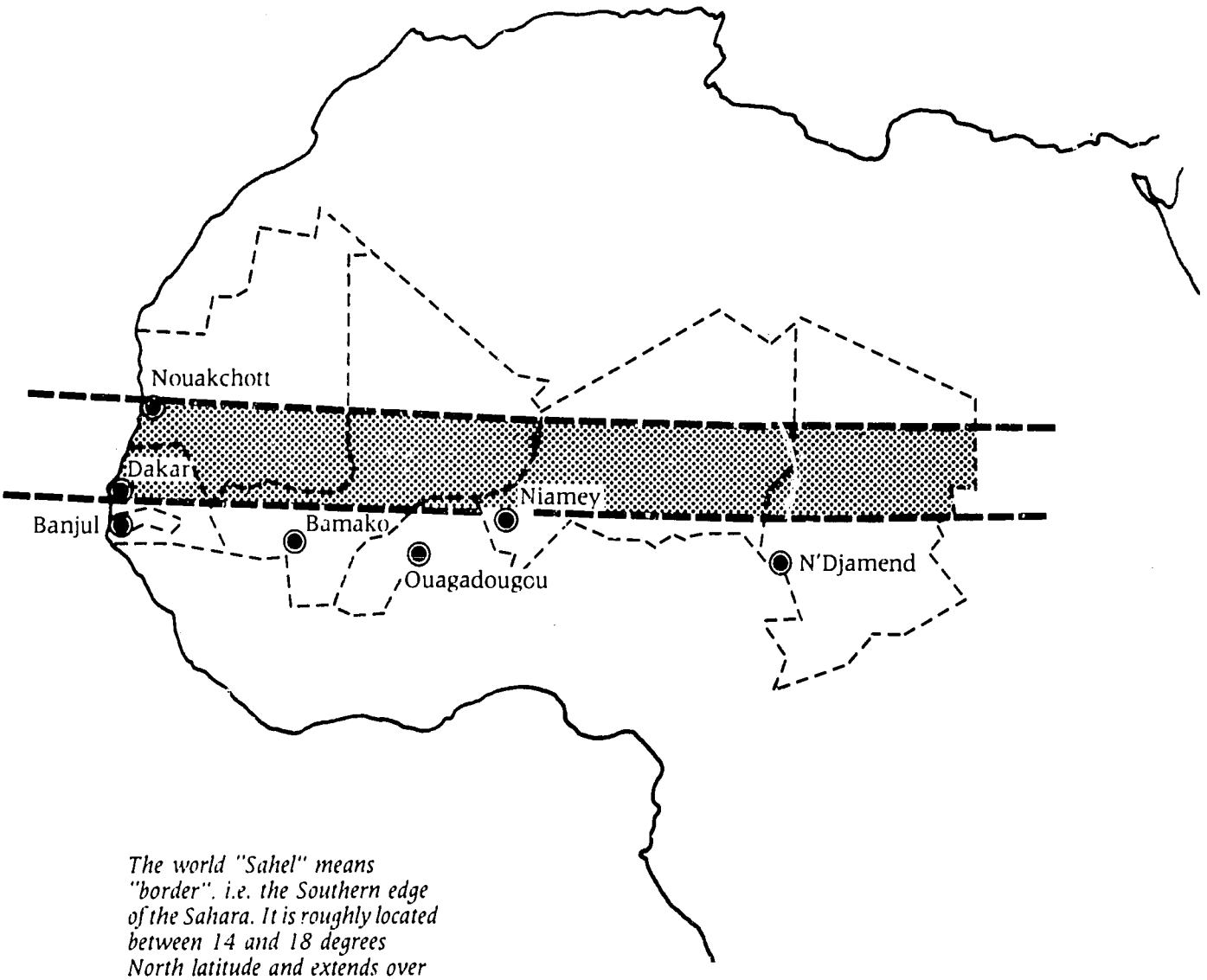

The world "Sahel" means "border", i.e. the Southern edge of the Sahara. It is roughly located between 14 and 18 degrees North latitude and extends over seven countries.

Programme for the Strengthening of the Agrometeorological and Hydrological Services in the Sudano-Sahelian Zone

INTRODUCTION

The recent long period of drought in the Sahel, the zone at the Southern edge of the Sahara, has attracted considerable attention all over the world. Although such periods of prolonged drought have occured before, the impact was, in terms of human disaster, never so great. The drought have had tremendous economic implications since the large majority of the population live from either cattle raising or agriculture, both heavily affected. The magnitude of the disaster has made people look for ways and means to mitigate such effects in future. One of these ways is the strengthening of the meteorological services in the Sahelian countries and the expansion of the meteorological networks in order that they can provide information and advice to agricultural operations. Studies on rainfall trends and statistical evaluation of rainfall data should be an essential activity of the expanded meteorological services.

SIGNIFICANCE OF METEOROLOGY AND HYDROLOGY FOR THE SOCIO-ECONOMIC DEVELOPMENT OF THE SUDANO-SAHELIAN REGION

Agriculture is by far the most important sector within the economies of the Sudano-Sahelian countries. The major limiting factor in agricultural production is the shortage of water caused by generally insufficient and very variable rainfall over a short rainy season, coupled to high evapotransipration rates throughout the year. Irrigation is possible over limited areas near large and permanent rivers but their flows are irregular even where their sources are located in better rainfall areas over mountains to the south of the Sudanian zone. Undergroundm water permits irrigation of crops only in areas where recharge from the surface is possible or rock fissures carry water to drier areas. Studies of the water balances and resources should show where increases of agricultural production under irrigation are possible. Underground water supplies in the large areas of nomadic herding further north are poorly known.

Rainfall, even in normal years, is barely adequate to maintain a sparse cover of xerophytic vegetation. Water tables have fallen considerably in many places over recent years and unrestricted use of resources may lead to exhaustion of supplies of usable water.

The economic and social problems, resulting from the recent severe drought, were:

(i) insufficient food supply resulting from insufficient rainfall in dry farming and nomadic herding areas;

(ii) exceptionally low river flows and lake levels which usually provide water to irrigated and flood-fed crops and provide water transport for food and other freight;

(iii) drying up of wells which usually provide water to men and animals in the Sahelian zone;

(iv) resultant loss of human lives and of a very large proportion of the herds;

(v) encroachment of the desert southwards;

(vi) the general movement southwards from the Sahelian zone of men and animals causing overcrowding in the Sudanian zone and conflict between the interests of nomads and sedentary farmers.

Semi-aridity is a permanent characteristic of the Sahelian zone to which the inhabitants had learned to adapt their lives in past generations. Occasional severe droughts have no doubt always caused special problems from which a return to usual practices was possible when populations of men and animals were small. The annual increase of about 3 per cent in population has resulted in an imbalance between man and his environment which is seriously aggravated by the recent drought and which now demands all efforts to provide for the future.

Shortages in supply of food and water are fundamentally the result of low rainfall and high evapotranspiration – these are meteorological factors.

There is at present only a rather remote possibility that weather can be modified to prevent drought. The contributions that meteorology and hydrology can make towards mitigation of the effects of drought and towards economic development are, however, large. Sound policies for water resources management, agriculture and protection of the soil and its vegetation can only be established with knowledge of and respect for climatic and hydrologic factors. Without measurement and understanding of these factors, attempts to develop agricultural production and improve water supplies, by extension or intensification in normal as well as in dry years, can only be on a trial and error basis. Such a process would be costly, time-consuming and ultimately destructive.

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Introduction of new varieties of crops, new husbandry practices and pasture management require maps of climatic conditions defining rainfall amounts and dates of probable occurrence, evapotranspiration, wind, temperature and radiation for specific areas. Management of water supplies requires similar maps, run-off, river flow lake level information and estimation of ground water resources.

Studies of weather/crop correlations should materially assist the early warning of crop failure essential for effective preparation of relief of food shortages.

Bush fires and cutting of trees for domestic heating have often been cited as major causes of degradation of vegetation and soil cover. Data on wind, radiation, temperature and humidity are necessary in the fight against bush fires. A knowledge of the first two of these elements of weather is also required for developments of uses of solar and wind energy for various purposes now relying on local wood fuel and imported oils.

Forecasts of weather and water supplies, both for a day or two ahead and for longer periods are needed for almost all operations in agriculture, forestry, fishing are water management. In particular, accurate forecasts over one to four days are necessary to avoid sowing of cereal seeds several times, taking a chance that there will be sufficient soil moisture for germination and continued growth until young plants are sufficiently deep-rooted to withstand a temporary drying out of soil moisture.

EXISTING INFRASTRUCTURE

Historically, organization of meteorological services in the Sudano-Sahelian countries during recent decades has been mainly to meet the needs of aviation. On behalf of the governments, the "Agence pour la sécurité de la navigation aérienne en Afrique et à Madagascar" (ASECNA) has acted as the operating agency. In six of the seven countries, valuable contribution to data and knowledge in climatological, meteorological and hydrological fields has been made over many years by such agencies as the "Office de la recherche scientifique et technique outre mer" (ORSTOM), the "Institut de recherche agronomique tropicale" (IRAT), the "Centre technique forestier tropical" (CTFT) and by the "Comité inter-africain d'études hydrauliques" (CIEH), on a national and regional basis and by agencies of UN in various special national and regional projects.

However, countries of the region need Meteorological and Hydrological Services which will co-ordinate effort and centralize data and knowledge in all sectors of meteorological activity. These services should have the authority, qualified personnel, standardized equipment and building facilities to ensure that the whole of the meteorological effort in each country is fully used to meet the needs of all sectors, not only in individual countries, but also in the sub-region as a whole. In general, the forecasts for agriculture, fishing and the economy need considerable extension and improvement to meet the special requirements of the zone.

Apart from forecasting, the drought problems of 1973 have riveted attention on the necessity for extension of meteorological services. Heads of individual Services and of inter-governmental agencies have increasingly turned their attention to the requirements for more data, for its rapid interpretation and dissemination. But these commendable efforts are handicapped by inadequate infra-structure, the more important weaknesses being in planned networks of observation stations and numbers of qualified personnel.

Also against the background of the recent drought there is much evidence from Ministers and all officials of awareness of the meteorological and hydrological problems and of intention to create or restructure national Services capable of meeting the needs of all users.

Hydrological Services are not combined with Meteorological Services in six of the Sudano-Sahelian countries and in most cases are within Ministries other than the Ministries of Public Works and Transport responsible for meteorology. In most countries there is either a national Hydrological or Hydraulic Service which is usually of recent creation and not developed to the standards found in most parts of the world. Some of these Hydrological Services maintain rainfall stations as well as river and lake level measurement stations. The data are usually copied to the Meteorological Service in the case of rainfall and to ORSTOM in the case of other hydrological data.

Again the main requirements of Hydrological Services are in trained personnel and in density of observing stations both for the basic network and for particular project areas.

The CIEH, formed in 1960, with its headquarters in Ouagadougou, centralizes information on water resources in 13 tropical African countries and carries out investigations on a sub-regional scale. The are tendencies within this agency to fill large gaps in such fields as agrometeorology and artificial rainfall augmentation which are usually regarded as falling within the meteorological sector.

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ORSTOM has several centres of hydrological and meteorological activity in countries of the Sudano-Sahelian zone and in some cases operates networks of rainfall and hydrological stations.

All these agencies have been contributing valuable knowledge in past years and have generally been increasingly active during 1973 in the fight against drought. But there is a need for centralization of general meteorology and of hydrology, both at the national and subregional levels in the same way as ASECNA has centralized activity in the fields of meteorology for aviation and some aspects of the World Weather Watch (WWW) of WMO. This need demands early development of Meteorological and Hydrological Services as such so that basic data, interpretations and investigations in these sectors may be made adequate to serve the community as a whole and to provide co-operation in interdisciplinary fields already regarded as the responsibilities of other agencies.

ELABORATION OF THE PROGRAMME

Following the drought conditions in the Sudano-Sahelian zone of West Africa, which had accumulated since 1969 and reached catastrophic proportions after the rain seasons of 1972 and 1973, six countries (Chad, Mali, Mauritania, Niger, Senegal and Upper Volta) decided to create the Permanent Inter-State Committee for Drought Control in the Sahel (CILSS). Gambia joined CILSS in 1974. Resolution No. 5 adopted at a meeting of Ministers of these countries in March 1973 requested the assistance of specialized international organizations in studies of drought problems including specific meteorological problems.

ECOSOC Resolution 1759 (LIV), adopted in May 1973, called upon the organizations of the UN system – each within its terms of reference – to organize as soon as possible the necessary action in order to respond to the requests of governments of the Sahelian zone with regard to their medium-term and long-term needs.

A meeting of UN Agencies and governments, inter-governmental and non-governmental organizations, held in Geneva in June 1973, drew up proposals for the general lines of development of activities of UN Agencies in medium and long-term programmes.

The Permanent Inter-State Committee for Drought Control in the Sahel at its first meeting in Ouagadougou in September 1973 adopted resolutions requiring development of:

(i) studies in hydrometeorology, agrometeorology and climatology;

(ii) networks of agrometeorological stations; and

(iii) creation of sub-regional centres for applied meteorology, including:

  (a) training of personnel

  (b) studies in agrometeorology for early warning of crop failure

  (c) experiments in rainfall augmentation.

Further indications of the intentions of the countries of the Sahel are given in the reports to the Committee by the Commissions of the Meeting of Experts which had immediately preceded the meeting of the Committee of Heads of State and Ministers as follows: Commission No. 1 – Agriculture and Hydraulic Engineering for Agriculture, recommended that to facilitate the execution of projects in all fields of the economy it was necessary to create or strengthen, at the national level, those services which were responsible for collection of data and research in climatology and water resources. Commission No. 2 – Environment and Climatology, recommended the creation of infra-structure which would provide information indispensable to the agricultural economy and specified the creation or restructuring of national Meteorological Services, increases in density of networks of observation stations, provision of equipment, creation of archives and a study centre. Studies of possible cycles of rainfall, utilization of satellite photographs and improvement of forecasting methods had special mention.

From the beginning of their activities in the drought affected Sudano-Sahelian countries, UNDP and WMO have worked closely with the CILSS and representatives of its member governments with a view to developing a technical co-operation programme meeting the above stated objectives. To this effect a UNDP financed WMO/FAO mission (May-July 1974) established in detail the needs of the seven countries and prepared a Programme for strengthening the Agrometeorological and Hydrological Services of the Sahelian countries and establishment of a Centre for training and applications of agrometeorology/operational hydrology. This programme takes into account the existing structures in the different countries.

OBJECTIVES OF THE PROGRAMME

The programme is divided into eight projects; seven of which are for the strengthening of the Meteorological and Hydrological Services of the seven Member countries of CILSS and one project for the establishment of a Centre for training and applications of agrometeorology/operational hydrology.

The objectives are as follows:

(a) At the national level, the strengthening of the national Meteorological and Hydrological Services of the region. This strengthening includes:

- Installation of new agrometeorological, climatological and hydrological stations and upgrading of existing ones;

- Establishment of a data processing unit for the interpretation and dissemination of agrometeorological and hydrological data in a form readily usable by the agricultural sector;

- Establishment of short-term forecasting units in the fields of meteorology and hydrology;

- Recruitment and training of professional personnel at all levels to staff the network and newly created units.

(b) At the regional level, establishment of a Centre for training and applications of agrometeorology/operational hydrology. This Centre will be located in Niamey (Niger). Its functions will be:

- Train Classes III, II and I meteorological personnel specialized in agrometeorology and climatology;

- Train hydrological technicians;

- Train instruments specialists;

- Collect and process data for the whole region and issue longer-range agrometeorological and hydrological forecasts;

- Carry out applied research into problems common to countries of the zone;

- Calibrate and repair the meteorological and hydrological instruments of the Services of the seven countries.

FINANCIAL INPUTS

This comprehensive programme calls for considerable financial inputs which cannot be met from one single source. Therefore 3 different sources of financing are foreseen:

1. *National inputs*

The seven countries participating in the programme will have to bear the cost for:

(a) the salary of the present staff as well as for the personnel recruited during the implementation of the programme;

(b) the installation of the equipment provided under the programme;

(c) the construction of the infra-structure for the new stations;

(d) the construction of new building facilities to accommodate the expanded Meteorological and Hydrological Services.

2. *UNDP inputs*

The UNDP has already accepted to participate in the financing of the programme. This participation is defined in 8 project documents agreed upon between the parties concerned. The UNDP will provide:

(a) meteorological, agrometeorological and climatological instructors for the Centre;

(b) expert services in the seven countries;

(c) a Programme Manager to co-ordinate the activities of the whole programme;

(d) financing of a sub-contract to an appropriate agency to conduct the hydrological activities of the programme: training of hydrological technicians in the Centre and strengthening of six of the seven Hydrological Services;

(e) fellowships for the training of the personnel;

(f) part of the meteorological and hydrological equipment for the strengthening of the networks as well as didactic material for the Centre.

The participation of the UNDP has a duration of five years for the training component of the Centre and two years for the national projects in the seven countries.

3. *Multinational inputs for which donations are solicited*

These inputs can be divided into two aspects:

(i) Immediate needs consisting in the financing of:

(a) the building for the Centre and dormitories for the students. This financing has first priority since the success of the programme is largely dependent on the availability of these facilities;

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(b) the buildings to house the headquarters of the expanded Meteorological and Hydrological Services. This item was mentioned under the national inputs since it would be logical for the governments to undertake these constructions. However, the economies of these countries have been seriously affected by the drought and it is doubtful that they can absorb these expenses, particularly those in respect of new headquarter buildings (it is assumed that expenses in connexion with construction of new meteorological and hydrological stations can be met by the governments and the tables on pages 17 and following have been prepared accordingly);

(ii) Longer term needs consisting in the financing of:

(a) the expansion of the activities of the Centre into data processing, longer-term forecasting and applied research. This expansion of activities is scheduled to start two years after the beginning of the programme;

(b) the extension of the assistance provided by the UNDP in the seven national projects after the initial phase of two years. This assistance should cover three more years.

Details of these different inputs can be found in the tables which follow this document.

CO-ORDINATION

The implementation of such a programme requires a high degree of co-ordination of efforts:

- at the technical level, this co-ordination will be ensured by the appointment of a Programme Manager posted in Niamey who will supervise the activities of the Centre as well as the activities carried out in the different countries. He will be appointed by WMO who will give him the technical and administrative support required to carry out his duties. He will also have the local support of the seven offices of the UNDP in the region;

- at the financial level, WMO will administer the UNDP contribution to the programme and ensure, in collaboration with the CILSS, proper co-ordination of the national and multinational inputs.

STATUS OF IMPLEMENTATION

The implementation of this programme is scheduled to start by mid 1975. Different actions have already been taken by WMO, as follows:

(a) Training of agrometeorological and climatological personnel
Arrangements are being made with the "Ecole africaine de la météorologie et de l'aviation civile" (EAMAC) for the training of Class III personnel, using their premises and facilities until the building for the Centre is completed. Support will be provided by WMO using the UNDP contribution in the form of expert services and didactic equipment;

(b) Training of hydrological technicians
This activity will be carried out by ORSTOM under a sub-contract with WMO. The first intake is scheduled to take place in December 1975 in a provisional building made available by the Government of Niger;

(c) Training of Class II and I meteorological personnel
Arrangements are being made with the University of Niamey, Faculty of Sciences, to establish these courses. However, it is not expected that these courses will start before October 1976;

(d) Appointment of a Programme Manager
Pending the final decision on the appointment of a Programme Manager, which is expected to take place about September 1975, WMO has appointed a highly qualified expert as its representative to ensure that the initial steps for the implementation of the programme are taken in time;

(e) Advice to the Meteorological Services
WMO has advertized the different adviser posts for the seven countries and is submitting candidatures to the governments. It is expected that at least half of these posts will be filled by the autumn 1975;

(f) Hydrological activities
These activities will be carried out by ORSTOM under a sub-contract with WMO. this sub-contract will be signed by the middle of June 1975 and operations are scheduled to start in summer;

(g) Equipment
The lists of equipment for the strenghtening of the meteorological and hydrological networks are being established with the Directors of the Services concerned and part of this equipment under the UNDP contribution has already been ordered.

(h) Building
The WMO is securing the services of an architect to establish the plans and estimates for the building and dormitories for the Centre.

PROGRAMME CO-ORDINATION

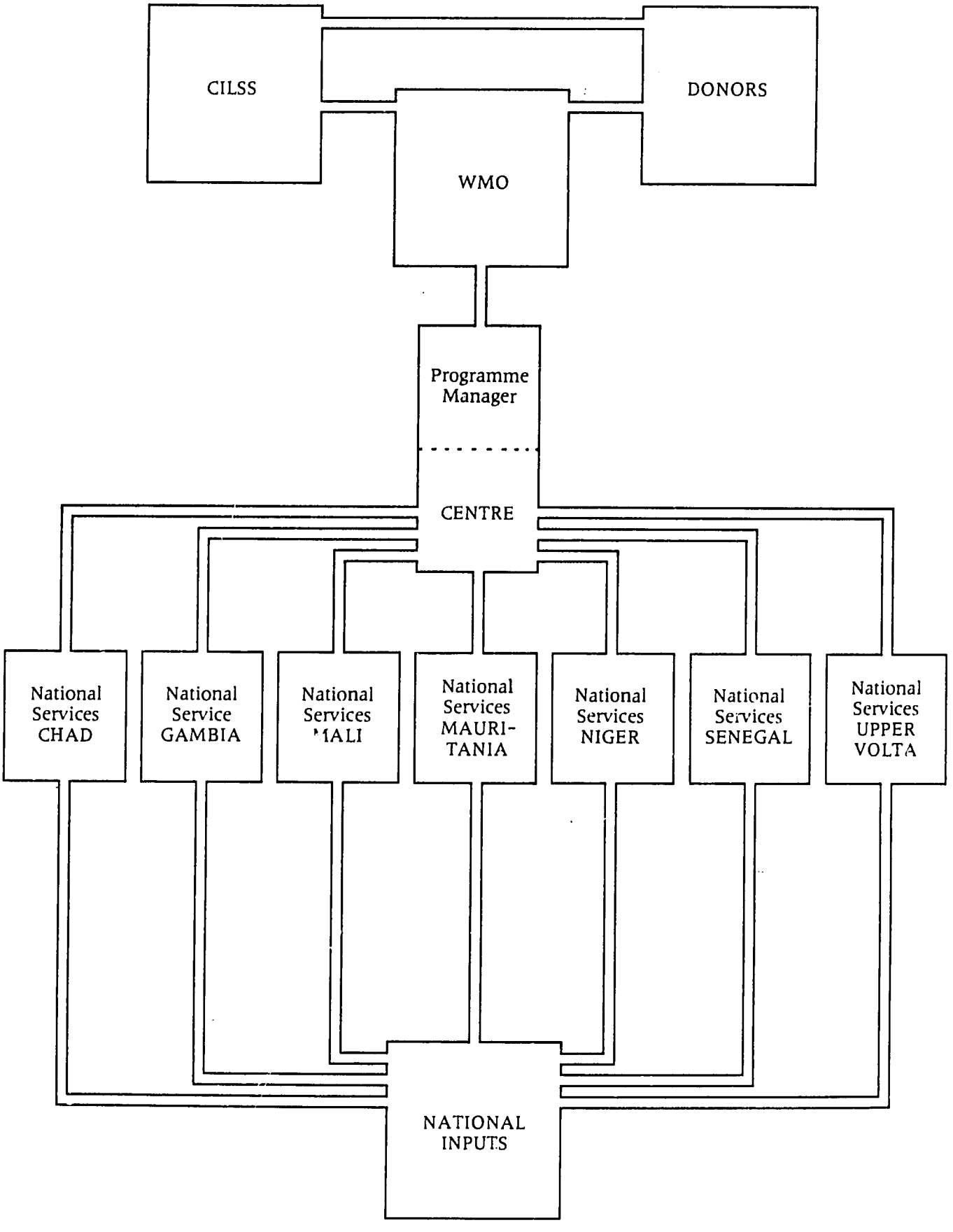

TABLE 1

National Inputs

(for 1975 and 1976 based on project documents for the 7 national projects and for 1977-1980 on extrapolations in line with proposals of 1974 WMO/FAO mission)

	1975	1976	1977	1978	1979	1980	Total
CHAD (in thousands of CFA							
– Personnel	37,000	53,000	55,000	57,000	60,000	62,000	324,000
– Building of stations	31,000	72,000	70,000	50,000	20,000	10,000	253,000
– Running costs	5,000	7,000	8,000	9,000	10,000	10,000	49,000
Total	73,000	132,000	133,000	116,000	90,000	82,000	626,000
GAMBIA (in Dalasis)							
– Personnel	89,000	120,000	130,000	140,000	150,000	160,000	789,000
– Building of stations	40,000	40,000	30,000	20,000	10,000	5,000	145,000
– Running costs	16,000	20,000	22,000	24,000	26,000	28,000	136,000
Total	145,000	180,000	182,000	184,000	186,000	193,000	1,070,000
MALI (in thousands of MF)							
– Personnel	41,000	58,000	62,000	65,000	68,000	70,000	364,000
– Building of stations	50,000	50,000	40,000	35,000	30,000	10,000	215,000
– Running costs	4,000	8,000	10,000	12,000	14,000	16,000	64,000
Total	95,000	116,000	112,000	112,000	112,000	96,000	643,000

TABLE 1

	1975	1976	1977	1978	1979	1980	Total
MAURITANIA (in thousands of Ouguiyas)							
– Personnel	8,000	11,000	13,000	15,000	17,000	18,000	82,000
– Building of stations	2,000	2,200	2,000	2,000	1,000	500	9,700
– Running costs	3,000	4,500	6,000	6,500	7,000	7,500	34,500
Total	13,000	17,700	21,000	23,500	25,000	26,000	126,200
NIGER (in thousands of CFA)							
– Personnel	26,000	37,000	40,000	45,000	50,000	55,000	253,000
– Building of stations	40,000	40,000	30,000	20,000	20,000	10,000	160,000
– Running costs	5,300	10,500	13,000	15,000	17,000	18,000	78,800
Total	71,300	87,500	83,000	80,000	87,000	83,000	491,800
SENEGAL (in thousands of CFA)							
– Personnel	14,000	25,000	28,000	30,000	33,000	36,000	166,000
– Building of stations	5,000	5,000	5,000	5,000	3,000	1,000	24,000
– Running costs	5,000	9,000	12,000	15,000	17,000	20,000	78,000
Total	24,000	39,000	45,000	50,000	53,000	57,000	268,000
UPPER VOLTA (in thousands of CFA)							
– Personnel	28,500	40,000	43,000	45,000	47,000	50,000	253,500
– Building of stations	30,000	40,000	30,000	20,000	10,000	10,000	140,000
– Running costs	5,400	10,000	12,000	14,000	16,000	18,000	75,400
Total	63,900	90,000	85,000	79,000	73,000	78,000	468,900

TABLE 2

Totals in thousands of US dollars	1975	1976	1977	1978	1979	1980	Total
CHAD	344	622	627	548	425	386	2,952
GAMBIA	87	108	110	111	112	116	644
MALI	224	273	264	264	264	227	1,516
MAURITANIA	306	417	495	555	590	613	2,976
NIGER	336	412	392	377	410	393	2,320
SENEGAL	113	184	212	236	250	269	1,264
UPPER VOLTA	301	425	401	373	344	368	2,212
Total	1,711	2,441	2,501	2,464	2,395	2,372	13,884

Combined National Inputs

In thousands of US dollars	1975	1976	1977	1978	1979	1980	Total
Co-Director (appointed by CILSS)	4,5	6	6	6	6	3	31,5
Running cost of centre building	1,0	2	12	12	12	4	43,0
Total	5,5	8	18	18	18	7	74,5

TABLE 3

UNDP Inputs
(in US dollars)

	1975	1976	1977	1978	1979	1980	Total
TRAINING CENTRE							
– Expert services	146,500	298,000	232,000	175,000	130,000	61,500	1,043,000
– Subcontract for hydrological activities	160,000	160,000	80,000	–	–	–	400,000
– Fellowships for national instructors	–	–	3,600	14,400	10,800	–	28,800
– Equipment	59,000	43,000	34,000	24,000	14,000	9,000	183,000
– Running costs	4,000	13,000	13,000	13,000	13,000	15,200	71,200
Total	369,500	514,000	362,600	226,400	167,800	85,700	1,726,000
NATIONAL PROJECTS							
– Expert services	225,000	261,000	63,000	–	–	–	549,000
– Fellowships	75,600	211,500	227,700	169,200	72,900	8,100	765,000
– Equipment	336,500	499,500	193,500	–	–	–	1,029,500
– Running costs	21,800	40,750	45,450	–	–	–	108,000
Total	658,900	1,012,750	529,650	169,200	72,900	8,100	2,451,500
GRAND TOTAL	1,028,400	1,526,750	892,250	395,600	240,700	93,800	4,177,500

TABLE 4

Multi-national Inputs for which Bilateral Donations are Solicited (in thousands of US dollars)

	1975	1976	1977	1978	1979	1980	Total
TRAINING CENTRE							
– Expert services (1)	–	–	159	300	282	141	882
– Telecommunication equipment	–	–	150	150	–	–	300
– Data processing equipment	–	–	100	100	–	–	200
– Didactic equipment	–	–	20	30	30	20	100
– *Building and dormitories	500	1000	500	–	–	–	2000
– Running costs	–	–	10	10	10	10	40
Total	500	1000	939	590	322	171	3522
NATIONAL PROJECTS							
– Expert services (1)	–	–	252	504	504	252	1512
– Fellowships	–	–	175	175	175	175	700
– Equipment	–	–	175	350	350	175	1050
– Running costs	–	–	35	35	35	35	140
– *Buildings for national headquarters	1000	1628	–	–	–	–	2628
Total	1000	1628	637	1064	1064	637	6030
GRAND TOTAL	1500	2628	1576	1654	1386	808	9552

* *Frist priority items*
(1) Explanation given on next page

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NOTES ON EXPERT SERVICES MENTIONED UNDER MULTINATIONAL INPUTS

Training Centre			US Dollars
Experts Services			
1 Telecommunications Expert	1977-78	12 m/m	36,000
1 Telecommunications Technician	1977-80	36 m/m	108,000
2 Data Processing Experts	1977-80	72 m/m	216,000
2 Agrometeorologists	1977-80	72 m/m	216,000
2 Hydrologists	1977-80	72 m/m	216,000
Short Consultant Services		30 m/m	90,000
			882,000

The Telecommunications Expert is required to establish the telecommunications facilities which will be necessary for data acquisition and information dissemination for the region. The telecommunications system will be maintained by the Technician through the second part of the programme.

The two data processing experts will be responsible for summarizing, analysing, archiving and publishing meteorological and hydrological data for the region.

The two Agrometeorologists and the two Hydrologists will be responsible for preparation of regular bulletins and, as far as possible, forecasts at short intervals to assist farmers, hydraulic engineers, planners in government and industry, as well as all other users of such information, in reaching decisions with thedue regard to meteorological and hydrological limitations.

National Projects

Each of the seven National Services will require during 1977-1980 an expert in agrometeorology and an expert in hydrology to advise Directors of national services and undertake on-the-job training.

TABLE 5

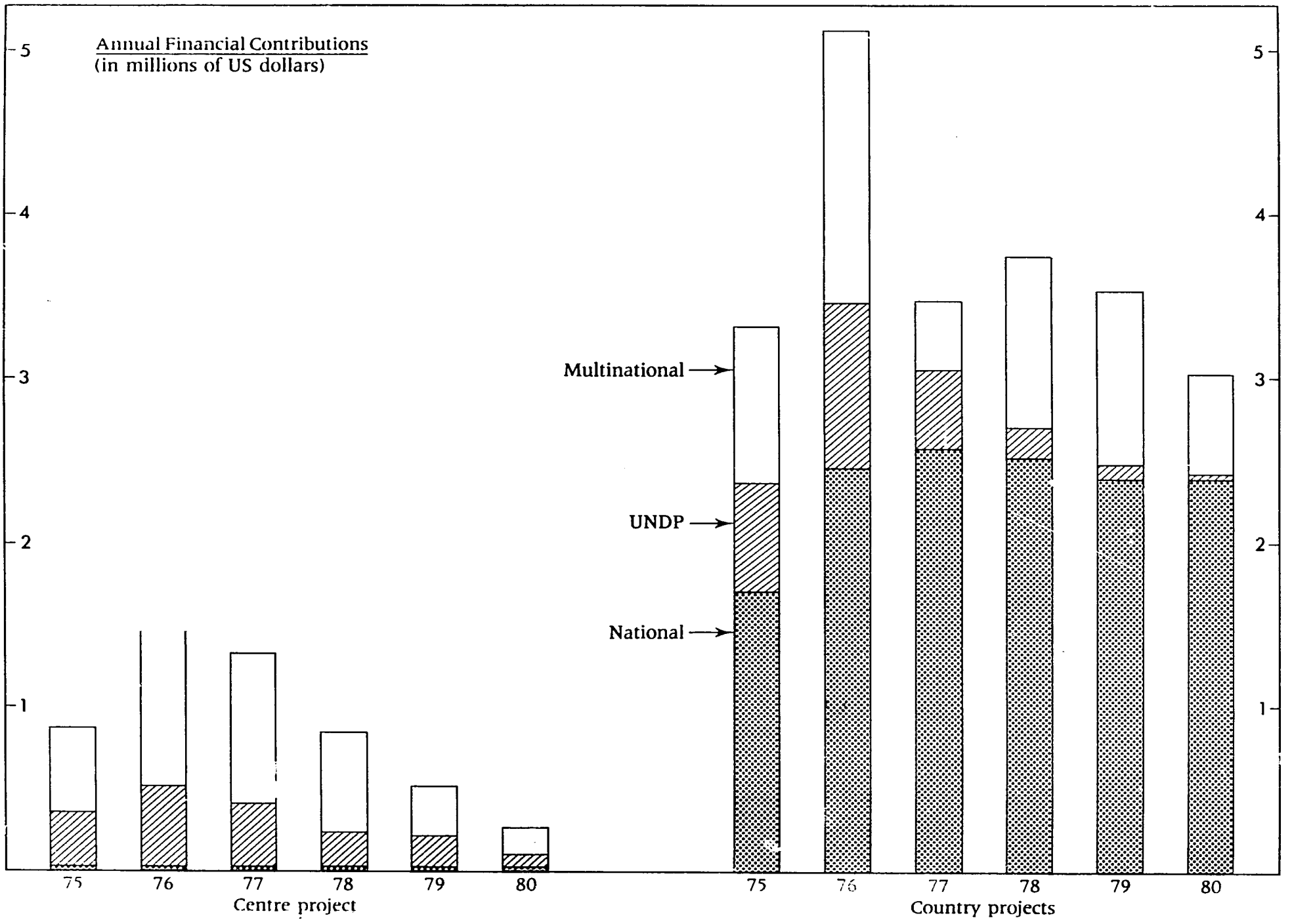
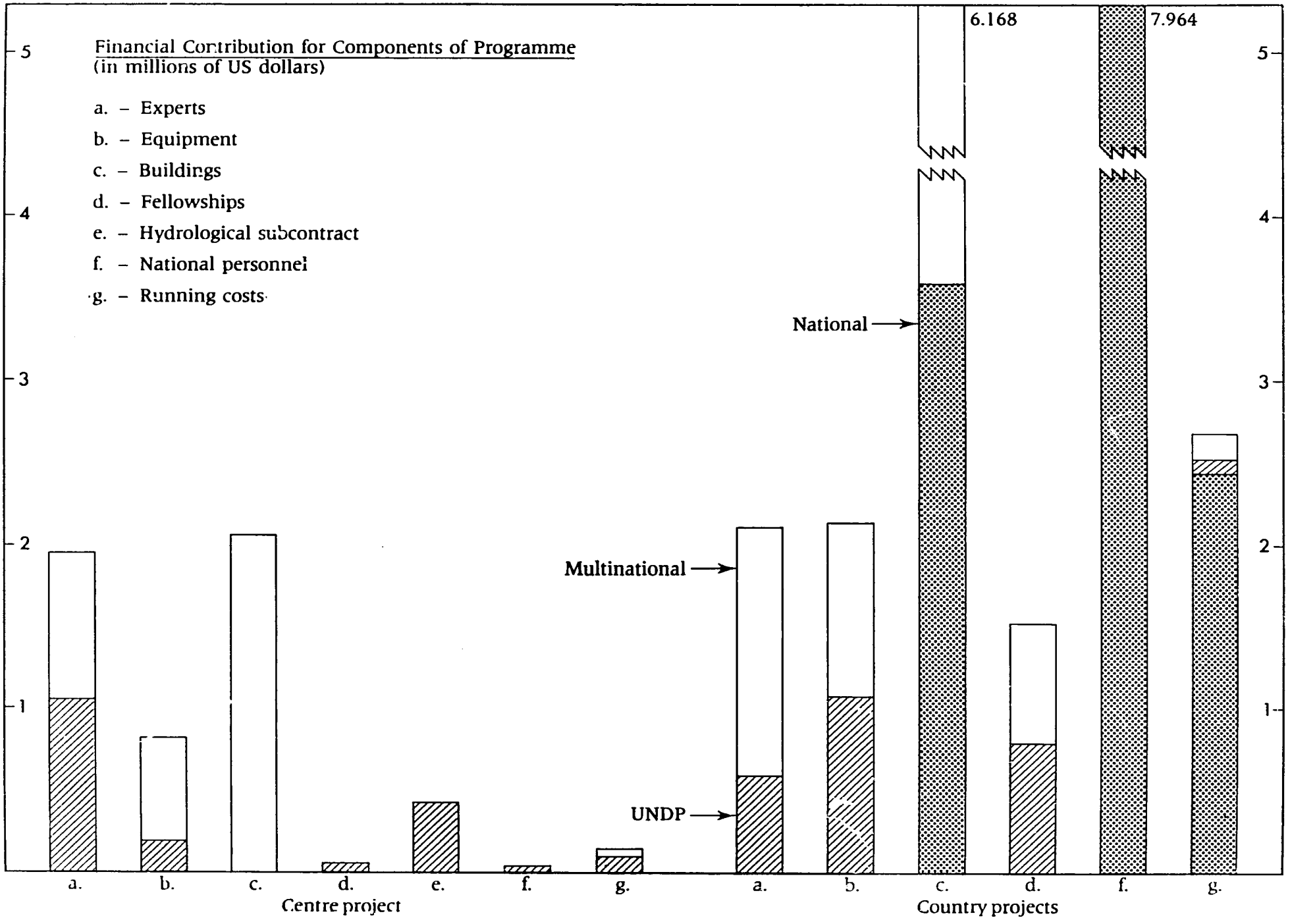
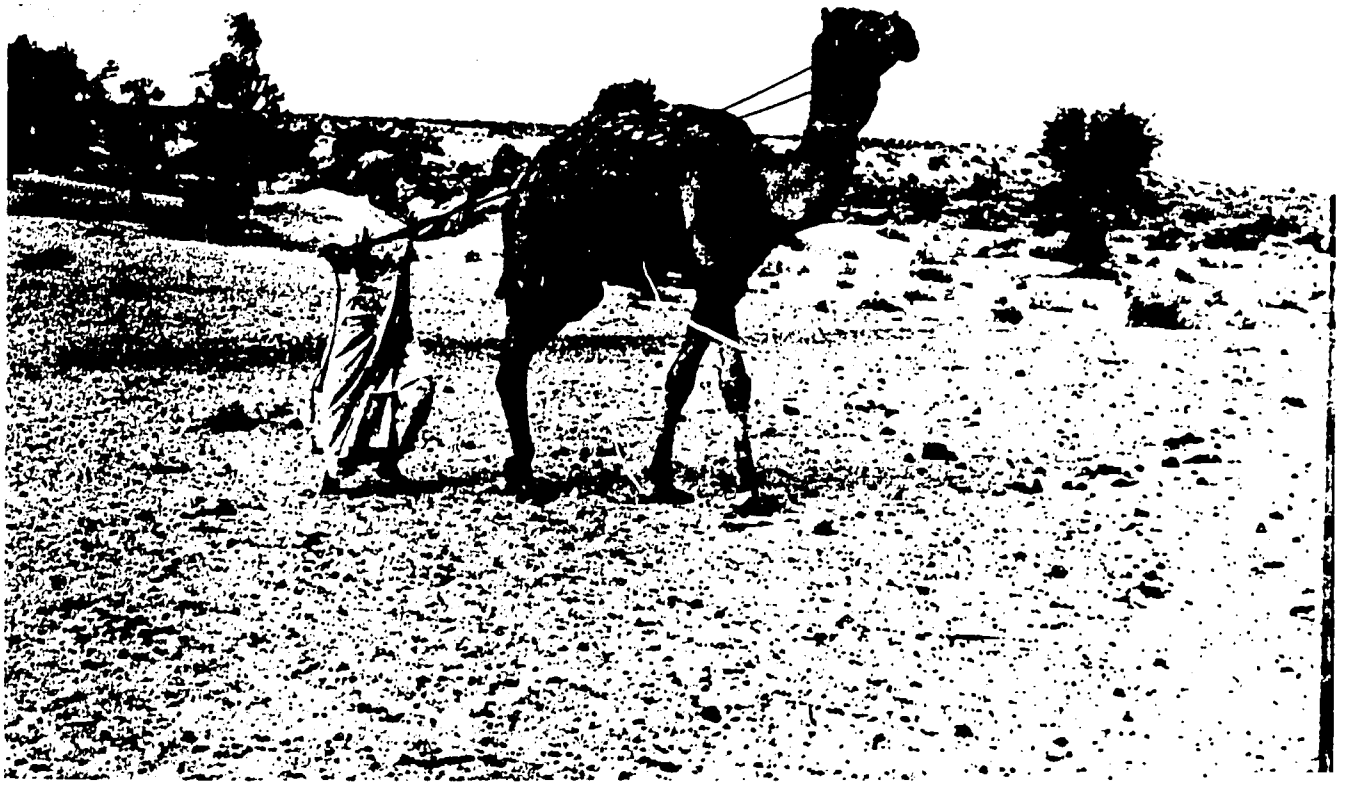
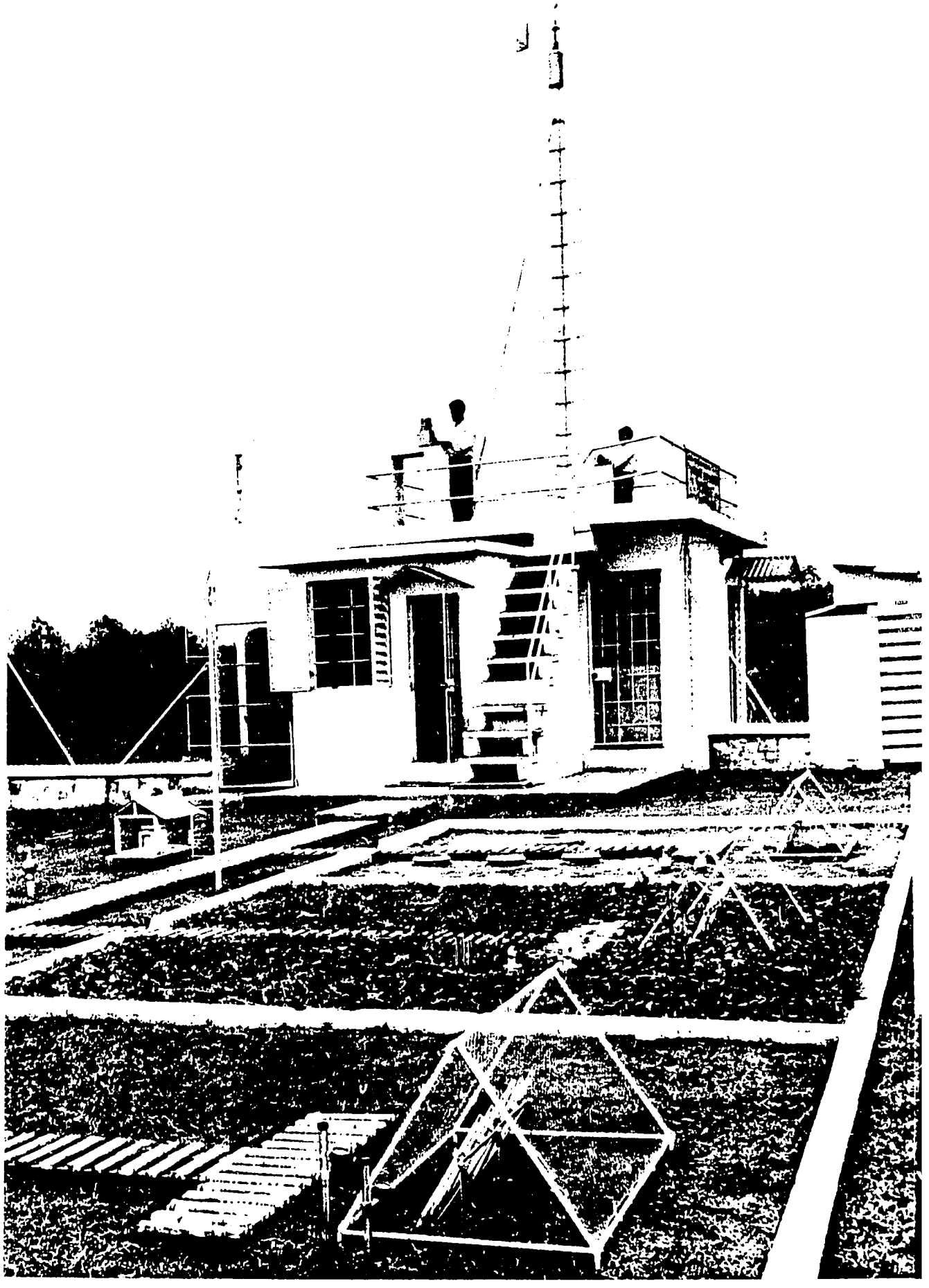

Annual Financial Contributions
(in millions of US dollars)
5
4
3
2
1
Multinational
UNDP
National
75
76
77
78
79
80
Centre project
75
76
77
78
79
80
Country projects

TABLE 6


Financial Contribution for Components of Programme
(in millions of US dollars)
a. – Experts
b. – Equipment
c. – Buildings
d. – Fellowships
e. – Hydrological subcontract
f. – National personnel
g. – Running costs
6.168
7.964
National
Multinational
UNDP
5
4
3
2
1
a. b. c. d. e. f. g.
Centre project
a. b. c. d. f. g.
Country projects



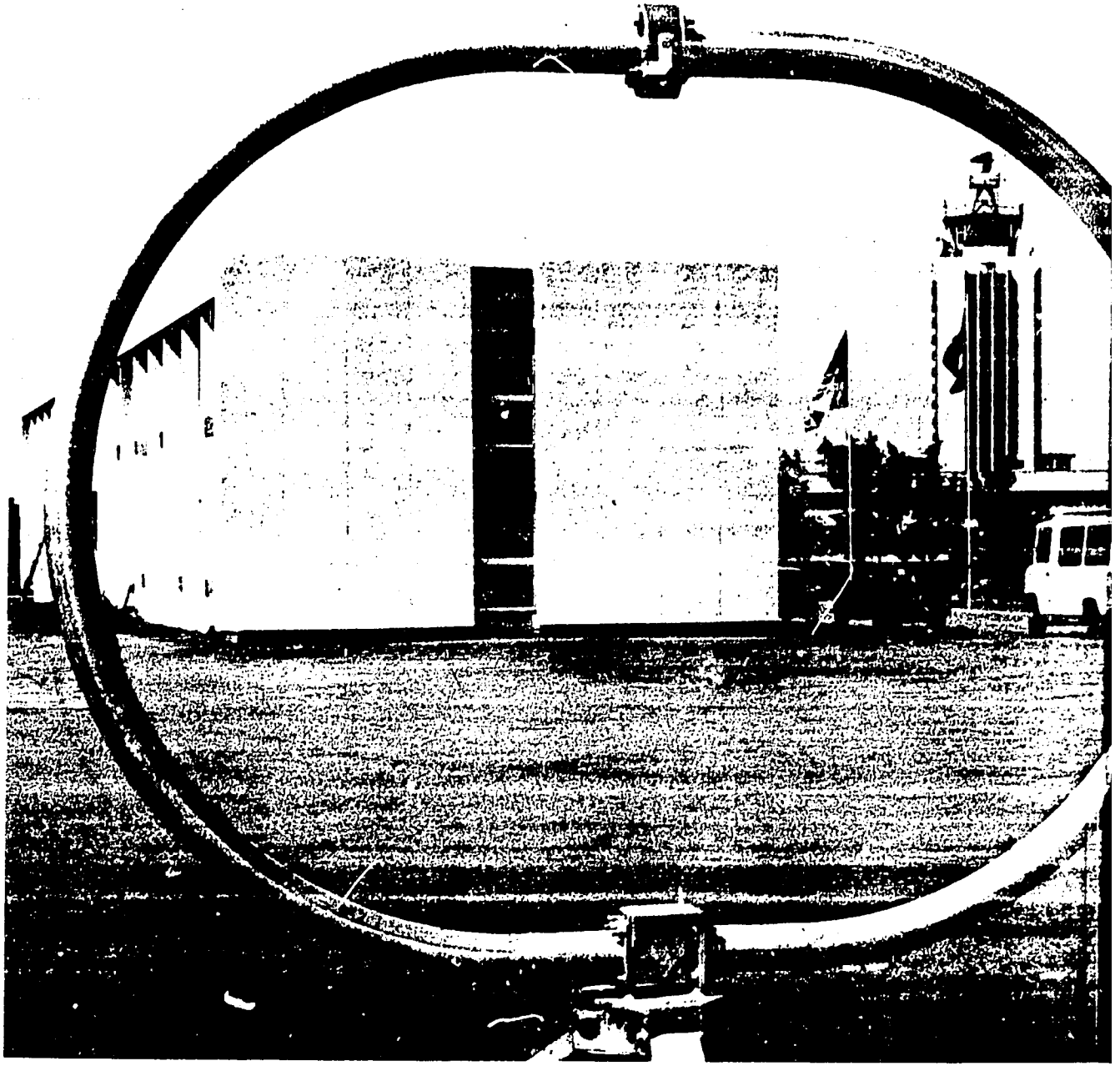
Typical Sahelian countryside picture
Aridity, rare xerophytic vegetation and distant wells are the main elements of the Sudano-Sahelian zone.



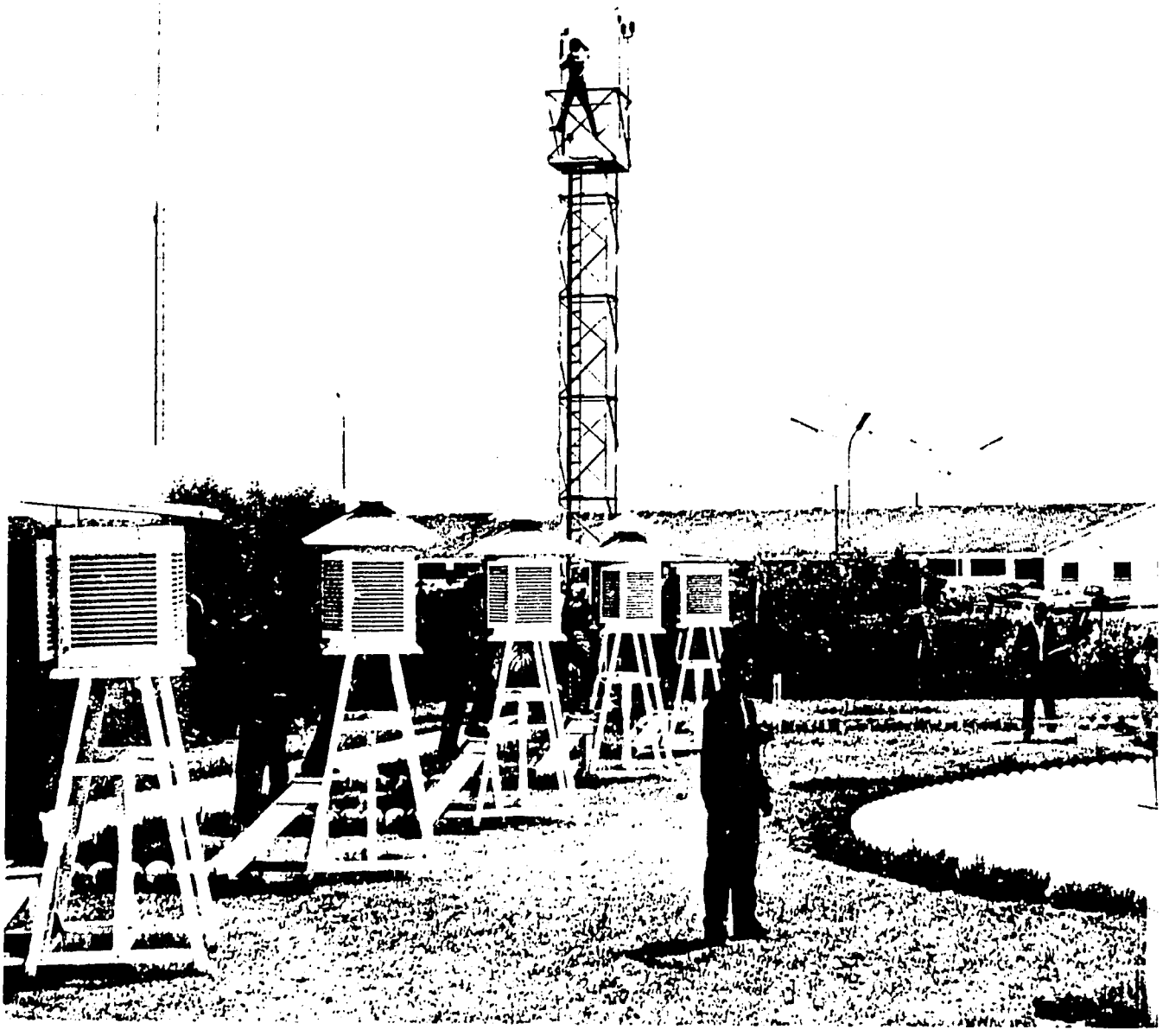
Agrometeorological station
About thirty-five of them will be installed in the Sudano-Sahelian countries during the life of the programme.

Evaporateur pan

Measurement of evaporation is an important element in the determination of water losses from soils and reservoirs. For example, Lake Chad loses 1,800 mm. of water per year through evaporation.

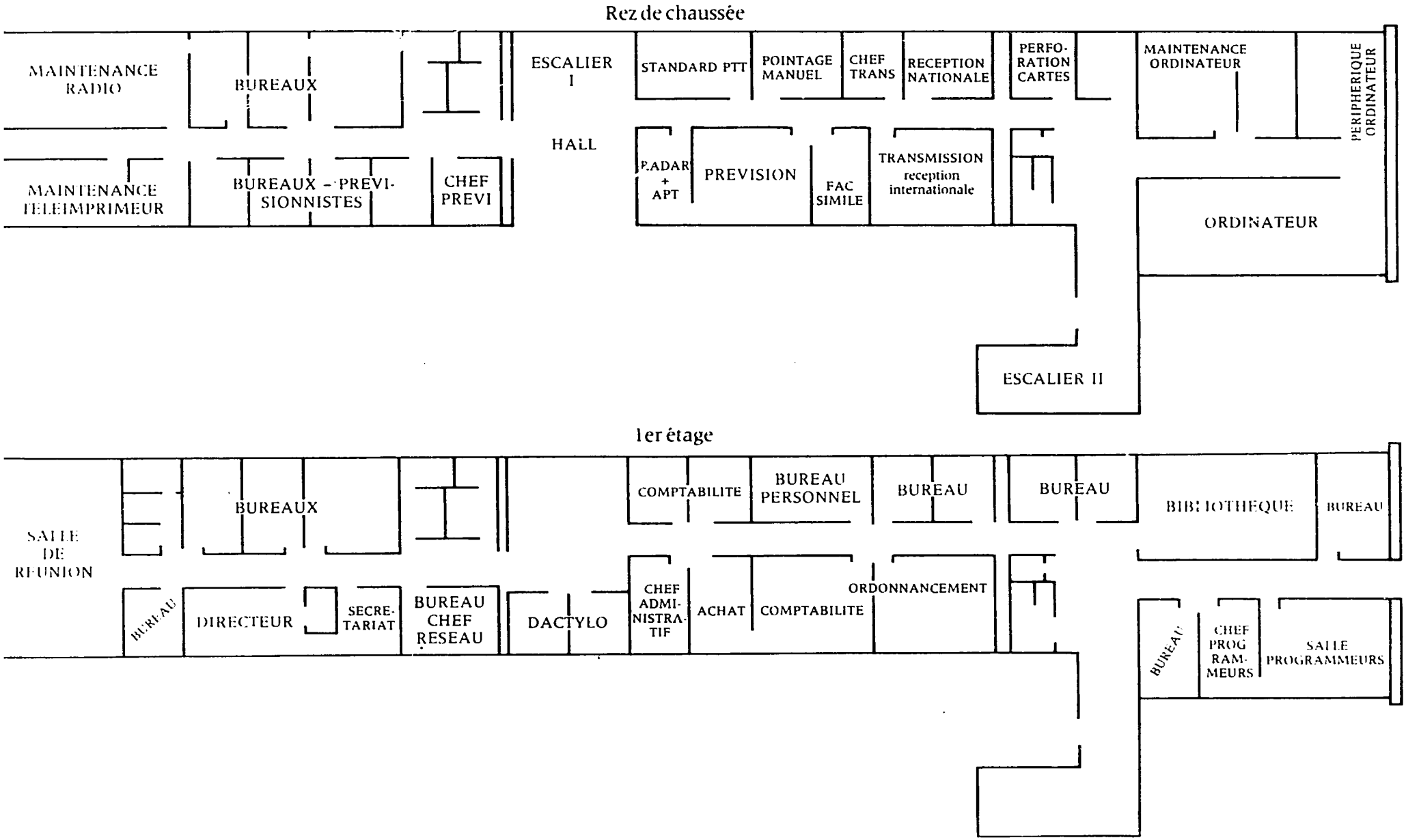


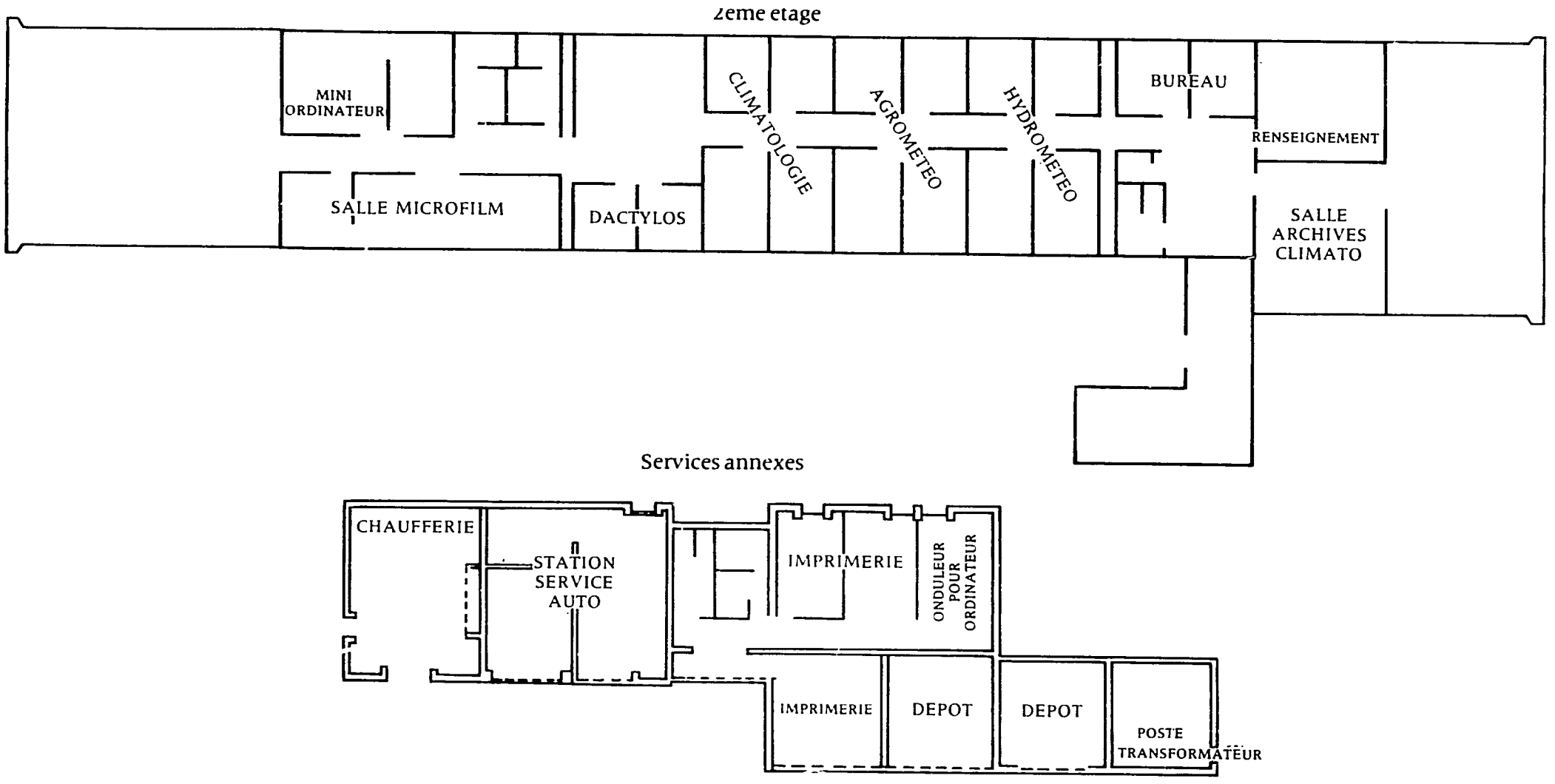
Meteorological Building, Dakar
This building was offered by the USA for the global atmospheric tropical experiment in 1974. Similar buildings will be needed in the other Sudano-Sahelian countries.



Instruments enclosure in a Meteorological Training Centre
Similar facilities will be made available to the Centre in Niamey.

PLANS OF A BUILDING
FOR A NATIONAL METEOROLOGICAL SERVICE

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MINI ORDINATEUR
SALLE MICROFILM
DACTYLOS
CLIMATOLOGIE
AGROMETEO
HYDROMETEO
BUREAU
RENSEIGNEMENT
SALLE ARCHIVES CLIMATO
Services annexes
CHAUFFERIE
STATION SERVICE AUTO
IMPRIMERIE
ONDULEUR POUR ORDINATEUR
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