventies due to the floods which probably corresponded to the floods described by the inhabitants of the May Farou in Niger.

In Niger there are no areas irrigated by the El Fadama and May Farou. However a Sogreah project dating from the sixties includes the construction of a dam to irrigate 500 ha. Implementation of this project is not envisaged at the present time. On the other hand market garden cultivation in the dry season is highly developed, using the traditional system of wells, sumps and shadoofs. The total surface area of these gardens - assuming a strip of 40 m width all along the watercourse - is of the order of 350 ha. Programmes for improving the traditional watering system are already being implemented, and mainly consist of building cement-lined permanent wells.

4. ANCILLARY ACTIVITIES FAVOURING THE PRODUCTION AND EXECUTION OF THE PLAN OF ACTION

These ancillary activities do not solely concern the activities of the Joint Commission in the zone of the Three Basins which are the subject of the present mission report. They concern also the Kamadougou-Yobé basin and, finally, the whole of the frontier region.

4.1. Legal aspects of the development and exploitation of the basins (1)

4.1.1. Summary of the general customs and legislation

The problems linked with the usage of water from international watercourses are complex. The most recent theories were crystallized in 1966 under the name of the Helsinki Rules.

i. Definition : An international drainage basin is defined as being a geographical zone which extends over two or more States and which is limited by the line of the watershed, comprising both surface waters and subterranean waters flowing in a common terminus.

ii. Rights of usage : Each State of the basin has a right to a reasonable and equitable part of the useful employment of the waters from an international drainage basin.

What is a reasonable and equitable part of the waters is to be determined as a function of all the pertinent factors in each particular case.

Amongst these pertinent factors there should be included, in a non-exhaustive manner :

a) the geography of the basin, and in particular the extent of the drainage basin in the territory of each of the States of the basin;

b) the hydrology of the basin, and in particular the waters furnished by each State of the basin;

c) the climate, inasfar as it affects the waters of the basin;

d) the past utilization of the waters of the basin, and in particular their present utilization;

e) the economic and social needs of each State of the basin;

f) the populations which depend on the waters of the basin in each State of the basin;

g) the relative costs of recharging solutions making it possible to meet the economic and social needs of each State of the basin;

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(1) Reference should be made to the very complete FAO document cited in the bibliography "The Law of International Water Resources" which forms the sum of the legislation at present in force. The French translation is being published under the title "Le régime juridique des ressources en eau internationale".

h) the availability of other resources;

i) the elimination of all useless wastage in the utilization of the waters of the basin;

j) the possibility of providing compensation to one or more States of the basin, with a view to reconciling the divergences between different utilizations; and

k) the extent to which it is possible to satisfy the needs of a State of the basin without at the same time causing serious damage to another State of the basin.

Each of these factors will be considered as a function of its importance in relation to the other pertinent factors. For the determination of a "reasonable and equitable part of the waters" it will be necessary to take into account all the pertinent factors and to draw a conclusion on the basis of all these factors taken together.

This principle of the equitable utilization of the waters leads to linking the exploitation of the joint basins to three subjects :

- information;
- administration;
- cooperation.

iii. Information involves not undertaking any work on the basin without informing and consulting the partner, in accordance with the "Charter of economic duties and rights of States" which lays down that "for the exploitation of natural resources shared by two or more countries each State must cooperate on the basis of a system of prior consultations and information with the aim of arriving at the optimal utilization of such resources without causing damage to the legitimate interests of the others".

iv. Administration of international waters refers to any form of arrangement, institutional or otherwise, established by an agreement between two or more riparian States with the aim of organizing the conservation, development and utilization of the waters of an international catchment area.

v. Cooperation comprises the duty of mutual consultation and information, together with the implementation of an administration, but goes beyond that. It envisages organizing joint valorization at regional level, in accordance with the declarations and resolutions of the United Nations Conference on Water (Mar del Plata, 1977), covering the development of resources in joint waters, the utilization of financial resources and technical cooperation between developing countries.

The Afro-Asiatic Legal Consultative Committee, meeting in New Delhi in 1973, incorporated in its draft legislation on international watercourses the principal articles of the Helsinki text and, in particular, those relating to equitable utilization.

4.1.2. The specific case of frontier basins - proposals

Institutions, such as that for Lake Tchad or the Niger River, are still at the stage of inventorying the resources and identifying their programmes for action. It is within this framework that various missions have been sent out in recent years to formulate the strategy for the utilization of the different basins.

The two member States, desirous of proceding to the optimal utilization of their joint water resources, have given a mandate to the Joint Nigerian-Niger Cooperation Commission to draw up a strategy for the utilization of the various basins, including a draft agreement on the subject of the utilization of the joint waters.

This draft will include the utilization of the Komadougou-Yobé water resources.

This is therefore a specific application of the role of the Joint Commission and of the development authorities for the basins in seeking better cooperation between the two States.

i. Competence of the Joint Commission

The case of the utilization of the joint basins may constitute a pilot programme of which the Commission will be the coordinator. The various components of this mission of coordination are clearly identified in the present document.

The mission of the Joint Commission should lead, at the end of the period of studies and inventory, to the formulation of a plan of action for the harmonious utilization of the joint resources. It will not be the role of the Commission to proceed to carrying out the actual development works, which have already been undertaken in the two countries by various development organizations (cf Chapter 2).

ii. Recommendations

Both Niger and Nigeria agree to including their cooperation within the general framework of international entente recommended by the United Nations. As is shown in the various technical chapters of the present report specific cases of the harmonious utilization of the joint resources are raised (1). It is necessary therefore to define, in addition, the legal and institutional framework within which agreement will be reached for the equitable utilization of these resources and for the deepening of cooperation. This is why it is proposed to provide for the Joint Commission a legal consultation to implement this legal and institutional framework. The principal lines of this draft will be as follows :

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(1) For example the watershed of the Maggia waters supplies the Birni N'Konni and Lake Kalmalo areas or those of the Gada River - Goulbi de Maradi waters.

- To prepare a draft agreement, to be submitted to the two Governments for negotiation, based on those texts already existing in this matter.

4.2. Coordination of the research work

In formulating the regional development strategy priority will be given to the optimal utilization of surface and subterranean water resources. But it is not enought to know these resources and to evaluate the needs resulting from these development projects.

We will see what instruments we have to arrive at this position, and how their implementation in a more efficacious and coherent manner may be suggested.

4.2.1. The institutions and programmes

i. In Niger

a) INRAN : For some years now agronomic research has been entrusted to INRAN (Institut National de Recherche Agronomique au Niger), which took over the activities of IRAT.

INRAN has nine departments which carry out various programmes of research :

	Department	Programmes
1.	Agricultural Research	millet, sorghum, niebe, rice, groundnuts, maize, market garden crops, multilocal trials, mechanization, general agronomy, sugar cane, fruit cultivation.
2.	Rural Economy	experimental agricultural production units.
3.	"Tapis vert" Project	integrated programme (see below).
4.	Forest Research	eucalyptus.
5.	Biological Protection	protection of palm plantations (Agades).
6.	ICRISAT	cooperative programme on cereals.
7.	Zootechnical and Veterinary Research	agrostology, ligneous vegetation, pasture management, forage crops, zootechnics, fattening cattle, Peuhl sheep, bacteriology, parasitology.
8.	Ecological Research	soil classification and cartography, soil physics and water economy, soil chemistry and fertility.
9.	Mycotoxins and Oleaginous products (section)	

At Tarna, in the Goulbi valley some kilometres upstream of Maradi, the Institute has its largest research station. The greater part of its work concerns rain-watered crops, research on irrigated crops having been rather neglected. In this field reliance is placed on some previous work which has made it possible to identify the parameters which govern the supply of water. At the present time research is limited to gumbo, onions and tomatoes.

The resources available to INRAN are limited in regard to personnel, infrastructures (six support stations for the whole of the country) and equipment.

For example the "Experimental Agricultural Production Units" project managed by the Rural Economics Research Department has been able to establish only a single unit. The aim of this research is to improve village farming on the basis of technical themes put forward by the research workers. It therefore involves studying the optimal conditions for the dissemination of the results of research work within the peasant environment. A unit was envisaged for the Madarounfa region, but it has not been possible to implement this.

The ambitious "Tapis Vert" programme, conducted in the Filingué region, is of considerable interest. This project covers the management of water resources, agronomic experiments, market garden crops, re-afforestation and conservation, draught-animal cultivation, aviculture and socio-economic studies.

b) Other institutions The Ecole Supérieure d'Agronomie (ESA) carries out research within the framework of the work of its students. One must deplore the very limited coordination between the ESA and INRAN, and also that between the latter and the IPDR at Kolo.

Several foreign Universities have carried out, or are carrying out, regional studies. Examples are the University of Bordeaux II (Maradi) and the University of Arizona (Zinder). Coordination between this research work and the national programmes is not always evident, and the results of this research work could have been better utilized.

ii. In Nigeria

a) I.A.R. The research programmes are supervised by the Federal Ministry for Science and Technology. For the northern part of the country agronomic research is entrusted to the Ahmadu Bello University of Samaru-Zaria, within which are grouped together the Institute for Agricultural Research (IAR), the Agricultural Extension and Research Liaison Service (AERLS) and the National Animal Production Research Institute (NAPRI).

The IAR is based at Samaru but also has six sub-stations (two of which specialize in irrigated agriculture). Within its 14 departments the Institute carries out a large number of research programmes :

Programmes		Subjects
1.	Improvement of cereals	sorghum, millet, wheat, maize;
2.	Oleaginous crops	
3.	Leguminous crops	
4.	Cotton and other fibres	
5.	Horticulture	tomatoes, onions, local vegetables, mangoes;
6.	Soils	
7.	Socio-economic studies and dissemination	
8.	Crop systems	companion crops, crop rotation;
9.	Irrigation	
10.	Agricultural machinery	trials, maintenance, manufacture;
11.	Nutrition	

It is important to note that the IAR has inherited more than a half century of research work, which started in 1922 under the Department of Agriculture of the Northern Provinces. It has more than 3000 ha of land and nearly 1500 employees, including more than 200 full-time research workers. From 1975 to 1980 the Institute received nearly 24 million Naira in subsidies from the Federal State. Its resources appear therefore to be considerable, as are also the results of its research work.

However the public resources of the Institute have suffered a dramatic fall from 5.5m Naira in 1975/76 to 4.2m Naira in 1979/80. The overall requirements for the next 5-year period are estimated at 69m Naira, divided up as follows :

personnel	34m Naira
other charges	10m
equipment	3m
capital	22m
Total :	69m Naira

Those responsible for the Institute feel that their area of competence is too extended, since it covers four agro-ecological zones : the Sahel, the Sudanian zone, and the north and south parts of the so-called "Guinea" zone, the University of Ibadan being responsible for research work in the southern part of the country.

Recently, however, the redistribution of the research areas has been studied as a project which would limit the zone of activity of the IAR to the three States of the north (Sokoto, Kaduna, Kano), five other institutes sharing the rest of the country.

b) Other Institutions

One section of research has been established within the University of Sokoto, but this is still very little developed. The authority for the development of the Lake Tchad basin has taken over a former station of the IAR. Finally the various rural development projects are carrying out some accompanying research work.

Mention should also be made of the National Institute for Horticultural Research (NIHR), the National Cereals Research Institute, the Agricultural Extension and Research Liaison Service (AERLS) and the National Animal Production Research Institute (NAPRI).

4.2.2. The results of the research work and their utilization

The transition from research work to the dissemination of its results is always difficult. Sometimes the preoccupations of the research workers do not correspond to the needs of the users, sometimes the means of applying the discoveries of the research workers are faulty. Often research work is ahead in relation to the potential of the land, but often also the financial resources are exhausted before the research work has reached its conclusion.

In Niger research workers and users have at least one occasion a year to meet and exchange their concerns. The meeting at the beginning of 1981 concluded that it was necessary to create firstly a Research - Dissemination unit and, secondly, to re-establish the dynamism of the National Committee for Agronomic Research. The efforts to be made in the following fields were emphasized :

- dissemination of the results;
- better matching of the programmes to the needs;
- the establishing of regular contacts between research workers and those responsible for disseminating the results, information and documentation;
- the rationalization of programmes and avoidance of duplication.

In Nigeria, as has been seen, various institutes exist and close contacts are maintained between them under the aegis of the Ministry for Science and Technology. The resources enjoyed by the Research Institutes for publishing

their work are considerable. For example the IAR published nearly 200 documents between 1975 and 1980, and the catalogue of all its publications contains nearly 500 titles - without counting periodicals.

But such publication does not guarantee dissemination of the results to the users: it is the responsibility of the AERLS to carry out this task.

Examination of the research programmes carried out in each country show that they often cover the same subjects (particularly in the field of improving cereals crops and, to a lesser extent, irrigated cultivation).

Unfortunately contacts between the research workers are very limited, if not non-existent. It would nevertheless be of value to the two countries if the work carried out, particularly in Tarna (Maradi) and Bakura (Sokoto) was better known beyond the frontier.

Both in Niger and in Nigeria there can be seen a serious handicap resulting from the lack of research personnel. This is an additional reason for rationalizing and harmonizing the programmes, as we propose below.

Certainly there are numerous coordinating organizations in the region :

- the Sahel Institute (CILSS, Bamako) coordinates research on millet and sorghum; it should soon be establishing a unit at Tarna (Maradi);
- Niger and Nigeria participate in the work of the Scientific, Technical and Research Commission of the O.A.U. and the SAFGRAD programme for research and development on food crops (millet, sorghum, niebe, maize) in the semi-arid zones;
- the two States also belong to ADRAO and participate in the ICRISAT programmes;
- finally the IAR is linked with the CARIS network, and INRAN will soon be linked with it with the support of the FAO.

The reality on the ground does not reflect very concretely the results which one could expect from this multiplication of international organizations. One of the principal reasons for this can undoubtedly be found in the fact that the world of research cultivates a certain isolation and remains cut off from the realities of the rural world which it is supposed to serve.

Here and there there is a consciousness of the necessity for research which, starting from the needs of traditional farming with all its human environment, both technical and natural, develops methods which respond to its needs and its potentialities. Too often there is a temptation to introduce, by force, the results of conventional research in a framework which rejects it.

4.2.3. Proposals

The frontier zone constitutes a unit of relative ecological and human homogeneity. It would therefore be desirable for research to be integrated in it - as could the regional development strategy, which stands upstream of it, at a later date.

i. Fields of research

The specific fields in which the coordination of research work is essential (in addition to the field of water resources, as already discussed) are as follows :

1 - improvements in cereal, leguminous and oleaginous crops;

2 - improvements in market garden and fruit crops;

3 - irrigated cultivation;

4 - agricultural machinery (mainly manufacture);

5 - socio-economic studies (evolutions in funding structures, the transition from research work to dissemination, storage and preservation, marketing).

On the basis of these joint subjects each country could then concentrate on their detailed application to differing local situations.

Since points 2, 3 and 4 are already somewhat retarded some priority should be given to them. Niger could profit considerably from the very advanced results obtained in Nigeria in the field of crops.

ii. Financing

The reports from the two principal institutes show the difficulties in financing certain programmes, in particular in the field of irrigated cultivation, market garden crops and the wider use of agricultural machinery.

Similarly it is intended to create in Nigeria a station devoted to research for the Sudano-Sahelian zone. Joint financing of this station by the two States should be envisaged, both in respect of its creation and its operation.

Two possibilities are envisaged: either the creation of an entirely new station, the location of which is to be decided on, or the development of the Tarna station.

The research work carried out in this Sudano-Sahelian station should deal both with irrigated cultivation and also rain-watered crops and also with all the ecological problems of the zone (including the defence of the environment).

iii. Coordination

The existing coordination structures result, as has been seen, in disappointing results. Initially it will be necessary to carry out an evaluation of these structures and to implement a system for the circulation of information. This returns to the field of documentation again.

4.3. Organization of the documentation

4.3.1. The existing resources

In Niger there are several documentation centres, mainly covering the rural sector.

The Centre of the Niger Basin Authority collects mainly documentation concerning water resources, the forestry sector and forms of energy. It benefits from the support of the FAO.

The Documentation Centre of INRAN will, as has been seen, soon be part of the CARIS network, so that the Ministry for Rural Development can integrate the AGRIS network and will benefit in this respect from the intervention of IFSID.

Finally the Ministry for Planning proposes to implement, with aid from USAID, an automated documentation system.

Nigeria is linked, through the Federal Ministry for Agriculture, to the AGRIS network; it will be recalled that the research institutes are integrated into the CARIS network.

The Documentation Centre of the Lake Tchad Basin Commission, at Ndjamena, has suffered from recent events but will be re-activated as soon as possible.

4.3.2. The role of the JN-NCC

The Joint Cooperation Commission has competence to carry out research, in all fields, into the means for coordinating and harmonizing the economies of the two countries with the object of increasing their cooperation and making it more effective.

International usage obliges States sharing natural and joint resources to inform each other on the subject of programmes for the valorization and exploitation of these resources.

The field of information therefore falls, without any ambiguity, within the competence of the Commission.

During the missions which it has financed the Joint Commission has been led to assemble together an increasing volume of documentation on subjects of joint interest to the two countries.

This movement is becoming amplified and needs to be organized within the Joint Commission so as to make the information readily accessible.

The principle of creating a documentation centre has been accepted: temporary assistance during the setting up of this centre is necessary, the more so since the system to be implemented must be compatible with the already existing regional systems, AGRIS, CARIS, RESADOC and PANIS, and also since there must be no duplication of the centres already existing at Niamey or those centres of easy access such as the FAO.

The documentation centre of the JN-NCC, by means of a microfilm service, could provide on request all the documents required by the operators in the region.

5. PROJECT FOR DRAWING UP A PLAN OF ACTION FOR THE UTILIZATION OF THE THREE JOINT BASINS IN NIGER AND NIGERIA

The terms of reference of the mission which is the subject of the present report provided for :

- a study of the terrain of the joint basins in order to identify its originalities and characteristics;
- a preliminary evaluation of the resources of these regions;
- the determination of the modifications or adaptations necessary for the general development plan;
- the establishment of one or more project documents.

Subsequent to the discussions which took place at the FAO Headquarters between the representatives of the Organization, the UNDP, the Permanent Secretariat of the Joint Nigerian-Niger Cooperation Commission and the consultants, three projects were retained : (1)

1. Project for drawing up a plan of action for the utilization of the three basins, with four components :

1.1. Reinforcement of the Planning Unit within the Commission;

1.2. A study and inventory of the water and soil resources of the three basins, including pedological studies, geophysical campaigns and borings; continuation of the evaluation of the surface water resources; the acquisition of satellite pictures for identifying flooding zones, pools and shallows; the establishment of a soil and pasturage use map; the construction of mathematical models for the surface and subterranean waters;

1.3. Legal consultation on water rights;

1.4. The creation of a documentation and information centre.

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(1) The forecast budget for the three projects is set out in Table 10.

On an experimental basis two concrete proposals are put forward :

2. Projects for the protection of the environment

3. Projects for the development of agricultural machinery

5.1. Component 1 - Reinforcement of the Planning Unit

5.1.1. Objectives

The long-term objective is to reinforce the capacity of the Joint Nigerian-Niger Cooperation Commission, and through it the Governments of Niger and Nigeria, for effective planning of the efficacious utilization of the frontier region.

This Project should in the immediate future :

1. Form, within the Joint Commission and also in the field, a team of technicians specializing in the fields of development which are of interest to the region.

2. Coordinate the programmes for studies, research work and the formulation of projects undertaken within the framework of preparing the plan of action.

3. Supervise the programmes financed directly by the Joint Commission or carried out under its responsibility for the preparation of this plan of action.

4. Draw up, on the basis of studies and research work carried out elsewhere or by its own resources, an inventory of the natural and human resources of the region, and identify those constraints which hinder their valorization.

5. Determine those potentialities favourable to a regional development which meets the needs of the populations.

6. Put forward a strategy for regional development, and propose a plan of action comprising the pre-investment and feasibility studies necessary for elaborating projects meeting the criteria of the financing organizations.

5.1.2. Content of the plan of action

At the conclusion of the Project the authorities should have a document containing the following component parts :

1. Inventory and mobilization of the agricultural potential :

   - a study of soil usage (by photographic interpretation and remote detection) with maps (see sub-contracting, paragraph 5.2.4.2.);
   - an analysis of the funding structures (including common land, pasturage and forests);
   - a balance sheet of agricultural workings (in the broader sense, including stock-raising: analysis of production systems and an evaluation of yields and productions; budgets of the workings);

2. The mobilization of water resources (on the basis of inventories made elsewhere);

3. Reorientation of the production systems : irrigated and rain-watered agriculture, agriculture - stock-raising;

4. Inventory and exploitation of forestry capital and alternative energy solutions;

5. Analysis of the existing eco-system;

6. Inventory and mobilization of non-agricultural productive potential: fishing, artisans, micro-industries, etc.;

7. Mobilization of labour resources: study and proposals concerning questions of training (self-management and agricultural management, artisans, etc.);

8. Study and proposals on the subject of regional inter-relations and relationships within the country and across the frontiers: linking roads, rural engineering, organization of the market for agricultural products and converted products;

9. Study of regional equilibrium: rural sector - urban sector;

10. Drawing up development programmes :

- conclusions on the possible evolution of the various sectors of activity,
- evaluation of the impact of completed and current programmes,
- evaluation of new programmes already identified and/or prepared, or entirely original,
- proposals for the ranking of these programmes as a function of various criteria such as : investment costs, operating costs, increases in production (food or revenue), effects on employment.

5.1.3. Activities

1. Supervision of the studies and research carried out within the framework of the master plan;

2. Periodical reports (follow-up, evaluation) on the state of progress of the sub-projects financed by the UN-NCC or carried out under its control (hydrological study, legal consultation, documentation service, research programme);

3. Organization of periodical meetings between the operators of the region;

4. Identification of complementary studies and research work;

5. Carrying out of the necessary studies, either by the permanent project personnel or by consultants;

6. Identification of specific projects which can be carried out immediately, even before the formulation of the master plan;

7. Drafting the plan of action for the development of the region;

8. Training of two planners. (1)(2)

5.1.4. Necessary resources

5.1.4.1. Personnel (2)

i. Personnel of the Joint Commission

- a regional economist-planner, responsible for coordination;
- an agronomist or agro-economist;
- supporting personnel (Project administration, secretaries, drivers, security staff, etc.)

ii. International personnel

- an economist-planner, principal technical adviser, specializing in regional development, adviser for the supervision of socio-economic studies and the follow-up of the projects and the documentation and information activities, based at the JN-NCC Headquarters;
- an agro-economist, responsible for the supervision of studies in the field and the coordination and execution of certain complementary work (Diffa);
- two assistant experts attached to the two Project advisers;
- consultants will be made available to the Project up to a total of 45 man/months; the programme of consultations will be drawn up by those responsible for the Project on the basis of the needs which they will have identified. It may already be forecast that these consultants will be specialists in the following fields :

- agronomy	6 man/months
- zootechnics/ pastoralism	6 man/months
- forestry	4 man/months (3)
- rural engineering	4 man/months
- sociology	10 man/months
Total	30 man/months

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(1) Planning is a continuous process and not temporary. It is necessary that the planning department of the JN-NCC should be sufficiently reinforced so that its activities can be continued after the end of external assistance. From the time of commencement of the Project two nationals are to receive the benefit of specialization in planning.

(2) Although treated separately for ease of presentation the two aspects of "planning" and "study and inventory of water and soil resources" form a unit. The permanent personnel for these two sub-projects form together the planning team of the Commission.

(3) A number of man/months of consultation are also forecast, from 1983 onwards, for the preparation of the pilot project for the defence of the environment in the Gada River-Goulbi de Maradi basin (forestry, pastoralism, rural engineering) (see Chapter 6.1).

The importance of more participatory development justifies the forecast duration of the mission of the sociologist.

At the time of preparing the plan of action a "task force" will be formed with certain of the consultants who will have been involved during the preparation or execution of the Project, up to a total of 9 man/months.

iii. Personnel for the complementary studies

The personnel necessary for certain complementary studies carried out directly by the Project will be provided by the Commission, such as investigators, etc.

5.1.4.2. Sub-contracting contracts

i. Production of the soil utilization maps by remote detection : see paragraph 5.2.4.2.

ii. Without being included in the forecast budget for the Project it is suggested that the Project team should examine the possibility of sub-contracting the production of the soil area monographs to national or foreign scientific research institutions. (1)

5.1.4.3. Training

Specialization in planning for the agro-economist and the hydrogeologist, a document librarian, etc., in 2-month cycles to a total of 18 man/months of bursaries.

5.1.4.4. Equipment and operations

The transport and other equipment will be covered by the Project, together with maintenance.

Vehicles :	2 station wagons at $ 10,000	$ 20,000
Radio equipment - SSB :		
	2 fixed stations (Niamey-Katsina-Diffa) mobile (vehicle from Katsina and Diffa) including installation and training of the operators	$ 35,000
Office equipment at Katsina and Diffa		
	office and reproduction equipment, computer, drawing board, typewriter	$ 11,000

(1) The model here would be the work carried out in 1978-80 by the University of Bordeaux: see Raynaut, C.L. : Recherches Multi-disciplinaire sur la Region de Maradi (Multi-disciplinary Research on the Maradi Region), University of Bordeaux II.

5.1.5. Forecast budget of external contributions to the planning unit

International Personnel	Total	1982	1983	1984	1985
PTC Niamey	30 262,800	3 23,400	12 100,800	12 109,200	3 29,400
Agro-economist	24 187,200	-	12 90,000	12 97,200	-
Assistant expert	48 10,000	-	24 5,000	24 5,000	-
Travelling costs	36,000	6,000	15,000	15,000	-
Consultants	30 225,000	-	21 157,500	9 67,500	-
Task force	35,000	-	-	35,000	-
Consultants' travel (1)	-	-	-	-	-
Follow-up	3,000	500	1,500	1,000	-
SUB-TOTAL	132 759,000	3 29,900	69 369,800	57 329,900	3 29,400
Supporting Personnel					
Draughtsmen (3)	10,000	-	10,000	-	
Investigators (4)	p.m.				
SUB-TOTAL	10,000	-	10,000	-	-
SUB-CONTRACTING (5)	-	-	-	-	-
TRAINING	14 51,750	-	7 24,750	7 27,000	-
Equipment					
Vehicles	20,000	20,000	-	-	-
Office equipment	11,000	9,000	1,000	1,000	-
SSB Radio	35,000	35,000	-	-	-
SUB-TOTAL	66,000	64,000	1,000	1,000	-
Operating costs					
Vehicle maintenance	10,000	1,000	4,000	4,000	1,000
Other maintenance & consumables	5,000	500	2,000	2,000	500
SUB-TOTAL	15,000	1,500	6,000	6,000	1,500
Reports	30,400	-	-	27,000	3,400
Translation & reproduction	25,000	-	-	20,000	5,000
Miscellaneous	9,850	850	4,000	4,000	1,000
SUB-TOTAL	65,250	850	4,000	51,000	9,400
OVERALL TOTAL	967,000	96,250	415,550	414,900	40,300

(1) A vehicle from the unit and a jeep from the base for their journeys.

(2) Travelling, accomodation etc. covered by the Project.

(3) Contractual, for work on site.

(4) Investigators recruited locally, provided by Governments.

(5) Remote detection, drilling, etc.: see the component "Water and soils".

5.2. Component 2 - Study and inventory of the water and soil resources of the three basins common to Niger and Nigeria

5.2.1. Introduction

A considerable number of hydro-agricultural development studies, including evaluations of waters and soils at local level, and hydrometeorological data already exist in both Niger and Nigeria. With the exception of two summary reports - which do however include some gaps - on the surface and subterranean water resources in Niger (SOGREAH and BRGM), most of the existing and available documents concern very limited zones and do not make it possible to formulate a programme of action for water utilization at the level of a complete basin. In particular there has been a complete neglect of the incidence on or the effects of that portion of the basin located in the neighbouring country. In addition to this certain erroneous figures on the volumes of water which are available are repeated from one report to another.

An exhaustive programme for the study and inventory of the resources is therefore proposed so as to permit the marmonized development of the three basins, the small quantities of available water of these constituting the limiting factor in any hydro-agricultural development project in the frontier region.

Conscious of this problem, and with the aim of accelerating the implementation of the projects, the two Governments concerned have launched a programme for the "Evaluation of surface water resources between Niger and Nigeria", under the auspices of the Joint Nigerian-Niger Cooperation Commission.

From 1978 onwards the problems of the utilization of waters common to Niger and Nigeria had already been raised at the time of the construction of dams on the Maggia and Gada in the context of studies on developing the regions near the frontier which separates the two countries.

At the Tenth Session of the Council of Ministers of Niger and Nigeria, held at Kano in December 1979 the principle of studying water resources common to the two countries was formulated, and the Joint Nigerian-Niger Cooperation Commission was entrusted with the responsibility for this work.

In January 1980 experts from the two countries met at Maradi to examine this problem, and recommended that a request be submitted to the next meeting of the Council of Ministers to undertake the joint evaluation and study of the waters of the basins situated along the frontier. They also recommended other immediate observations and measures relating to the work in hand on the Goulbi de Maradi. During the meeting of the Council of Ministers, which was held at Maradi in June 1980, the Council decided to entrust the evaluation of the surface waters to the competent departments of each country, namely the Directorate of Water Resources of the Hydraulics Ministry in the case of Niger and the Federal Ministry of Water Resources in the case of Nigeria.

The study, originally with a duration of two years (1980-1981) but for which an extension to three years has already been approved, comprises the following aspects :

- the equipping of new pluviometric and hydrometric stations;

- the geomorphological study of the basins;
- pluviometric measurements;
- hydrometric measurements;
- the processing, summarizing and publication of the data.

The total cost of the study, originally 35,552,000 FCFA (= 101,576 Naira) was to be met equally by the two countries.

Niger established three measuring teams based at Tahoua, Maradi and Zinder, whilst Nigeria established four teams, two at Sokoto, one at Kano and one at Maidiguri.

An initial summary report should be published at the end of 1982.

5.2.2. Objectives

The long-term objective is to establish, for each common catchment area, a rational and harmonious exploitation strategy for the surface and subterranean waters, taking into account the existing and forecast developments and without prejudice to either of the countries concerned and integrating them into the framework of the investment projects to be formulated for the present Project. Since the limiting factor for development in the zone is the availability of water, which varies in time and space, this is to be evaluated in the general context of each of the catchment areas so as to draw up a balance sheet which is exhaustive and which individualizes each of its components :

- surface waters (flowrate of watercourses, storage in pools and lakes, evaporation);
- subterranean waters (flowrates, recharge and reserves);
- present and future utilization of water for agriculture, human or pastoral use, industry, etc.

The "water" inventory will be supplemented by the potentiality of soils for agricultural use.

The existing basic data are fragmentary, dispersed, incomplete and often lack accuracy, so making any summarizing difficult. The objective of this component will consist of summarizing the existing documents, identifying the outstanding data, implementing programmes for supplementary measurements and putting the acquired results into definitive form.

Amongst the Governmental organizations responsible for these problems are, in particular, the Department of Water Resources of the Hydraulics Ministry, the Ministry for Rural Development, ORSTOM in Niger and the Sokoto-Rima River Basin Development Authority, the Federal Ministry of Water Resources, the Water Boards of the States of Kaduna and Kano and the Ministry of Rural Development in Nigeria.

At the conclusion of the Project the JN-NCC will have centralized the data necessary for the study of hydro-agricultural investment projects and will have the means for testing the long-term implications of the hydrological pattern of the rivers and subterranean water layers, and their probable consequences of the operation of existing and/or forecast downstream developments.

5.2.3. Activities

1. Collection of all existing documents concerning water resources and utilization (projects for irrigation and water supplies, the construction of dams, hydrological studies and annual reports, drilling logs, data for geophysical and pedological campaigns):

2. Summarizing of the existing data, listing of gaps and the establishment of a plan designed to complete the network of existing piezometric measurements. It is accepted that the "surface waters" part of this work, undertaken since 1980 under the aegis of the JN-NCC, will be exhaustive and available at the start of the Project and that routine measurements will continue throughout the period of the Project:

3. Collecting together of existing data on the geology and details of hydrogeological maps and sections showing the interrelations between the rivers, the superficial water layer and the layer(s) located below the surface, the isopachytes and the various contact surfaces:

4. Supplementary inventory of water points with accurate levels of existing wells, or wells to be dug, so as to draw the piezometric maps which correspond to the various levels:

5. Estimation of the flowrates sampled annually on the subterranean layers and the collection of data on annual and interannual piezometric fluctuations:

6. Estimation of flowrates infiltrating into the river beds by differential gauging between points where the river is fully limited to its minor bed, so as to eliminate the effect of evaporation; this estimation is also to be checked by determination of the subterranean flowrate from piezometric data and the hydraulic characteristics of the superficial aquifer:

7. Installation of additional piezometric measuring appliances and the organization of a team of hydrometrists:

8. Pedological studies on possible sites for hydro-agricultural developments. Existing pedological and potential soil utilization maps will be collected together so as to delineate the zones with soils suitable for irrigation. On the basis of the collected documents systematic field trips will be organized so as to fill in the identified gaps and so as to establish for each basin a soil aptitude map:

9. Flowrate tests in about twenty existing and representative borings so as to determine the hydraulic characteristics of the phreatic layers. In order to improve the quality of the results observation piezometers will be inserted in the proximity of the borings or wells selected for the tests:

10. Establishment of a programme for borings designed to supplement the existing network. The programme will take into account the needs for standardization for the geophysical programme:

11. Carrying out the programme of drillings. The injection drilling technique will be used when the conditions are favourable (sandy alluvia). For other sub-soil conditions a mixed-type drilling machine for drilling with mud or with percussion head will be used. Flowrate tests will be carried out systematically;

12. The compilation and re-interpretation of all the existing geophysical data. Establishment of a programme for supplementary geophysical campaigns and the interpretation of the results collected from them. Production of structural maps of the alluvial aquifer reservoirs;

13. Geophysical campaign with a period of about two months, carried out by a specialist company;

14. The construction, for each basin, of two mathematical surface and subterranean flow models, linked by the infiltration term. These models will include all the data collected and will be adjusted to the hydrological pattern of the previous years. The result expected from these models is a quantification of all the factors in the hydrological balance sheet, firstly at the level of the basin and secondly of all the successive reaches which have been individualized during the process of dividing the basins up into discrete units. The existing and forecast modifications of the natural hydrological pattern resulting from the development projects will need to be included. A series of forecasts will be established by utilizing, if necessary, stochastic series of data generated by the computer on the basis of the existing data. Successions of normal, dry or wet years will be selected to test each scenario proposed. These models will be designed so that they can be periodically updated as a result of the acquisition of new data;

15. Identification and observation of flooded areas and pools against time, using the existing Landsat satellite pictures. Additional pictures will be requested in order to follow up, by interpolation, the evolution of these zones during several seasons;

16. The establishment of programmes for the utilization of surface and subterranean waters, corresponding to the various development hypotheses.

5.2.4. Resources required

5.2.4.1. Personnel

i. Personnel of the JN-NCC

The Governments will make available to the Project the executive personnel acting as national counterparts, together with technical and administrative staff. The team will consist of :

1 hydrogeologist or hydrologist
4 hydrometrists
1 topographer
1 technician
1 draughtsman
supporting personnel (secretaries, drivers, assistant topographers, clerks)

ii. International personnel

1 Hydrogeologist, responsible for coordinating field activities from the Katsina base; activities are forecast in regard to the estimation of water and soil resources: he will put forward the terms of reference for the geophysical, agro-pedological and mathematical models consultants, together with the contracts for the sub-contracting of drillings, geophysical campaign and remote detection, to the PTC. In particular he will, with the assistance of the national counterpart, take charge of the activities set out under numbers 1 to 6, 10 and 16 in paragraph 5.3.2. above, and will supervise the other points.

1 Consultant geophysicist. During an initial mission of two months he will re-interpret all the available geophysical data, using the logs of existing drillings. On the basis of this work he will draw up the programme for a supplementary geophysical campaign intended to fill in the existing gaps. He will also quote the drillings which will be necessary for a reliable interpretation of the existing and future geophysical data.

After the geophysical campaign the consultant will produce a summary of all the existing documents and the results which have been acquired so as to produce structural maps of the alluvial basins, showing the special points of the geology such as sills, fracture zones, zones of interest for the exploitation of subterranean water, etc.

This consultant may be seconded from the geophysical company and his costs associated with the sub-contracting contract for the geophysical work.

1 Consultant in agro-pedology. During two missions, each of three months duration, he will draw up the inventory of available studies and will identify the gaps to be filled in. He will determine and carry out a field programme including taking samples which will be analysed in a soil analysis laboratory of one of the two Governments. In collaboration with the other experts of the Project he will identify possible sites for hydro-agricultural developments and will draw up a soil suitability map.

1 Specialist in mathematical models, responsible for the choice of models to be used, for ordering the data provided by the Project and for calibrating and operating the models. He will also be responsible for training the technical personnel who will be responsible for updating and operating the mathematical models. It is assumed that a computer of sufficient power will be available at Niamey (Agrhymet Project, for example).

5.2.4.2. Sub-contracting contracts

i. Geophysical campaign

On the basis of the programme for geophysical investigation drawn up by the consultant provision is made for a contract to a company for a geophysical campaign of electrical soundings, totalling 150 km of profiles with soundings about every 500 metres. The A-B spacing will depend on the depth of the base of the aquifer system being investigated. Duration of the campaign: about two months.

ii. Drilling campaign

A drilling plan will be drawn up by the Project hydrogeologist, in collaboration with the consultant geophysicist. In the sandy alluvia it is proposed to use the simple technique of injection drilling ("jetted wells") which could make the peasants conscious of this simple technique for exploiting subterranean water. About 1400 metres of drillings will be produced by this method. In the clayey and rocky zones about 500 metres of drillings will be produced by a team equipped with a mixed-type drilling rig for mud and percussion boring.

iii. Remote detection

Interpretation of the Landsat satellite pictures will be entrusted to the FAO or to a company specializing in remote detection. Digital processing of the pictures should make it possible to produce the following maps :

- Soil use maps, comprising the identification of cultivated land by conjecture into dry and irrigated, fallow land, non-worked cultivatable land, forests, non-cultivatable land, hydromorphic zones and pasturage,
- biomass, comparative maps, at at least five-year intervals,
- marshy and spreading zones, together with their spatial variation with time.

The maps, covering the whole of the Sudano-Sahelian zone, will be produced at a scale of 1:200,000, those specific to the basins at a scale of 1:50,000.

Table 5.2.5. Forecast budget for external contributions (in US$) for soil and water studies in the three basins

	Unit	TOTAL		YEAR 1		YEAR 2	
		Number	Cost US$	Number	Cost US$	Number	Cost US$
Personnel							
Hydrogeologist (permanent, Katsina)	man/month	24	187,200	12	90,000	12	97,200
Consultant geophysicist	man/month	3	22,500	1	7,500	2	15,000
Consultant agro-pedologist	man/month	6	45,000	3	22,500	3	22,500
Mathematical models consultant	man/month	6	45,000		-	6	45,000
Travelling costs	6 d/qtr		2,400		1,200		1,200
Cost of trips	at cost		9,000		4,500		4,500
SUB-TOTAL I		39	311,100	16	125,700	23	185,400
Sub-contracting contracts							
Geophysical campaigns	months	2	70,000		-	2	70,000
Drilling : (5)							
- injection boreholes	metres	1400	98,000		-	1400	98,000
- drilling sites	metres	500	125,000		-	500	125,000
+ structural map (1)	at cost		27,000		-		27,000
			250,000				250,000
Remote detection :							
- picture acquisition	number	30	9,000	30	9,000		--
- field work (2)	at cost	3	21,000		-	3	21,000
			30,000		9,000		21,000
SUB-TOTAL II			350,000		9,000		341,000
Equipment							
F.W.D. vehicles	number	2	30,000	2	30,000		--
Measuring instruments (piezometers)	at cost		10,000		10,000		--
SUB-TOTAL III			40,000		40,000		--
Operating costs							
Vehicles	at cost	2	12,000	2	6,000	2	6,000
Computer hire (4)	at cost		10,000		-		10,000
SUB-TOTAL IV			21,000		6,000		16,000
Miscellaneous	at cost		5,100		2,500		2,600
Reports (3)			6,000		2,000		4,000
OVERALL TOTAL			734,000		185,000		549,000

Notes to table on page 53

(1) Cost of interpretation by the FAO or by a specialist company, in liaison with the experts in the field.

(2) Summary of the work and study of significant points.

(3) Reports of the consultants (30 pages) and final report of the hydrogeologist.

(4) Estimate of services provided by Agrhymet.

(5) Excluding cost of the analyses carried out in the national laboratories and counted as support given by the Governments.

Table 5.2.5. Forecast budget for the external contribution (US$)

	Unit	Unit cost	TOTAL		YEAR 1		YEAR 2	
			Number	Cost US$	Number	Cost US$	Number	Cost US$
I. Personnel								
Hydrogeologist	man/month	6,330	24	151,200	12	75,600	12	75,600
Consultant geophysicist	man/month	9,000	3	27,000	2	18,000	6	9,000
Consultant agro-pedologist	man/month	9,000	6	54,000	3	27,000	3	27,000
Mathematical models consultant	man/month	9,000	6	54,000	-	-	6	54,000
Travelling costs	days	80	200	16,000	100	8,000	100	8,000
Cost of trips	at cost	2,000	5	10,000	2	4,000	3	6,000
SUB-TOTAL I	-	-	-	312,200	-	132,600	-	179,600
II. Sub-contracting contracts								
Geophysical campaign	months	35,000	2	70,000	-	-	2	70,000
Drilling :								
- Injection boreholes	metres	70	1,400	98,000	-	-	1,400	98,000
- Drilling sites	metres	250	500	125,000	-	-	500	125,000
				223,000				223,000
Remote detection :								
- Picture acquisition	number	300	30	9,000	30	9,000	-	-
- Field work	man/month	9,000	8	72,000	4	36,000	4	36,000
- Cost of trips	at cost	2,000	2	4,000	1	2,000	1	2,000
				85,000		47,000		38,000
SUB-TOTAL II	-	-	-	378,000	-	47,000	-	331,000
III. Equipment								
F.W.D. vehicles	number	18,000	2	36,000	2	36,000	-	-
Measuring instruments (piezometers)	at cost	10,000	1	10,000	1	10,000	-	-
SUB-TOTAL III				46,000		46,000		
IV. Operating costs								
Vehicles	at cost	6,000	2	12,000	1	6,000	1	6,000
Computer hire	at cost	10,000	1	10,000	-	-	1	10,000
SUB-TOTAL IV				22,000		6,000		16,000
REPORTS & MISCELLANEOUS	-	-	-	76,800	-	23,400	-	53,400
OVERALL TOTAL	-	-	-	835,000	-	255,000	-	580,000

5.3. Component 3 - Consultation for the study of legal questions

The legal aspects of developing the basins were examined in chapter 4.1.

It is the responsibility of the Joint Nigerian-Niger Cooperation Commission to put forward to the Governments of the member States the legal framework within which the development programmes are to be drawn up and, in general, the plan of action for developing the shared basins.

5.3.1. Objectives

The long-term objective is to allow the Governments of Niger and Nigeria to develop gradually an effective planning of the utilization of the water resources available in the catchment areas through which their frontier passes.

The immediate objectives are :

1. To formulate, in favour of the two Governments, opinions and recommendations in regard to the negotiation of the agreement which is necessary within the framework of the valorization of the resources in the shared basins.

2. To formulate recommendations for drafting national water legislation making it possible to lift or reduce the constraints and limitations.

3. To recommend any other necessary action.

5.3.2. Expected results

The project will result in a report and a draft agreement which, through the Joint Nigerian-Niger Cooperation Commission as final client, will be submitted to the two Governments. They will identify the constraints bearing on the existing national and international frameworks, on the basis of the general principles amd agreements in force. They will formulate recommendations relating to the measures to be taken to specify the rights and obligations of the two parties.

During this, and as the needs arise, the Project will consult the Legal Department of the FAO to receive their opinions on the negotiations which it will be necessary to undertake, basin by basin, for the valorization of the joint resources and the formulation of valid procedures and principles for the development of the whole of the region.

5.3.3. Activities

1. To complete the existing documentation on international agreements and legislation concerning the right to national and international waters in the two countries.

2. Legal assistance in drafting any agreement or other arrangement necessary for the utilization of the surface or subterranean waters of the shared basins.

5.3.4. Contributions

5.3.4.1. Contribution of the Joint Commission

Logistical support

The Joint Cooperation Commission will supply the premises and support of secretarial staff and supplies necessary for the accomplishment of the mission. It will provide the means of transport for the travelling of the consultant and of the permanent jurists.

5.3.4.2. External contributions

a) Personnel

It will be necessary to call on the services of a consultant of the highest level, a qualified jurist specializing in the law of international and national waters, for a total period of four months, spread over two years.

b) Documentation

The purchase of the necessary reference works together with the cost of copying the various documents which will form the basic legal documentation, established within the Documentation Department of the Joint Commission.

c) Training

The Project will accept the cost of any training courses which may be necessary.

5.3.5. Forecast budget : Legal consultation

		man/ months	Total US$
1.	Personnel		
	Assistance of FAO Legal Department	-	p.m.
	Consultant (provisional indication)	2	15,000
	Travel (Lagos)	-	1,000
	Total	2	16,000
2.	Training		
	Course at Rome	2	7,500
	Other courses	-	-
	Total	2	7,500
3.	Documentation		3,000
4.	Miscellaneous and bilingual reports		2,000
	OVERALL TOTAL		US$ 28,500

5.4. Component 4 - Organization of a documentation and information department

5.4.1. Objectives

The Project should assist the Joint Cooperation Commission in ensuring the circulation of information and the supply of adequate documents to all the operators involved in the development, study or research programmes in the region.

Its precise objectives are :

- The material organization of a documentation department;
- An inventory of the existing documentation on the region;
- The collection of all the new documentation created in the region or relating to it;
- The organization of all this documentation in the form of originals or of microfiches;
- The distribution of information to the departments concerned with the region, the technical departments, research institutes and projects;
- Training the personnel of the department;
- The establishment of close links for cooperation, mutual aid and exchanges of information with the documentation departments of the Niger River Basin Authority and of the Lake Tchad Basin Commission.

5.4.2. Results expected

The Project will reinforce the capability of the Joint Commission to provide assistance to the regional development operators. It will possess a documentation department ready for use and will supply, on request, copies of documents or, at the least, the necessary references for the operators when carrying out their tasks.

5.4.3. Activities

1. Establishment of basic documentation on the region and for the users working on the development projects in the region.

2. The conservation and distribution of documents on the region in the form of microfiches.

3. The publication of periodical information sheets.

4. Training local personnel in documentation techniques.

The processing systems adopted should be compatible with the international (AGRIS and CARIS) and regional (RESADOC) systems already used by other institutions in the region.

5.4.4. Contributions

5.4.4.1. Contributions of the Joint Cooperation Commission

1. Personnel The Commission will supply the permanent personnel of the department, namely :

1 Record keeper (bilingual), responsible for the department

1 Assistant record keeper (bilingual)

2 Typists (French and/or English)

1 Clerk-operator for copying

Maintenance personnel.

2. Premises The department will be housed within the Headquarters of the Joint Commission.

3. Transport The Commission will fund the travelling necessary for collecting the documents.

4. Operation The Commission will be responsible for supplying normal materials for the production and reproduction of documents.

5. Purchases of documentation The Commission will endeavour to establish a fund allowing it to acquire original documents and works of reference whenever these are necessary.

5.4.4.2. External contributions

1. International personnel

1. Consultant : Record keeper/Archivist/Librarian responsible for assisting the personnel of the Commission in the implementation of the Documentation Department, in seeking and circulating documents and in studying the network for information on research : 4 man/months
2. Aid from an assistant expert, making it possible to ensure the training of the document keepers of the Commission under satisfactory conditions : 12 man/months

2. Training

1. Training in documentation techniques 2 man/months
2. Applications courses in the regional documentation centres (ABN, RESADOC, etc.) p.m.

3. Equipment

Reprographics equipment :

1 Microfiche reader/reproducer	10,000	
12 Microfiche readers	6,000	21,000
Consumables and miscellaneous equipment	5,000	

5.4.5. Forecast budget for the external contribution to the Documentation Centre

	TOTAL		Year 1		Year 2	
	m/m	US$	m/m	US$	m/m	US$
Personnel						
Consultants	4	30,000	2	15,000	2	15,000
Voluntary helpers	12	12,000	-	-	12	12,000
Official trips		1,000		500		500
Training						
Courses and study visits	2	6,800	-	-	2	6,800
Equipment						
Non-consumable equipment		21,000		20,000		1,000
Consumable materials		3,000		-		3,000
Miscellaneous						
Report (30 pages) and recommendations		2,000		-		2,000
Bibliographical research and microfiche production		4,000		1,000		3,000
General costs		3,000		-		3,000
TOTALS, US$		82,800		36,500		46,300

6. SUPPLEMENTARY PROJECTS

There are two other projects which, in the form of a consultation, would allow the Joint Nigerian-Niger Cooperation Commission to identify rapidly those actions which are capable of being put into effect immediately without having to wait for the formulation of the plan of action for the whole of the region.

6.1. Protection of the environment

The disturbing degradation of the environment in the project region is described in the present report. The whole ecological system is menaced: the soils, the vegetable cover, the survival of livestock and, finally, the standard of living of the rural populations.

Amongst the imbalances which the environment suffers there are, in particular, the energy and biomass balance sheets.

From the energy point of view the overexploitation of forests and scrubland results in a shortage of fuel and of overhead pasture, together with the aggravation of erosion by wind and water. The solution may perhaps be found in systematic re-afforestation, but above all in the more rational utilization of the resources. The wider use of improved cookers, which is starting to take place in the Sahel, makes it possible to reduce the amount of wood used by half.

In addition the less excessive exploitation of the existing biomass must be recommended. Amongst the suitable cultivation techniques leading to this end is the systematic composting of organic waste materials, the ploughing-in of foliage and the production of methane on farms. This latter technique has the advantage of recovering a combustible gas from organic waste materials without detracting from their value as fertilizers. It is therefore capable, a priori, of more effectively motivating the peasant to collect and compost such waste. Despite the fact that it is widely used in some major Asiatic countries it has unfortunately proved difficult to introduce in other areas, both for financial reasons and also for socio-cultural reasons. The climate of the Sudano-Sahelian region could, however, prove to be favourable for the introduction of this technique.

There are other methods for the recovery of organic waste materials. In particular it is possible to produce fuel brickettes from groundnut shells, using artisan-type or semi-industrial presses.

More generally the better utilization of solar energy still remains to be studied. This involves drawing up a coherent strategy for fighting the degradations caused to the environment by the sun under certain conditions. It also involves optimalizing the yield of photosynthesis by introducing vegetable species which usefully assimilate the maximum percentage of the gross solar energy which they receive (in this connection algae are of special interest). This is a vast and still insufficiently studied subject, but its interest is nevertheless very considerable. In the zone chosen for this Project it would be easy to make the studies needed profitable by way of the immediate impact they would have on village economies.

On either side of the frontier sectoral projects have been put into effect in an attempt to hold back this change: "integrated" rural development projects, reafforestation, stockraising projects, etc. Yet none of these appear to take into account this phenomenon in all its aspects and, in particular, to integrate with sufficient attention its socio-economic implications. It is necessary to accept fully the fact that the results of "ecological" projects such as those indicated above are often very meagre when compared with the considerable capital investments involved.

It is proposed that, during the consideration which will be given at the time of preparing the master development plan for the frontier basins, one of these basins is made the subject of an exhaustive study of environmental problems and that, subsequently, it be made the subject of a project implementing the conclusions of this study.

The basin selected is that of the Gada River - Goulbi de Maradi, which has the advantage of presenting a range of diverse situations: intermittent or quasi-perennial watercourses, variable levels of soil utilization and of population densities, more or less circumscribed pasturage and access zones, forests which are either well preserved or in course of degradation, etc. It forms a well-delineated study unit in the field and so provides an effectively circumscribed operational framework.

6.1.1. Objectives

In order to re-establish the ecological equilibrium which is threatened in the Gada River - Goulbi de Maradi basin by carrying out a programme of reconstitution and protection of the soil and of the vegetable cover one may fix the following objectives :

1. To evaluate the present situation of the natural environment in the Gada River - Goulbi de Maradi basin;
2. To evaluate the impact of existing or projected development programmes on the environment in the basin and their contribution to its protection;
3. To prepare a programme for the defence of the environment, covering the whole of the basin;
4. To prepare for concrete operations allowing the exploitation of renewable forms of energy or of fuel economies.

6.1.2. Results

The consultation will make it possible to formulate a project for the defence of the environment for the basin concerned, to constitute a first and immediate step in the development of all the frontier basins. It will also prepare operational projects for the manufacture of improved cookers and farm digesters.

6.1.3. Activities

1 To draw up a balance sheet of the present situation of the eco-system in the basin, including the following factors (it involves the provisional evaluation of certain data, it being the intention of the master plan preparation project to go more deeply into these) :

- soil utilization (1);
- situation regarding pasturage and access to common land;
- valorization of the existing biomass;
- exploitation of the forests;
- fuel consumption and needs;
- valorization of photosynthesis and of the effects of sunshine;
- phenomena of erosion:

2. To list the current and forecast development programmes so as to evaluate the implications for the environment:

3. To evaluate the result of current and completed projects in the fields of reafforestation and agrostology:

4. To study work carried out in the other basins (in particular Maggia):

5. To formulate an intervention project comprising specific actions in regard to rural soil development, reafforestation, fuel economies, the production of energy and of agrostology and, in general, all which could contribute to the defence of the environment; this project will take into account those operations already undertaken within the framework of other programmes.

6.1.4. Contributions

6.1.4.1. Contributions from the Joint Nigerian-Niger Cooperation Commission

The JN-NCC will be responsible for the transport of the consultants, and will provide the necessary material and logistic support needed during their mission.

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(1) The soil utilization map will have been produced at the time of starting the principal project for preparing the plan of action for the development of the basins.

6.1.4.2. External contributions	man/months	US$
1 Consultant, specialist in environmental matters, head of the mission	5	37,000
1 Consultant, specialist in energy (improved cookers, biogas)	2	15,000
1 Forestry consultant	2	15,000
1 Consultant, specialist in rural soil development	1	7,000
1 Pastoralist-agrostologist consultant	2	15,000
Travelling		1,000
Miscellaneous costs (reports, translations)		2,000
TOTAL		93,000

6.2. The development of agricultural machinery

The development of the productive system in the project region, as has been described, requires the implementation of new techniques and, in particular, the introduction of small agricultural machines. The reduction in the available manpower, due to the considerable exodus from the region, is one of the major justifications for this.

All rural development projects include a "draught cultivation" component. Serious evaluations carried out in other places, for example in Upper Volta, have shown that draught cultivation can increase production by 20 to 25%, as a result of better soil penetration. The success of draught cultivation programmes where they have been put into effect efficiently (that is to say accompanied by a series of supplementary technical subjects) bear witness to their validity. Once it is understood this equipment is greatly desired by the peasants. In the Gusau (Sokoto) pilot zone the areas under draught cultivation have doubled in four years, from 60,000 to 120,000 ha. In Niger manufacturing workshops have been created in all the Regions, but are not sufficient to meet the demand.

Agricultural mechanization is not limited to draught cultivation: the processing of the production and pumping equipment for irrigated cultivation are also important. Finally the widespread use of such equipment poses the problem of its maintenance at peasant level.

The network of local enterprises capable of producing such equipment and subsequently carrying out its maintenance is totally insufficient. This is a sector where it is recommended that the Joint Commission fulfils its mission of promoting the industrial sector.

Initially consultation with the competent departments of the FAO (Agricultural Engineering Service) would make it possible to specify the way in which the agricultural machinery sector could be improved in the region.

6.2.1. Long-term objective

The long-term objective is to establish within the region, in Niger and in Nigeria and, in particular, in the Regions and States bordering the frontier, the industrial and artisan-scale manufacture of agricultural equipment which will cover the needs of the development programmes undertaken in the region.

6.2.2. Immediate objectives

The immediate objectives are :

1. To study the present situation regarding the production of agricultural equipment;

2. To evaluate the requirements of the various current or projected development programmes;

3. To study the feasibility of one or more local projects, of different sizes, for the production of equipment.

The possibilities of the establishment of enterprises and of financing their requirements will be determined by ad hoc organizations such as OPEN in the case of Niger.

6.2.3. Special considerations

The mission of the JN-NCC is to identify, on behalf of the two Governments, the possibilities of developing new industries and agro-industries within the region.

The United Nations grants it permanent support by way of Project RAF/77/020. The present consultation therefore falls directly within the scope of this mission.

6.2.4 General information and justification

The frontier region of Niger and Nigeria constitutes one of the development poles for the whole of the Sudano-Sahelian area of West Africa. It is a relatively homogeneous region of 150,000 km² with about 9.5 million inhabitants, more than 80% of whom are farmers. The productive system consists essentially of small family farms of a few hectares, most of which use the traditional and elementary techniques. However these techniques have, until recently, ensured a degree of equilibrium. Nevertheless there has been, for some years now, a fairly severe degradation of the natural environment, against which the peasants have difficulty in defending themselves.

The Governments are implementing rural development programmes to a total cost estimated at nearly US$ 2 billion over the next five years. The mechanization of agriculture, and in particular small mechanization and the use of traction, forms a general component of the technical subjects involved. However the implementation of this aspect of the operations often comes up against a lack of availability of the equipment. It is necessary to import it. Firstly such equipment is costly, because of the cost of bringing it in, but secondly it is often not suited to local requirements.

More suitable equipment has been designed and tested locally, in particular by research institutes, but its manufacture has not been undertaken generally. Some workshops have been established, but these do not cover the growing needs.

This is, therefore, a sector in which local initiatives should be encouraged.

6.2.5. Results

1. The consultation will make it possible to launch a programme for the establishment of local manufacturing units;

2. A series of projects for creating these units will be prepared, staggered in time and spread throughout the whole of the region:

6.2.6. Activities

1. Visits to the production units now installed, inventorying of existing production and evaluation of its quality;

2. Visits to the development projects interested and estimation of their equipment needs:

3. Evaluation of existing imports of equipment:

4. Proposals for the improvement of existing production:

5. Proposals for the creation of new units :

- equipment to be produced,
- quantities,
- location,
- timetable for implementation.

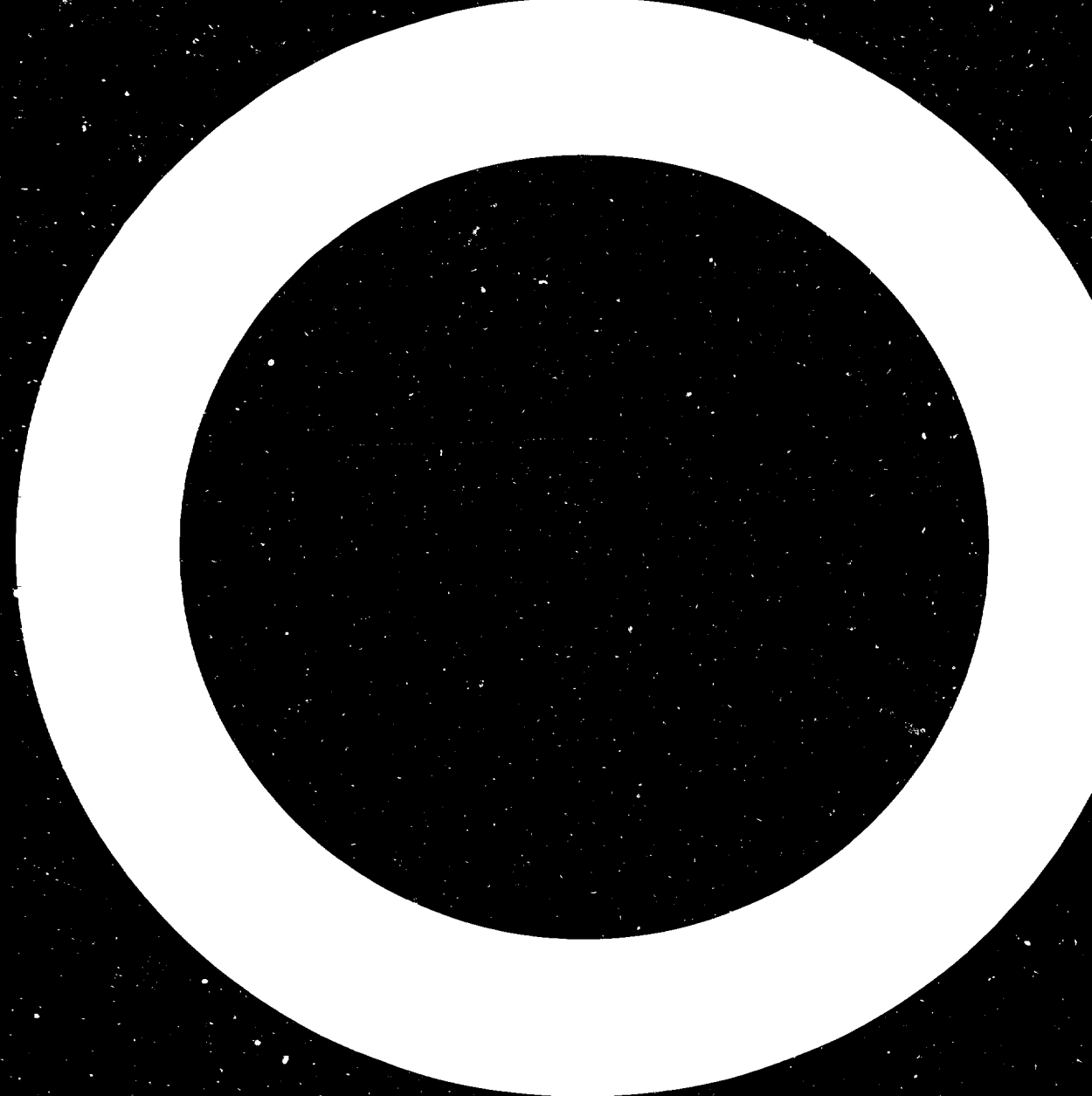
6.2.7. Contributions

6.2.7.1. Contribution from the Joint Cooperation Commission

The JN-NCC will be responsible for the transport of the consultants and will supply them with material and logistic support during their mission.

6.2.7.2. External contribution

	man/months	US$
2 Consultants for two months (1 specialist in agricultural equipment and 1 specialist in small and medium-sized industries)	4	30,000
Travelling		1,500
Bilingual report		2,000
Miscellaneous costs		2,000
TOTAL		35,500



ANNEX 1

TIMETABLE OF THE MISSION

Composition of the mission

SEGERS, Jean Marc, Rural economist - planner, consultant

BERNEY, Olivier, Civil engineer - hydrologist, consultant

Itinerary of the mission

August 1981

14 Arrival at Niamey

15 - 19 Niamey: discussions with representatives of the UNDP, the Joint Nigerian-Niger Cooperation Commission, the national Departments of the Ministries of Planning, Rural Development, Hydraulics, ONAHA, IGN and of the Coopération Technique Belge.

20 - 21 Dosso: visits to the Rural Development Project and the Regional Planning Department.

Tahoua: discussions with the Regional Planning Departments, ONAHA, the Rural, Agriculture, Stock-raising, Water and Forests Department and the UNCC.

22 Tahoua Region: visit to the Maggia basin (Birni N'Konni irrigated area, Mozagué and Zongo dams, irrigated areas of Galmi, Nouella and Kwara).

Maradi: discussions with the regional Planning Department.

23 Maradi: examination of the existing documents (Goulbi de Maradi, Goulbi de Gabi, Maradi Productivity Project, etc.).

24 Maradi Region: site visits - Goulbi de Gabi, Lake Madarounfa, gauging station at Nielloua, irrigated areas of the Maradi Productivity Project.

25 Gazaoua: visit to El Fadama and May Farou.

Zinder: making contact with the regional Planning Departments, examining documents (Koramas basin).

26 Zinder: meeting with the regional departments of Planning, Rural Engineering, Stock-raising, Education, Water and Forests and the 3M Project. Site visits : Aguié, Korama, Matameye and Tapkin-Gada-Kwaya pools.

August 1981

27 Kano: contact with the Niger Consulate.

28 Kano: meetings with the Department of State Budget for Kano, with WRECA (Water Resources and Engineering Construction Agency) with the Hadejia-Jama'are River Basin Development Authority and the Ministry for Agriculture and Rural Development.

29 Zaria: discussions with the UNDP personnel seconded to the Ahmadu Bello University and the Director of the Institute for Agronomic Research.

30 Zaria: continuation of the discussions.

Kaduna: discussions with the agronomics expert of the Agricultural Projects Monitoring, Evaluation and Planning Unit for Nigeria.

31 Kaduna: visits to the Ministry for Agriculture, the Water Board and the Integrated Rural Development Project.

September 1981

1 Kano: discussions with the Budget Department. Visit to the Tagwai catchment area.

2 Katsina: discussions with the representatives of the Water Supply to Rural Zones Section of the Ministry for Agriculture. Visit to the Ajiwa dam and discussions with the Water Board. Visit to the gauging station at Jibyia on the Gada River.

3 Gusau: discussions with the Regional Directorate of the Integrated Rural Development Project.

Sokoto: discussions at the Ministry for Water and Electricity.

4 Sokoto: discussions with the Sokoto-Rima River Basin Development Authority, with the Ministries for Agriculture and Rural Development, for Water and Electricity, Finance and Economic Planning, visit to the Lake Kware pumping station, the spring and irrigated area of Tugan Tudu and the Lake Kalmalo installations.

5 - 6 Drafting the mission report. Visit to the Tombo Bouya zone.

7 - 9 Niamey: discussions at the Ministries of Planning and Hydraulics, with ORSTOM, UNDP and the EDF.

10 Summarizing meeting, at the Joint Nigerian-Niger Cooperation Commission with its representatives and those of the Ministries of Planning, Rural Development, Hydraulics, ONAHA and ORSTOM.

September 1981

11 Return to Rome

14.9 to 21.10 Rome: drafting the provisional report.

January 1982

18.1 to 22.1 Rome: meeting of the "Task Force" consisting of representatives of the JN-NCC, the FAO, the UNDP and the members of the formulation mission.

25.1 to 30.1 Rome: drafting the definitive report.

ANNEX 2

LIST OF THE PERSONS MET

IN NIGER

Niamey

United Nations

Mr BEGUIN, A., Deputy Assistant PAM, FAO Representative a.i.

Mr BOELENS, E., Deputy Resident Representative.

Mme NORMAND, Archivist

Mr OKAMBAWA, F., Senior Clerk, UNICEF

Mr PIERRE-LOUIS, R., Programme Head, FAO

Mr VAN WAGENINGEN, C., Administrative Assistant, FAO

Joint Nigerian-Niger Cooperation Commission

Mr AKUNWAFOR, G., Secretary General

Mr KAIGL, V., Principal Technical Adviser, UNIDO, Project RAF/77/020

Mr LAMBERT-DAYNAC, G., FAO Adviser, Project RAF/77/020

Mr MAGAGI, M., Deputy Secretary General

Ministry of Planning

Mr ALIOU, M., Director of Programmes and Planning

Mr BACHIR, A., Head of Regional Planning Department

Mr CHAFANI, L., Directorate of Programmes and Planning

Mme HAMISSOU, M., Directorate of Programmes and Planning

Mr KABO, Planning Department

Mme LORLEACH, M., Adviser, Regional Planning Department

Mr MALLAM ABBA, I., Executive Office Director

Mr NASSIROU, S., Regional Planning Department

Mr NORMAND, Adviser, Planning Department

Mr HOUSMANE, R., Head of Planning Department

Ministry of Rural Development

Mr ANNOU, G., INRAN

Mr BAWALE, R., Head of Draught Cultivation, Kamia

Mr CISSE, A.A., Director General, ONAHA

Mr DESAUNETTES, J.R., Principal Technical Adviser, NER/75/009

Mr HALIDOU, A., Director of Rural Engineering

Mr MAMADOU A., Deputy Head, Kamia area

Mr MATZENMILLER, K., FAO Adviser, IPDR-Kolo

Mr RANDON, Adviser on Agricultural Statistics

Mr SALEY, M., Director, INRAN

Mr SEYNI, A., Secretary General, Haut-Commissariat du Barrage de Kandadji

Ministry of Hydraulics

Mr BEIDOU, B., Director of Water Resources

Others

Mr DEACON, Economic Adviser, EDF Delegation

Mr DUBEE, ORSTOM

Mr MARCHAL, Belgian Ambassador

Mr MENTEN, Head of Cooperation Section, Belgian Embassy

Mr PRIN, Representative a.i. of IGN

Dosso

Mr GADO, B., Head of Regional Planning Department

Mr MAROUNA, A., Sous-Préfet, Dogon Doutchi

Mr PRADON, Administrative Director, Rural Development Project

Mr ROUX, J.M., Rural Development Project

The Chief of the Tibiri Canton.

Tahoua

Mr ALLIOU, I. Head of the Regional Rural Engineering Department

Mr ATCHABI, A., Head of the Regional Agricultural Department

Mr BLACKMAYER, GTZ

Mr DAN DJIBO, E., Head of the Regional Department of ONAHA

Mr GOURO S.A., Head of the Regional Stock-raising Department

Mr IBRAH, L., Head of the Regional Water and Forests Department

Mr KORONEY, M., Head of the Regional Department of OFEL.ES

Mr MOUMOUNI, M., Departmental Representative of the UNCC

Mr ROUSSEAU, G., Volunteer, Regional Planning Department

Mr SKRYSCZAK, P., Adviser, Regional Planning Department

Mr SOULEY, A., Head of the Regional Planning Department

Birni N'Konni

The Sous-Préfet

Mr DOGO, L., Clerk of Works, GR

Mr KANTOU, M., Director, Moullela area

Maradi

Mr AKILOU, I., Head of the Regional Training Department

Mr ARNOUX, J.M., Adviser, Rural Development Project

Mr AROUNA, A., Préfet

Mr BOUKARY, Y., Head of the Regional Stock-raising Department

Mr BOULAMA, M., Rural Development Project

Mr DAN KAOURA, Y., Agriculture, Gazaoua

Mr EN SEYNI, N., Sous-Préfet, Madarounfa

Mr IDAO, A., Sous-Préfet, Aguié

Mr IDI, I., Adviser, Gazaoua

Mr ILLIASSOU, M., Head of the Regional Rural Engineering Department

Mr ISSOUBOULE, H., Agriculture, Gazaoua

Mr MAIGA, H., Head of the Regional Planning Department

Mr MANZO, S., In charge of the irrigated area

Mr KATY, D., Gazaoua Canton

Mr OUMAROU, E.M., Head of the Regional Planning Department

Zinder

Mr BAGNOU, B., Préfet

Mr BATOURE, I., Head of the Regional Rural Engineering Department

Mr BOULHASSANE, S., Sous-Préfet, Mirzia

Mr DOGO, N., Head of the Regional Training Department

Mr HAMA, A., Deputy Préfet

Mr HAROUNA, M., Deputy Head, Regional Agricultural Department

Mr KASSAOURA, S., Director, 3M Project

Mme LAWELL, Z., Urban Training

Mr MAINA, B., Head of the Regional Planning Department

Mr MALIDOU, D., Head of the Regional Stock-raising Department

IN NIGERIA

Kano

Mr ABARA, D., Consul for Niger

Mr BADAWI, A., Accountant General

Mr HAMISSOU, I., Chief Irrigation Engineer, Ministry of Agriculture

Mr KASSIM, M., Director of Budget

Mr MAGAGI, A., Director of WRECA

Mr MOUSSA, WRECA

Mr MUSA, S., Senior Research Officer, Ministry of Agriculture

Mr SHEMU, E.Y., Senior Planning Officer, Department of Budget

Mr SOUMANA, A., SONARA

Mr WIJAYATILEKE, M.G., Chief Irrigation Engineer, Hadejia-Jama'are River Basin Development Authority

Ahmadu Bello University, Zaria

Mr DAVIES, J., Director, Institute of Agricultural Research

Mr KALKAT, H.S., IAR

Mr MUSA, M.L., IAR

Mr OKIROR, S.O., ICRISAT (UNDP)

Mr SUNDARAM, N.V., ICRISAT (UNDP)

Kaduna

Mr ADGEBOYE, J.B., Deputy Head, APMEPU

Mr BIVINS, J., Evaluation Officer, APMEPU

Mr DAN TEMY, UNDP

Mr JIBRILU, Assistant Chief Engineer, Ministry of Agriculture

Mr QUINN, J.G., Adviser, APMEPU

Katsina

Mr AMINU, M.A., Head of Central Administration

Mr AM MAROUNA, Secretary, Local Government

Mr AM USMAN, K., Principal Water Supply Intendant

Mr CMANDRAN, M., Electrical Engineer, Water Board

Mr DURAI, A., Water Engineer, Water Board

Mr OUSMAN, M.T., Assistant Secretary

Mr PRAKESH, C., District Manager, Water Board

Mr RAFIMDADI, Y., Project Manager, SRBDA

Sokoto

Mr IYER, M.P., Chief Irrigation Engineer, Ministry of Agriculture

Mr KOHLI, K.N., Hydrologist

Mr KWAZO, A., Agriculturist Division, Ministry of Agriculture

Mr RANAWEERA, T.A., UN Adviser, Ministry of Finance and Economic Planning

Mr SHEIKH, M., Assistant General Manager, Engineering, SRBDA

Mr SULE, A., Assistant General Manager, Administration; Acting General Manager, SRBDA

Mr TUKUR, M., Acting General Manager, ADP, Gusau

ANNEX 3

NIGER-NIGERIA - SUDANO-SAHELIAN REGION

DEVELOPMENT PROGRAMME OPERATORS

Locality	Organization
Niamey	JN-NCC, Headquarters Ministry of Planning Ministry of Hydraulics ONAHA Niger River Basin Authority
Tahoua	Hydraulics Department Planning Department Productivity Project (GTZ) Badeguicheri Project (EDF)
Birni N'Konni	Irrigation area (ONAHA)
Maradi	Hydraulics Department Planning Department Rural Development Project (IRDB) Tarna Station (INRAN)
Zinder	Hydraulics Department Planning Department 3M Project (EDF)
Diffa	Planning Department Productivity Project (CIDA)
Maiduguri	Rural Development Project (IRDB) Ministry of Planning Ministry of Agriculture Water Board Lake Tchad Basin Commission
Kano	Budget Department Ministry of Agriculture WRECA Hadeja-Jama'are River Basin Authority Rural Development Project (IRDB)
Kaduna	Ministry of Planning Ministry of Agriculture Rural Development Project (IRDB) Water Board APMEPU

Samaru	Ahmado Bello University, Research Institutes
Katsina	JN-NCC Documentation Centre SRBDA Sub-station
Sokoto	Ministry of Planning Water Board Rural Development Project (IRDB) Sokoto-Rima River Basin Development Authority (SRBDA)

ANNEX 4

DOCUMENTS CONSULTED

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ANNEX 5

ADDITIONAL INFORMATION ON THE INTEGRATED AGRICULTURAL PROJECTS

NATIONAL CEREALS PROJECT

Objectives : research, with a view to developing new cereals varieties suited to the specific conditions of Niger:

- reinforcement of the spreading of agricultural knowledge;
- development of research and production infrastructures.

The project has cereal breeding farms in all the Regions.

CENTRE-EAST STOCK-RAISING DEVELOPMENT

This project gives assistance to stock-raisers in the fields of animal health and assistance services. It places special emphasis on cooperation between stock-raisers.

Subjects : animal health
credit
pastoral hydraulics
flock and herd management

The project covers the regions of Maradi, Zinder and Diffa.

REAFFORESTATION

This is a pilot project, consisting of the following components :

- 400 ha of irrigated plantations;
- 700 ha of rain-watered plantations;
- assistance to technical services;
- training with a view to spreading knowledge;
- research.

Priority is being given to the Maggia regions and to the frontier zone of the regions of Maradi and Zinder (Madarounfa, Tessaoua, Matameye and Magaria)

---

(1) Total external participation.

(Translator's note : This footnote seems to be out of place.)

BIRNI N'KONNI AREA

Objectives : development of 2600 ha of irrigated crops and 1500 ha for dry season cultivation.

Rainy season crops : sorghum (2/3) and cotton (1/3).

Out-of-season crops : wheat, niebe, maize, cassava, potatoes and onions.

The development covers 11 villages with a total of 25,000 inhabitants, 3500 farms with irrigated crops and 7500 with out-of-season crops. The area is supplied by the two dams of Zongo and Mozague.

TAHOUA PRODUCTIVITY

Objectives :
- improvement of traditional agricultural productivity by the introduction of simple and profitable techniques within the reach of the peasants, so that they can achieve self-sufficiency in foodstuffs;
- increasing rural incomes;
- implementation of a participative structure;
- re-balancing of the ecological system.

Subjects :
- rain-watered crops;
- market-garden crops;
- improvements in land ownership;
- studies.

Geographical area : Tahoua, Kaita, Bouza and Madaoua.

Observation : the valley of the Maggia passes through the districts of Bouza and Madoua, but the project covers only a part of each district (8% of the area and 14% of the population) and is not initially of direct interest to this valley since it is covered by the small developments programmes of Rural Engineering and the ONAHA.

MAGGIA VALLEY AREAS

ONAHA manages, or will manage, eight areas stretching along the Maggia or its tributaries, with a total irrigated area of 940 ha divided up as follows :

- Guidam Kododi	250
- Guidam Bagilbi	250
- Moulela	63
- Kawara	50
- Gounfara	120
- Guidam Magagi	120
- Tounfafi	28
- Gadaroumé	60

The rotation cropping consists, in general, of 2/3rds sorghum and 1/3rd cotton.

GALMI AREA

ONAHA will be responsible for the management of the Galmi Area and the feeder dam at Guidam-Kododi. The commencement of this development is forecast for Autumn 1981. The financing (1 billion FCFA) is being provided by the Federal Republic of Germany (GTZ).

KONNI POOLS AND FLATLANDS

Objectives : Development of market-garden and rice crops around the pools and flatlands; formation of cooperative movements for better management.

A conservation and restoration of the land scheme is under study.

Geographical area : The North-east of the Region.

C'DARMA - TAHOUA

Objectives :
- development of agricultural machinery
- manufacture of 2000 units for draught cultivation per year
- training of rural artisans.

MARADI RURAL DEVELOPMENT

Objectives :
- increasing the income from farms
- improving the well-being and standard of living of the rural population.

Subjects :
- improving techniques for rain-watered cultivation
- spreading knowledge by the "training and visiting" system
- agricultural credit
- irrigated crops on 740 ha
- applied research
- multiplication of seeds
- functional literacy
- village timber
- veterinary actions.

The project covers the whole of the southern part of the Region, and in particular the valleys of the Goulbi de Maradi and the Goulbi de Gabi and the Lake of Madarounfa.

ZINDER RURAL DEVELOPMENT

Objectives :
- security in respect of foodstuffs (self-sufficiency and the establishment of safety stocks)
- increasing the monetary resources of the peasants
- cooperative and technical self-management.

Subjects :
- maintenance and correction of fertility
- technical subjects (packet)
- out-of-season crops
- small stock-raising (goats, poultry)
- extension and consolidation of the cooperative and self-management network
- disenclosing of land.

This project covers the three districts of the South of the Region which, broadly speaking, correspond to the basin of the Koramas. In includes a section on the manufacture of trailed cultivation equipment.

IN NIGERIA

SOKOTO AGRICULTURAL DEVELOPMENT

This project consists of the extension of the Gusau pilot project to cover the whole of the State of Sokoto.

The objectives are to provide major assistance to the peasants of the State by reinforcing the services for the spreading of knowledge and also the infrastructures. This involves :

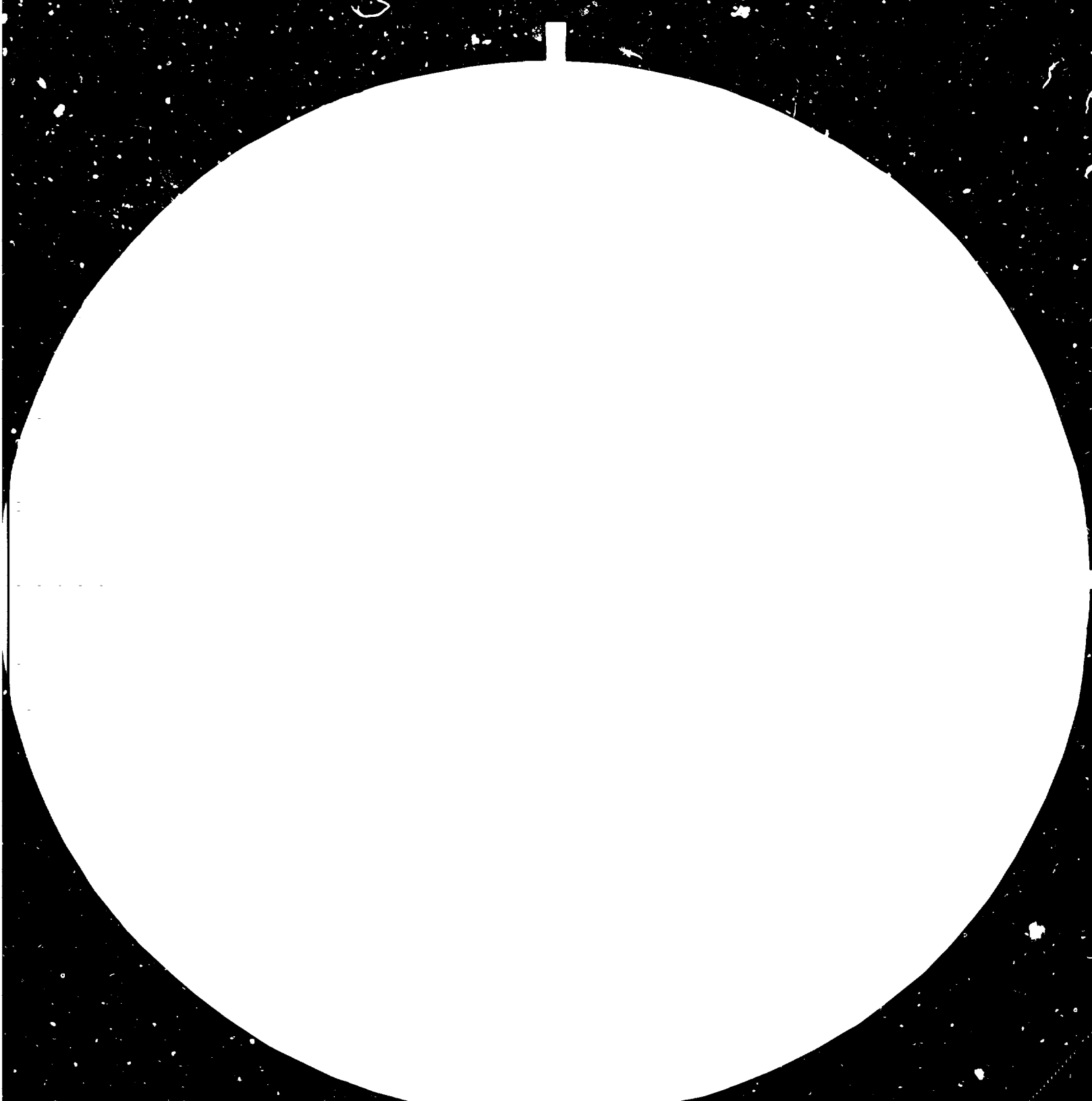
- planning soil usage
- improving riverside crops
- developing flatland crops
- constructing access roads
- a water supply programme
- the distribution of inputs
- assistance to cooperatives and for marketing.

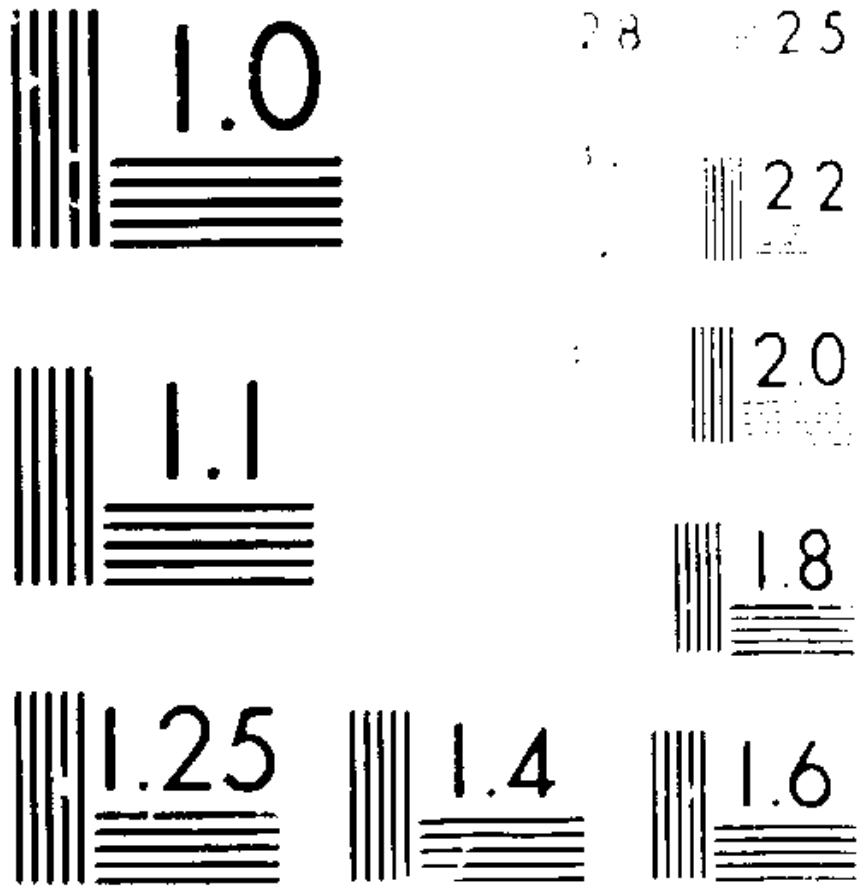
The region downstream of the River Lamido (or Maggia) corresponds to zone III of the project, the centre of which, Gwadabawa, is located on the road from Sokoto to Birni N'Konni.

KADUNA AGRICULTURAL DEVELOPMENT

The success of the Funtua pilot project has led to the preparation of a project covering the whole of the State of Kaduna. It comprises the following elements :

- the development of dry crops
- the development of flatland crops
- the management of pasturage land
- the management of green belt and forest capital
- the multiplication of the supply of inputs and resources
- applied research
- access roads
- village wells and borings
- space planning
- training.




1.0
2.8
2.5
2.2
1.1
2.0
1.8
1.25
1.4
1.6

Zone I of the project (Katsina, Mani and Daura) corresponds to the basins of the Gada and Tagwai rivers.

Certain administrative difficulties at the last moment have temporarily held up the procedures for the involvement of the World Bank in this project, but it will start on the basis of the State's own funds.

GADA VALLEY DEVELOPMENT

Five projects for dams on the Gada and its tributaries have been studied :

Kurfi	15 Mm^3
Fakuwa-Cheranchi	18 Mm^3
Gada-Benye	60 Mm^3
Ruma	9 Mm^3
Jibiya	142 Mm^3

These are projects intended to supply the water distribution systems. Furthermore it is intended to develop areas of 2500 ha at Gada-Banye and 3700 ha at Jibiya. Feasibility study on these various projects have been completed and they could be put into effect as soon as the necessary funds have been found.

LAKE KALMALO IRRIGATION AREA

The total irrigated areas supplied by pumping from Lake Kalmalo amount to 270 ha. Financing of the project has been covered by the State of Sokoto on the basis of a NEDECO study. The entry into operation dates back to 1979, but they have only been able to operate intermittently due to the inadequate natural refilling of the lake by the River Maggia (or Lamido).

Table 1 PLAN OF ACTION FOR THE DEVELOPMENT OF THE SUDANO-SAHELIAN FRONTIER REGION OF NIGER AND NIGERIA. OBJECTIVES AND ACTIVITIES, 1981-1985

The aim of this exercise is to attempt to estimate the human resources to be employed when drawing up the plan of action. This estimate is based on the principal elements of the diagnoses made by the "Komadougou-Yobé" and "Four Basins" missions.

These principal elements are :

1. The degradation of the environment:
2. The inadequacy of the present programmes to meet the needs:
3. The underemployment of the water resources:
4. The constraining politico-administrative structures.

Remedies can be envisaged to overcome these major constraints. Certain instruments exist for applying these remedies, others need to be devised. The Joint Commission, with all the projects it has to supervise, has a number of tasks to accomplish. These will be entrusted to national or external specialists.

In this provisional document it has not been specified which are to be the permanent staff or which the consultants. Those specialities which are to be involved as a matter of priority during the start-up phase are indicated by the symbol ■.

It will be the responsibility of these specialists to define the terms of reference and the duration of the other missions which are necessary.

In the chart :

- certain necessary links between the various elements for analysis are indicated by arrows;
- the word "project" in the "Results" column indicates that identification of these projects is to be carried out under the aegis of the Commission;
- simple consultations are not distinguished from sub-contracting, except in certain cases indicated by the symbol ✱.

The specialist categories are indicated in the chart by the following key :

a	Planner	j	Rural engineer
b	Rural economist	k	Forester
c	Agro-industrial economist	l	Zootechnician
d	Photo-interpreter	m	Sociologist
e	Hydrogeologist	n	Jurist
f	Geophysicist	o	Others
g	Pedologist	p	Agricultural research
h	Agrostologist	q	Economics research
i	Agronomist	r	A.D. Projects.

PLAN OF ACTION FOR THE FRONTIER REGION - OBJECTIVES AND ACTIVITIES - 1982 - 1985

A	FACTORS B	REMEDIES C	INSTRUMENTS D	TASKS E	OPERATORS : a b c d e f g h i j k l m n o p q r	RESULTS F
1	DEGRADATION OF THE ENVIRONMENT					
2	Over-exploitation of the land (→3,5,7)	Intensification		Inventory	d M, g X, h ■	Soil use map
3	(2→) Disappearance of fallow land		Technical improvement - see 30	Research	p X	Disseminable techniques
4			Irrigated cultivation	See 41 et seq.		
5	Over-exploitation of pasture land (→7)	Flock management		Inventory	d M, h X, l ■, p X, q X	See 2
6			Integrated agro-pastoral system		b X, i X, l X, m X, r X	
7	(2,5→) Destruction of vegetable cover			Inventory	d M, k ■	See 2
8	→ Fuel →	Economies	Improved stoves	See 29	o M	Project
			New forms of energy	See 29	o M	Project
9	→ Timber →	Plantations	Species of rapid growth. Village plantations		k X, r X	Projects
10	→Over-pasturing	See 5	See 6			
11	(2,5,7→) Wind erosion →	See 9,2 and 5				
12		Planting wind-breaks	Village plantations		k X, r X	
13	(2→) Erosion by water	Anti-erosion campaigns			j X, r X	
14	INADEQUACY OF EXISTING PROGRAMMES TO MEET THE NEEDS					
15	Participation bank (←→19,28)	Possibility of expression	Study of the basic needs		a ■, b X, i X, k X, l X, m ■, r X	Monographs
16		Auto-management	Cooperatization		r X	
17	Lack of knowledge of the environment (→28)	Participation	Participation institutions	Study of the environment	a X, b X, m ■	See 15

PLAN OF ACTION FOR THE FRONTIER REGION - OBJECTIVES AND ACTIVITIES - 1982 - 1985 (contd.)

A	FACTORS B	REMEDIES C	INSTRUMENTS D	TASKS E	OPERATORS : a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	RESULTS F
18	- Family organization - Role of women		- Traditional organizations																				
19	- Traditional authority - Funding law		- Chieftainry - Cooperatives																				
20	- Customary usages		...																				
21	Absence of planning of the labour force →	Intensification see 2																					
22		Development of secondary and tertiary sectors	- Rural artisans - Transport, etc.	- See 8 for example			X																Projects
23	Insufficient support for production	Intensification	Improvement of the inputs	Coordination	X	X							X							X		X	
24	Inadequacy of the infrastructures →	Credit systems	Cooperatization			X											X					X	
25			Reinforcement of the institutions		X	X																X	
26		Marketing structures	Marketing organizations →	Organization of local and national markets	X	X																X	
27				Organization of the international market	X	X											X						Bilateral agreements
28	(27 →) Artificial division of the rural environment	Integration	- Rain-watered and irrigated agriculture	See 35 et seq.																			
29			- Agriculture and stock-raising			X							X			X	X					X	
30			- Primary and other sectors	See 22																			
31	Quantitative shortfall of managers	Participation see 16																					

PLAN OF ACTION FOR THE FRONTIER REGION - OBJECTIVES AND ACTIVITIES - 1982 - 1985 (contd.)

A	FACTORS B	REMEDIES C	INSTRUMENTS D	TASKS E	OPERATORS : a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p	q	r	RESULTS F
32		Technical assistance																				X	
33	Quality of the management	Training, motivation		Inventory and formulation of programme	X	X							X	X	X	X						X	
34	UNDER-EMPLOYMENT OF THE HYDRAULIC RESOURCES																						
35	Lack of knowledge of the resources	Inventory of surface waters	Work of technical departments	Analyses and processing				M	M														Various maps, balance sheet and
36		Inventory of sub-terranean waters		Study				M	M	M													mathematical models
37	Lack of integration of operations	Integrated exploitation		Exploitation model		X							X	X								X	Models
38	"Capital intensive" approach to projects	To be abandoned																					
39	Lack of knowledge of the techniques	Research		Coordination																X	X	X	Improved techniques
40	Management and the peasants	Training																				X	
41	Funding problems	Legislation		See 24																			
42	Problems of inter-national sharing	Negotiations	See 45																				
44	POLITICO-ADMINISTRATIVE STRUCTURES																						
45	International frontier	Negotiations	Concerted action institutions	Study and proposals													X						International agreements
46*	Centralization of technical depts,	Improvement of decentralization	Regional concerted action institns.	Coordination	■																	X	
47**	Autonomy of States and Local Governments		Systems of : - information		■																	X	
48	Autonomy of certain operators		- communication	Coordination	■																	X	
			- documentation															X					Documentation centre

* - Mainly Niger ** - Nigeria

Table 2 - CLIMATIC DATA

COUNTRY - NIGER | STATION - TAHOUA | NUMBER - 61 43

LATITUDE - 14°52' | LONGITUDE - 5°13' | ELEVATION - 386 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	1	0	0	2	18	45	117	144	66	14	0	0	407
TEMP: AVERAGE	23.6	26.0	30.1	32.7	33.3	31.7	30.0	29.0	30.0	29.6	27.6	24.0	29.0
TEMP MEAN MAX	31.6	35.1	39.0	41.1	41.2	39.1	36.0	34.0	36.0	38.2	35.0	33.1	36.6
TEMP MEAN MIN	15.0	18.2	22.3	26.1	27.1	26.0	24.0	24.0	23.7	23.5	19.0	17.0	22.1
TEMP MEAN DAY	26.3	29.7	33.7	36.3	36.7	34.9	32.1	30.8	32.0	33.4	29.8	27.9	32.0
TEMP MN NIGHT	20.6	23.9	27.9	31.0	31.7	30.2	27.7	27.1	27.4	27.9	23.7	21.7	26.7
VAPOUR PRESS.	4.6	4.3	5.1	8.5	16.5	21.5	23.8	25.6	25.3	15.3	7.3	5.6	13.6
WIND SPEED 2M	4.0	4.0	4.2	4.1	4.5	4.7	4.7	4.1	3.7	3.6	4.0	4.1	4.1
SUNSHINE %	79	81	69	58	64	66	71	66	69	79	82	82	72
TOT RADIATION	427	481	485	466	496	502	521	497	492	491	452	422	478
EVAPOTRANSP.	255	257	335	301	312	260	222	192	195	237	251	252	3069

COUNTRY - NIGER | STATION - BIRNI N'KONI | NUMBER - 61 75

LATITUDE - 13°46' | LONGITUDE - 5°13' | ELEVATION - 272 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	1	0	0	2	29	72	138	232	111	13	0	0	598
TEMP: AVERAGE	24.1	26.5	30.6	32.7	33.0	31.0	28.0	26.7	27.6	28.8	27.3	24.5	28.5
TEMP MEAN MAX	32.0	35.7	39.3	41.0	40.5	38.0	34.8	33.0	34.7	37.6	35.0	33.3	36.2
TEMP MEAN MIN	15.1	18.1	21.3	25.0	26.1	25.2	23.5	22.5	22.8	21.6	18.5	16.5	21.5
TEMP MEAN DAY	26.6	30.1	33.6	35.9	35.9	33.9	31.2	29.6	30.9	32.4	29.7	27.8	31.5
TEMP MN NIGHT	20.8	24.0	27.3	30.3	30.7	29.3	27.0	25.7	26.4	26.4	23.4	21.5	26.1
VAPOUR PRESS.	7.7	7.0	9.6	14.3	21.7	24.2	28.8	27.1	27.5	21.8	12.0	8.5	17.5
WIND SPEED 2M	3.8	3.7	3.1	3.0	3.3	3.5	3.5	3.0	2.6	2.5	2.7	3.3	3.2
SUNSHINE %	83	84	76	69	75	74	67	58	71	82	87	87	76
TOT RADIATION	448	498	515	511	539	531	501	463	501	507	476	446	495
EVAPOTRANSP.	238	242	273	259	258	212	165	146	150	191	197	211	2542

Source : FAO

Table 2 - CLIMATIC DATA - continued

COUNTRY - NIGER | STATION - MARADI | NUMBER - 61 80

LATITUDE - 13°26' | LONGITUDE - 7°03' | ELEVATION - 368 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	0	0	0	4	32	60	164	260	110	12	0	0	642
TEMP: AVERAGE	22.2	24.5	29.2	31.5	31.8	30.2	27.0	25.8	26.8	27.5	25.5	22.3	27.0
TEMP MEAN MAX	31.0	34.7	38.5	40.2	39.6	37.5	33.7	32.0	33.5	36.5	34.0	32.5	35.3
TEMP MEAN MIN	12.3	15.0	19.3	23.6	25.0	24.5	23.1	22.0	22.0	19.7	15.5	13.2	19.6
TEMP MEAN DAY	25.1	28.4	32.4	34.9	34.9	33.3	30.3	28.8	29.8	31.1	28.0	26.2	30.3
TEMP MN NIGHT	18.6	21.6	25.7	29.1	29.7	28.6	26.4	25.1	25.5	24.7	21.0	18.9	24.6
VAPOUR PRESS.	6.1	5.8	7.2	12.0	19.8	23.2	25.0	26.3	26.5	20.5	10.3	7.2	15.8
WIND SPEED 2M	2.2	2.3	2.3	2.2	2.5	2.3	2.5	2.2	1.7	1.6	1.8	2.0	2.1
SUNSHINE %	80	81	73	65	74	74	66	58	69	81	82	80	74
TOT RADIATION	440	489	504	494	534	529	496	463	494	505	462	427	486
EVAPOTRANSP.	165	175	227	227	225	184	155	134	137	164	155	150	2098

COUNTRY - NIGER | STATION - ZINDER | NUMBER - 61 90

LATITUDE - 13°45' | LONGITUDE - 8°57' | ELEVATION - 460 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	0	0	0	3	27	55	153	232	71	7	0	0	548
TEMP: AVERAGE	22.7	27.1	29.8	32.5	32.6	31.0	28.0	26.2	27.8	29.5	27.1	23.3	28.1
TEMP MEAN MAX	29.6	33.1	37.1	39.3	39.7	38.0	34.8	32.6	35.0	36.6	32.7	31.1	35.0
TEMP MEAN MIN	14.1	17.0	21.1	24.8	25.7	25.3	23.6	22.5	23.1	22.3	18.0	15.5	21.1
TEMP MEAN DAY	24.7	28.0	32.0	34.7	35.2	33.9	31.2	29.3	31.2	32.0	27.9	26.0	30.5
TEMP MN NIGHT	19.3	22.4	26.4	29.6	30.2	29.4	27.1	25.6	26.7	26.6	22.4	20.1	25.5
VAPOUR PRESS.	7.5	8.2	8.8	11.1	18.7	23.0	25.2	26.2	25.5	16.8	10.5	8.5	15.8
WIND SPEED 2M	2.8	3.0	3.0	2.8	3.0	3.0	3.0	2.6	2.1	2.1	2.6	2.7	2.7
SUNSHINE %	82	85	76	69	76	75	68	61	73	81	85	87	77
TOT RADIATION	445	502	515	511	543	535	506	476	509	504	470	447	497
EVAPOTRANSP.	177	210	250	240	240	204	170	143	152	186	177	169	2318

Table 2 - CLIMATIC DATA - continued

COUNTRY - NIGERIA STATION - SOKOTO NUMBER - 65 10

LATITUDE - 13°00' LONGITUDE - 5°13' ELEVATION - 345 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	1	0	2	10	42	93	152	244	132	13	1	0	690
TEMP: AVERAGE	24.5	26.5	30.5	33.5	32.5	30.0	28.0	26.5	27.5	29.5	27.5	24.5	28.5
TEMP MEAN MAX	33.0	36.0	39.0	41.0	39.0	36.0	33.0	31.0	33.0	37.0	36.0	33.0	36.0
TEMP MEAN MIN	16.0	17.0	22.0	26.0	26.0	24.0	23.0	22.0	22.0	22.0	19.0	16.0	21.0
TEMP MEAN DAY	27.6	30.0	33.6	36.2	34.8	32.2	29.8	28.1	29.5	32.1	30.5	27.5	31.0
TEMP MN NIGHT	21.7	23.4	27.6	30.9	30.2	27.8	26.1	24.8	25.4	26.5	24.1	21.0	25.8
VAPOUR PRESS.	5.3	5.0	7.7	14.7	20.5	22.8	25.0	25.8	25.7	21.0	9.7	6.5	15.7
WIND SPEED 2M	2.5	2.5	2.2	2.3	2.3	2.3	2.0	1.8	1.5	1.5	2.0	2.1	2.1
SUNSHINE %	79	82	76	69	71	73	58	51	66	83	86	84	73
TOT RADIATION	440	495	517	510	520	524	462	434	483	514	478	443	485
EVAPOTRANSP.	191	192	227	224	207	177	151	132	138	168	174	166	2147

COUNTRY - NIGERIA STATION - GUSAU NUMBER - 65 15

LATITUDE - 12°08' LONGITUDE - 6°40' ELEVATION - 463 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	1	1	6	14	83	123	212	303	203	24	1	1	972
TEMP: AVERAGE	22.8	25.6	28.6	31.0	30.2	27.2	25.5	24.7	25.6	26.3	24.3	23.3	26.3
TEMP MEAN MAX	31.5	34.7	37.2	37.8	36.6	32.6	29.8	28.7	30.7	33.5	33.6	33.0	33.3
TEMP MEAN MIN	14.2	16.5	20.0	24.0	23.8	22.0	21.1	20.7	20.6	19.1	15.0	13.7	19.2
TEMP MEAN DAY	26.0	28.9	31.7	33.4	32.5	29.2	27.0	26.1	27.4	28.8	27.6	26.7	28.8
TEMP MN NIGHT	20.0	22.6	25.7	28.5	27.9	25.4	23.8	23.2	23.7	23.4	20.6	19.5	23.7
VAPOUR PRESS.	6.1	6.1	9.0	16.2	21.3	24.2	25.1	25.3	25.7	16.1	11.0	7.0	16.1
WIND SPEED 2M	3.1	3.2	2.7	2.5	2.3	2.3	2.3	2.1	1.8	2.0	2.5	3.0	2.5
SUNSHINE %	84	87	69	48	53	45	28	19	37	58	73	79	56
TOT RADIATION	463	518	491	424	444	407	338	303	368	424	439	434	421
EVAPOTRANSP.	210	220	245	206	187	144	123	109	117	165	177	202	2105

Table 2 - CLIMATIC DATA - continued

COUNTRY - NIGERIA STATION - KATSINA NUMBER - 65 28

LATITUDE - 13°00' LONGITUDE - 7°39' ELEVATION - 517 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	0	0	0	5	58	84	183	267	130	10	0	0	737
TEMP: AVERAGE	21.1	23.6	28.3	30.8	30.7	28.8	26.0	24.7	25.7	26.7	24.5	21.2	26.0
TEMP MEAN MAX	30.1	32.8	37.0	38.6	37.3	34.7	30.7	28.8	30.7	34.0	33.5	30.1	33.2
TEMP MEAN MIN	12.0	14.5	19.6	23.0	24.1	23.0	21.0	20.5	20.6	19.5	15.3	12.2	18.7
TEMP MEAN DAY	24.3	27.0	31.5	33.6	33.1	31.0	27.6	26.1	27.4	29.3	27.6	24.3	28.6
TEMP MN NIGHT	18.1	20.6	25.4	28.1	28.4	26.7	24.0	23.1	23.7	23.8	20.7	17.5	23.3
VAPOUR PRESS.	6.0	5.2	6.5	11.7	19.5	22.3	24.0	24.8	24.7	18.6	9.5	7.1	15.0
WIND SPEED 2M	1.5	1.7	1.5	1.7	2.1	2.2	2.0	1.6	1.2	1.0	1.1	1.3	1.6
SUNSHINE %	82	79	66	62	67	71	64	50	72	82	86	92	73
TOT RADIATION	450	485	478	482	504	515	487	430	506	511	478	469	483
EVAPOTRANSP.	131	146	182	193	195	166	143	120	130	141	125	117	1789

COUNTRY - NIGERIA STATION - KANO NUMBER - 65 46

LATITUDE - 12°01' LONGITUDE - 8°30' ELEVATION - 476 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	0	1	2	8	71	119	209	311	137	14	1	0	873
TEMP: AVERAGE	21.3	23.8	28.1	30.5	30.1	28.0	25.6	25.0	25.8	26.7	24.7	21.7	26.0
TEMP MEAN MAX	30.0	33.0	37.0	38.0	37.0	34.0	31.0	29.0	31.0	34.0	33.0	31.0	33.0
TEMP MEAN MIN	13.0	15.0	19.0	24.0	24.0	23.0	22.0	21.0	21.0	19.0	16.0	13.0	19.0
TEMP MEAN DAY	24.6	27.3	31.3	33.5	32.8	30.5	28.1	26.4	27.8	29.1	27.5	25.2	28.7
TEMP MN NIGHT	18.7	21.0	24.9	28.6	28.2	26.5	24.8	23.5	24.1	23.5	21.1	18.4	23.6
VAPOUR PRESS.	7.0	7.1	8.7	13.7	20.6	23.5	24.2	25.1	25.0	20.0	10.8	8.1	16.1
WIND SPEED 2M	2.7	2.8	2.7	3.5	3.8	3.8	3.5	3.0	2.5	2.3	2.3	2.5	3.0
SUNSHINE %	77	78	72	68	70	68	59	48	65	80	84	80	71
TOT RADIATION	441	486	504	506	513	500	463	420	480	507	478	438	478
EVAPOTRANSP.	183	193	243	244	229	183	155	136	142	172	173	169	2222

Table 2 - CLIMATIC DATA - continued

COUNTRY - NIGERIA STATION - NGURU NUMBER - 65 64

LATITUDE - 12°51' LONGITUDE - 10°26' ELEVATION - 343 metres

	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEPT	OCT	NOV	DEC	YEAR
PRECIPITATION	0	0	0	3	28	61	125	236	104	10	3	0	570
TEMP: AVERAGE	21.8	24.1	28.5	30.8	31.7	30.3	27.5	26.1	27.1	27.8	25.8	22.3	27.0
TEMP MEAN MAX	31.0	33.8	38.0	40.0	39.2	36.7	32.3	30.5	32.3	35.8	35.1	31.3	34.6
TEMP MEAN MIN	12.6	14.3	18.8	21.6	24.1	24.0	22.5	21.7	21.8	19.8	16.5	13.2	19.2
TEMP MEAN DAY	25.1	27.6	31.9	34.1	34.4	32.6	29.2	27.7	28.9	30.6	29.1	25.4	29.7
TEMP MN NIGHT	18.8	20.8	25.2	27.6	29.0	28.0	25.6	24.4	25.0	24.6	22.1	18.6	24.1
VAPOUR PRESS.	5.6	6.3	7.0	10.5	18.7	22.5	24.5	25.7	25.5	18.0	8.5	6.6	15.0
WIND SPEED 2M	0.7	0.7	0.7	1.0	1.5	1.7	2.1	1.5	0.7	0.8	1.0	1.0	1.1
SUNSHINE %	76	76	63	61	71	70	62	53	72	82	86	88	72
TOT RADIATION	432	475	466	478	520	511	478	442	507	511	479	457	479
EVAPOTRANSP.	104	110	144	168	196	170	152	128	132	144	126	112	1686

Table 3 - POPULATION [1] and TOTAL AREAS

	Regions (Niger) or States (Nigeria)		Total for the Sudan -Sahelian region		The basins [3]		Remainder of the Sudano-Sahelian region	
	Area km^2	Popln. [2] thousands	Area km^2	Population thousands	Area km^2	Population thousands	Area km^2	Population thousands
TAHOUA	106,700	1,103	19,500	660	2,290	167	17,210	493
SOKOTO	102,600	5,668	23,300	2,240	905	169	25,395	2,071
MARADI	38,500	1,087	38,000	1,468	7,550	434	30,450	1,034
ZINDER	145,000	1,147						
KADUNA	68,000	4,293	16,200	1,932	10,215	1,284	5,985	648
KANO	111,300	8,500	45,000	3,200	240	33	44,760	3,167
TOTALS	572,100	16,696	145,000	9,500	21,200	2,087	123,800	7,413

(1) Sources : Niger - 1977 Census and documents relating to the Plan
Nigeria - Preparatory reports for the rural development projects

(2) 1982 Population

(3) For the details for each basin see Tables 4 and 5.

Table 4 - MAGGIA-LAMIDO RIVER - Administrative Divisions : Population and area

	Area km²	1982 Popn. 1000's	Of which nomads 1000's	Rate of growth %	Density persons/km²	Distribution	Frontier region			Basins		
							Area	Popn.	Density	Area	Popn.	Density
Totals/Niger (region)	19,500	660	103	2.1	34		17,210	493	28	2,290	167	73
Bouza	3,600	158	-	2.2	44							
						Maggia				710	34	48
						Rem. of dist.	2,090	124	41			
Illela	6,700	146	18	2.1	22							
						Maggia				40	1	25
						Rem. of dist.	6,660	145	22			
Madoua	4,500	162	59	1.9	36							
						Maggia				125	0	0
						Rem. of dist.	4,375	162	37			
Birni N'Konni	4,700	194	26	2.1	41							
						Maggia				1,410	115	82
						Konni Town				5	17	3,400
						Rem. of dist.	3,285	62	19			
Total, Sudano-Sahelian region	45,800	2,900		2.2	63							
Total, basin							42,605	2,564	60	3,050	321	105
Silame	6,800	228			34		6,800	228	34			
Gwadabawa	3,700	477			129							
						Basin				730	146	200 (1)
						Rem. of L.G.	2,970	331	111			
Sokoto	1,600	438			274							
						Basin				30	8	265 (1)
						Rem. of L.G.	1,570	430	273			
Worno	4,200	400			95		4,200	400	95			
Isa	5,300	326			62		5,300	326	62			
Kaura Namoda	4,700	371			79	(Gada Riv.) (2)				(145	15	100)
						Rem. of L.G.	4,555	356	78			
Totals/Nigeria (region)	26,300	2,240		2.3 (3)	85		25,395	2,071	82	760	154	202

(1) Estimate (2) a small part of Sokoto State is related to the Gada River basin (3) estimate normally utilized in Nigeria

Sources : Niger - 1977 Census and Ministry of Planning documents
Nigeria - Reports for preparation of IRDB projects.

Table 5 - GADA RIVER - GOULBI DE MARADI/TAGWAI-EL FADAMA - Administrative Divisions : Population and area

	Area km²	1982 Popn. 1000's	Of which nomads 1000's	Rate of growth %	Density persons/km²	Distribution	Frontier region			Basins		
							Area	Popn.	Density	Area	Popn.	Density
Totals/Niger (region)	38,000	1,468	205	2.7	39		21,550	466	22	7,550	434	57
Tessaoua	5,000	167	48	2.4	33							
						Fadamas				570	31	54
						Rem. of dist.	4,430	136	31			
Aguié	2,800	144	-	2.8	51							
						G. Maradi				65	3 (1)	51
						Fadamas				970	63	65
						Rem. of dist.	1,765	78	44			
Maradi town	50	61	-	6.0	1,220	G. Maradi				50	61	1,220
Gouidan-Roumji	4,700	163	-	2.8	95							
						G. Maradi				2,475	110	44
						Rem. of dist.	2,225	53	24			
Madarounfa	3,450	160	12	2.7	46							
						G. Maradi				2,270	140	51
						Fadamas				25	1	40
						Rem. of dist.	655	19	29			
3M (Zinder)	22,000	773	145	2.5	35							
						Fadamas (4)				625	25	40
						Rem. of dist.	12,475	180	14			
Total, Sudano-Sahelian region	54,200	3,400	-	2.5	63							
Total, Gada-Goulbi										9,760	803	82
Total, Tagwai-Fadamas							27,535	1,114	40	8,390	963	115
(Kaura Namoda) (4)						Gada				145	15	100
Katsina	3,400	447			131							
						Gada				1,590	209	131 (2)
						Tagwai				1,590	209	131 (2)
						Rem. of L.G.	220	29	131			
Dutsin Ma	4,500	432			96							
						Gada				2,340	225	96 (2)
						Tagwai				55	5	96 (2)
						Rem. of L.G.	2,105	202	96			
Kankiya	3,200	398			124							
						Gada				325	40	124 (2)
						Tagwai				865	107	124 (2)
						Rem. of L.G.	2,010	251	124			
						Tagwai/Sebke				2,400	384	160 (2)
Mani	2,400	384			160							
Daura	2,700	271			100							
						Tagwai/Sebke				1,050	105	100 (2)
(Roni) (3)						Rem. of L.G.	1,650	166	100			
						Sabka				240	33	136
Totals/Nigeria (region)	16,200	1,932		2,3	119		5,985	648	108	10,600	1,332	126

(1) Estimate (2) In the absence of further information the average density has been utilized
(3) Part of the State of Kano (4) Kaura Namoda belongs to the State of Sokoto.

Table 6 - Annual flow volumes in the Maggia (in Mm^3)

	STATIONS		
	TSERNAWA	TIERASSA	BIRNI N'KONNI
Area - km^2	2,525	2,775	2,800
Year			
1962	80	-	-
1963	41	-	-
1964	103	-	-
1965	-	-	-
1966	27	-	-
1967	44	-	-
1968	-	-	-
1969	54	37	-
1970	73	49	-
1971	25	18	-
1972	34	28	20
1973	54	38	33
1974	179	89	76
1975	108	61	40
1976	86	71	-
1977	87	-	79
1978	121	-	-
1979	23	-	19
Mean	72	51	50
Standard deviation	44	25	37
Number of years	15	7	6
Mean, 1972 to 1975	94	54	42

Table 7 - MAGGIA-LAMIDO - Existing and future developments

	NAME OF PROJECT	EXISTING			FUTURE (additional)		
		Irrigated area ha	Consumption Mm³	Volume stored Mm³	Irrigated area ha	Consumption Mm³	Volume stored Mm³
i.	NIGER						
1.	Garadoumé (1968)				60	0.9	0.7(1)
2.	Tounfafi-Ladama (1968)	28	0.4	0.25			
3.	Gounfara				44	0.7	?
4.	Guidan Magagi (1971)	120	1.8	2.4			
5.	Kawara (1967)	52	0.8	0.55			
6.	Koré-Taboye (1965)	12	0.2	0.06			
7.	Moulela (1966)	63	0.9	1.0			
8.	Guidan Bagilbi				200	3.0	?
9.	Galmi-Guidan Kodidi (1981)	250	3.8	3.5(?)			
10.	Birni N'Konni (1980) (dams at Mozagué (30 Mm³) and Zango (15 Mm³) + reserve (9.5 Mm³)	1,300	19.5	54.5	1,300	19.5	0
11.	Gardens	520	5.2	wells			
12.	Overall potentialities(3)				6,900	103.5	?
	SUB-TOTAL for NIGER	2,345	32.6	62	8,504	127.6	?
	Ditto cumulative (existing + future)				10,849	160.2	?
ii.	NIGERIA						
13.	Kalmalo (1980)	270	4.1	lake	530(2)	8.0	lake
14.	Tugan Tudu	120	1.8	spring			
15.	Kaware (supplies Sokoto)		11.6	lake	30(1)	0.5	borings
16.	Gardens	290	2.9	wells			
	SUB-TOTAL for NIGERIA	680	20.4	0	560	8.5	0
	Ditto cumulative (existing + future)				1,240	28.9	0
	OVERALL TOTALS, NIGER + NIGERIA	3,025	53.0	62	9,064	136.1	?
	Ditto cumulative (existing + future)				12,089	189.1	?

(1) Abandoned areas taken into account for future rehabilitations.

(2) Provided sufficient water reserves available from Lake Kalmalo.

(3) According to estimate in SOGREAH report.

Table 8 - Annual flow volumes in the Gada River, Goulbi de Maradi and Goulbi de Gabi (in Mm^3)

	STATION						
	Mile 20 Katsina	Jibiya	Nielloua	Madarounfa	Siconiger	Guidam-Roumji	Gabi to Bargaya
Area - km^2	388	4,331	3,950	4,840	?	8,740	720
Year							
1956	-	-	-	219	-	223	-
1957	-	-	56	107	-	145	-
1958	-	-	126	181	-	196	-
1959	-	-	-	-	-	-	-
1960	-	n.a.	-	-	-	-	-
1961	-	n.a.	508	438	-	?	-
1962	-	n.a.	130	97	-	132	-
1963	-	226	198	149	-	204	18
1964	-	406	194	268	-	378	n.a.
1965	-	195	120	139	-	166	n.a.
1966	-	n.a.	93	135	-	100	9
1967	-	n.a.	310	277	-	366	n.a.
1968	-	n.a.	75	75	-	54	n.a.
1969	-	n.a.	108	136	-	[illegible]	n.a.
1970	-	n.a.	310	331	-		17
1971	-	n.a.	183	193	-	[illegible]	15
1972	22	70	116	86	-	53	9
1973	23	81	140	145	-	73	8
1974	56	205	294	303	-	225	44
1975	-	n.a.	353	260	-	224	31
1976	-	n.a.	150	98	-	72	20
1977	-	n.a.	272	175	-	214	62
1978	-	-	293	198	-	-	n.a.
1979	-	-	263	273	-	-	47
1980	-	-	269	-	181	-	n.a.
Mean	(34)	361	207	195	(181)	177	25
Standard deviation	-	n.a.	111	93	-	96	18
Number of years	3	15	22	22	1	19	11

Table 9 - GADA RIVER - GOULBI DE MARADI - Existing and future developments

NAME OF PROJECT	EXISTING			FUTURE (additional)		
	Irrigated area ha	Consumption Mm^3	Volume stored Mm^3	Irrigated area ha	Consumption Mm^3	Volume stored Mm^3
i. NIGERIA						
1. Ruma (drinking water)					3.5	8.6
2. Kurfi (drinking water)					c.5.3	15.2
3. Fukuwa-Cheranchi (drinking water)					7.0	18.4
4. Gada-Benye (drinking water) (irrigation)				2,500	4.8 } 19.7 }	60.0
5. Jibiya (drinking water) (irrigation)				3,700	4.6 } 28.6 }	142.0
6. Goulbi de Gabi upstream (stock-raising ?)	?	?	c.0.5			
7. Gardens, small plots	est. 450	4.5	?			
SUB-TOTAL for NIGERIA	>450	>4.5	?	6,200	73.5	244
Ditto cumulative (existing + future)				>6,650	>78	>244
ii. NIGER						
8. Maradi Productivity	212	3.2	pumping	900	13.5	neg.
9. Kountoumi				6,000	90.0	100
10. Madarounfa				3,000	45.0	lake
11. Gabi				300	5.0	-
12. Market gardens	500	5.0	wells			
SUB-TOTAL for NIGER	712	8.2	0	10,200	153,5	100
Ditto cumulative (existing + future)				10,942	161.7	100
OVERALL TOTALS, NIGERIA + NIGER	1,162	12.7	-	16,430	227.0	344
Ditto cumulative (existing + future)				17,592	239.7	344

Table 10 - Indicative budget for external contribution - Summary

Components of the Project / Elements		Construction of a plan of action for the utilization of the three basins shared by Niger and Nigeria					Complementary projects	
		Planning 1 Niamey	Water & soils 2 Katsina	Legal 3 Niamey	Documentation 4 Niamey	TOTAL	Environment Diffa	Agricultural machinery Diffa
I	PERSONNEL	769,000	311,100	(16,000)(1)	(27,500)(2)	1,080,100	90,000	30,000
II	TRAINING	51,750	-	7,500	6,800	66,050	-	-
III	SUB-CONTRACTS	-	350,000	-	-	350,000	-	-
IV	EQUIPMENT	66,000	40,000	3,000	21,000	130,000	-	-
V	OPERATION	15,000	22,000	-	3,000	40,000	-	-
VI	REPORTS	30,400	11,000	-	2,000	43,500	-	-
	TRANSLATIONS	25,000	-	-	-	25,000	3,000	5,000
	MISCELLANEOUS	9,850	-	2,000	7,000	18,850	-	-
	T O T A L	967,000	734,200	12,500 (28,500)	39,800 (67,300)	1,753,500	93,000	35,500

(1) Provisional sum in the event that the FAO legal assistance exceeds the present forecasts: to be entered on the "Consultant" line of the "Planning" component.

(2) The consultants' fees are already taken into account in the "Planning Unit" component.