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OFFICE OF THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

THE ROLE OF AID IN THE DEVELOPMENT OF SAHEL TRANSPORTATION INFRASTRUCTURE

A Strategy Proposed by the
Office of International Transportation Programs

VOLUME I

Department of Transportation
Washington, D.C. 20590

March 1, 1979

(Review Copy)

OFFICE OF THE SECRETARY OF TRANSPORTATION
WASHINGTON, D.C. 20590

March 5, 1979

Mr. Jim Kelly
Director, Office of Sahel & Francophone
West African Affairs
Room 2497
Agency for International Development
Washington, D.C. 20523

Dear Mr. Kelly:

We are pleased to submit herewith...review copies of the Final Report on "The Role of AID in the Development of Sahel Transportation Infrastructure." After receipt of your comments they will be incorporated into the 50 copies of the Final Report.

Because of the urgency with which your staff needed the results of this study, we have submitted to your organization the drafts of the individual chapters of the report as they become available. We have therefore, already benefited considerably from comments made by your staff, especially Mr. Jim Mudge and Mr. Sam Lubin.

We are pleased to provide these advisory services and look forward to being of continued assistance to your office.

Sincerely,

Voyce J. Mack
Deputy Director
Office of International Transportation Programs

TABLE OF CONTENTS

	Page No.
CHAPTER I: EXECUTIVE SUMMARY	
A. General	I-1
B. Overview of Transport in the Sahel	I-2
C. Investment Opportunities for AID in the Sahel	I-5
D. Current Donor Activity in Transport Infrastructure Investment	I-9
CHAPTER II: PROBLEM IDENTIFICATION	
A. General	II-1
1. Study Objectives	II-2
2. The Sahelian Status Quo	
B. Historical Background of Sahelian Transport	II-3
1. Evolution of Transport	II-3
2. AID Assistance in Transport Development	II-4
3. Present Organization for Development in the Sahel	II-7
C. Current Condition of Transport Sector	II-9
1. General	II-9
2. Country Overviews	II-11
3. Physical Plant	II-23
a) Roads and Vehicles	
b) Railroads and Rolling Stock	
c) Ocean Ports	
d) River Transport	
e) Aviation	
4. Human Resources	II-59
5. Organization of Road Transport Industry	II-64
CHAPTER III: CURRENT ACTIONS AND PLANS OF USAID AND CLUB DU SAHEL IN THE TRANSPORT SECTOR	III-1
A. Summary	III-1
B. USAID Participation	III-3
C. Estimating the Costs and Completion Times of 19 Transportation Projects	III-6
D. Data Sources	III-8

Table of Content (Continue)

	Page No.
CHAPTER IV: LEGISLATIVE GUIDELINES RELATING TO AID INVESTMENT IN SAHEL TRANSPORT INFRASTRUCTURE	IV-1
A. General	IV-1
B. Principal Elements of "New Directions" Legislation	IV-2
1. The Target Group	IV-2
2. Project Orientation	IV-3
3. Multi-Donor Coordinated Effort	IV-6
4. Authorized Amounts	IV-7
5. Timing	IV-8
CHAPTER V: ALTERNATIVE TRANSPORT MODES AND THEIR RELATION TO THE CONGRESSIONAL MANDATE	V-1
A. General	V-1
B. Road and Road Projects	V-4
1. Definition of Road Categories	V-4
2. Benefits from Road Improvements Projects	V-11
3. Benefitsfrom Labor - Intensive Road Projects	V-22
C. Economic and Social Welfare Benefits of Roads:	V-27
Case Studies	V-28
1. Malawi Case Study	V-28
2. Philippines Case Study	V-32
3. Korea Case Study	V-36
4. Honduras Western Highway	V-41
5. The Canas - Upala Road in Costa Rica	V-45
6. The New Guinea Case Study	V-48
D. Rail Projects	V-51
E. Port and Airport Improvements Projects	V-53
F. Transport Surveys and Technical Assistance to Transport Institutions	V-54
CHAPTER VI: TRANSPORT INFRASTRUCTURE NEEDED IN THE SAHEL AND AID OPTIONS FOR INVESTMENT	VI-1
A. Transport Infrastructure Construction, Improvement, Maintenance	VI-1
B. Management of Financial Resources	VI-7
C. Integrated Area Development	VI-19
D. Technical Assistance	VI-19
E. Conclusion	VI-23

Table of Content (Continue)

		Page No.
CHAPTER VII:	FIELD GUIDELINES FOR SCREENING RURAL ROAD PROJECTS IN THE SAHEL	VII-1
A.	Introduction	VII-1
B.	General Description of the Screening Technique	VII-2
C	Road Improvement Levels	VII-5
D	Screening	VII-8
CHAPTER VIII:	A FRAMEWORK FOR EVALUATING TRANSPORT INFRASTRUCTURE PROJECTS IN DEVELOPING COUNTRIES	VIII-1
A.	Basic Approach	VIII-1
B.	Principal Phases of Project Evaluation	VIII-3
C.	Project Identification, Phase I	VIII-4
D.	Economic Evaluation (ERR), Phase II	VIII-4
E.	Social Evaluation (SRR), Phase III	VIII-5
F.	Socioeconomic Ranking - Phase IV	VIII-10
G.	Example of Socioeconomic Ranking	VIII-13
ANNEXES , VOLUME II		
1.	Climatic Zone Characteristics	A1-1
2.	Population Distribution by Country	A2-2
3.	Current and Projected Economic Activity	A3-1
4.	The Rural Poor	A4-1
5.	Terrain Evaluation of Roads	A5-1
6.	Road Needs of Irrigation Projects	A6-1
7.	Sahel Road Maintenance/Construction: Some Salient Factors	A7-1
8.	Training	A8-1
9.	Geography of the Sahel	A9-1
10.	Economy of the Sahel	A10-1
11.	Scope of Work for DOT Advisory Services to the AID Sahel Program	A11-1
12.	Retrospective Evaluation of 35 Transport Infrastructure Projects.	A12-1
13.	IBRD Maps of Sahel Transport Infrastructure Population Density and Climatic Zones	A13-1

LIST OF TABLES AND FIGURES

Chapter II

Table II B-1: Sahel - Selected Social and Economic Indicators

" II C-1: Road Network of the Sahel Region, 1978

" II C-2: Cape Verde - Road Network and Vehicle Fleet

" II C-3: Chad - Road Network and Vehicle Fleet

" II C-4: Gambia - Road Network and Vehicle Fleet

" II C-5: Mali - Road Network and Vehicle Fleet

" II C-6: Mauritania - Road Network and Vehicle Fleet

" II C-7: Niger - Road Network and Vehicle Fleet

" II C-8: Senegal - Road Network and Vehicle Fleet

" II C-9: Upper Volta - Road Network and Vehicle Fleet

" II C-10: Principal Rail Lines, Sahel Countries, 1978

" II C-11: Railroads of West Africa - A Comparison of Freight Traffic (1968-1976)

" II C-12: Total Cost and Distribution of Project Costs for Proposed Railroad Projects in West Africa

" II C-13: Principal Inland Waterways, Sahel Countries

" II C-14: Sahel Domestic Air Feeder Services, Aircraft and Ground Facilities (1971)

" II C-15: Airline Traffic - Upper Volta, Niger, Chad, Mauritania and Senegal (1972-1977)

" II C-16: Airline Traffic - Mali (1972-1976)

" II C-17: Agricultural Labor Force and Literacy, Sahel Countries

" II C-18: Organization of the Road Transport Industries in the Sahel Countries

Chapter III

Table III A-1: Current Actions and Plans of AID and Club du Sahel in the Transport Sector

" III A-2: Club du Sahel - Current and Planned Transport Investments by Mode

" III A-3: Club du Sahel - Additional co-financing Required for Transport Projects

" III A-4: Club du Sahel - Current and Planned Road Investments by Type of Road Work: Construction, Rehabilitation, Maintenance

" III A-5: Club du Sahel - Current and Planned Investments by Type of Road

" III A-6: Timestream of Funding Committed, Under Consideration, or Required for Transport Infrastructure Projects, 1970-1990

" III A-7: Distribution by Recipient Country of Club du Sahel Current and Planned Transport Investments

" III A-8: Loans and Grants from Socialist Countries to CILSS Member States, 1954-1977

Figure III A-1: Funding Committed, Under Consideration, and Required for Transport Infrastructure Projects Being Implemented or Pending, 1970-1990

" III A-2: Funding Required for Transport Infrastructure Projects, 1970-1990

" III A-3: All Funding for Road Construction, Rehabilitation and Maintenance, 1973-1988

Table III B-1: USAID - Current Actions and Plans in Sahel Transport Sector

Map III E-1: Current Actions and Plans of AID and Club du Sahel in the Transport Sector

Chapter V

Figure V B-1: Hierarchy of Roads

Table V B-1: Index of Truck Operating Costs on Paved and Gravel Roads in Good and Bad Condition

Table V B-2: Potential Impact of the Various Transport Infrastructure Programs on the Participation by the Rural Poor

Table V C-1: Philippines Case Study - Average Percentage Increases in Sales Volume Comparing One Year Before and One Year After Construction of the Road

Table V C-2: Philippines Case Study - Average Drop in Transportation Cost of Farm Products After Construction of the Road

Table V C-3: Korea Case Study - Degree of Commercialization by Location

Table V C-4: Korea Case Study - Farm Size Related to Road Proximity

Table V C-5: Korea Case Study - Comparative Commodity Farmgate Prices (1967)

Table V C-6: Korea Case Study - Expenditures for Inputs and Credit (1967)

Table V C-7: Korea Case Study - Value of Farm Assets

Table V C-8: Korea Case Study - Number of Trips - Two Rural Villages, Jan.-Aug. 1968

Table V C-9: Honduras Case Study - Production of Corn and Beans in the Western Region (Honduras) by Municipality Groups

Table V D-1: Freight Traffic Carried on the Mali Railway, 1976

Chapter VI

Table VI A-1: Road vs. Rail Operating Costs

Annex 1

Figure 1: The Sahelian Countries - Climatic Zones

" 2: Rainfall in Chad

" 3: Rainfall in Niger

" 4: Rainfall in Mauritania

" 5: Vegetation Belts in Mauritania

" 6: Climate in Senegal

" 7: Senegal - Rainfall and Cultivation

" 8: Sahel - Major Environmental Handicaps to Economic Development

" 9: Sahel - Annual Precipitation

" 10: Sahel - Rainfall (Averages of Annual Rain) 1923-1974

Figure 11: Sahel - Rainfall 1974

" 12: Sahel - Rainfall

" 13: Sahel - Vegetation

Annex 2

Table 1 : Cape Verde - Prefecture Populations

" 2 : Chad - Prefectures - Chief Towns

" 3 : a) Composition of Population in Chad (1964)
b) Population Density in the Villages of Chad

Figure 1 : Selected Ethnic Distribution of Chad

" 2 : Population Patterns in Mauritania

Table 4 : a) Administrative Regions of Mauritania
b) Estimate of the Mauritanian Population by Region, 1969

Table 5 : Mauritania - a) Regions (1972)
b) Principal Towns - Population (1975 estimates)

Figure 3 : Senegal - Rainfall and Population

Table 6 : Senegal - Population by Region

Table 7 : Senegal - Ten Largest Urban Centers, 1973

Table 8 : Upper Volta - Principal Towns (1975 population estimates)

Annex 3

Figure 1 : Cape Verde Islands

Table 1 : Chad- Agricultural Production

Figure 2 : Chad- Areas of Maximum Production- Selected Crops of Chad

Figure 3 : Chad

Table 2 : Chad- Cotton Production

Figure 4 : Schematic Representation of Maximum Cattle Raising in Chad, 1970

Table 3 : Chad- Livestock Production

Table 4 : Chad- Agricultural Processing Facilities and their locations (1970's)

Table 5 : Chad-Industrial Production

Figure 5 : The Gambia

Table 6 : Mali Agriculture

Table 7 : Mali-Livestock and Livestock Products

Table 8 : Mali-Industrial Production

Figure 6 : Mali-Livestock Project

Table 9 : Mauritania-Major Crops

Table 10: Mauritania-Livestock and Livestock Products

Table 11: Mauritania-Industry; Selected Products

Table 12: Mauritania-Mining

Figure 7 : Mauritania

Figure 8 : Agriculture and Mining in Mauritania

Figure 9 : Niger

Table 13: Niger-Agricultural Production

Table 14: Niger-Industry

Table 15: Niger-Mining

Figure 10: Senegal-Rainfall and Cultivation

Figure 11: Senegal

Table 16: Senegal Principal Crops

Table 17: Senegal-Projected Growth of Major Agricultural Products to 1980

Figure 12: Senegal-Location of Main Industries

Table 18: Senegal-Industry

Table 19: Senegal-Mining

Table 20: Upper Volta-Agricultural Production

Table 21: Upper Volta-Livestock and Livestock Products

Figure 13: Upper Volta-Ecomomic Resources and Rainfall

Table 22: Upper Volta-Industrial Production

Annex 5

Figure 1 : Land System-Nigeria Example NO.1

Table 1 : Lugge Land System

Table 2 : Some Values of Lateritic Ironstone Gravels Obtained From Four Widely Separated Sites With the Same Land Facet-Land Facet 3 Lugge Land System

Table 3 : Gombe Land System

Table 4 : Facets of Gombe Land System

Figure 2 : Block Section Showing the Land Facets of the Gombe Land System, Nigeria

Table 5 : Engineering Properties of Materials-Gombe Land System

Table 6 : Engineering Resources: Gombe Land System

Table 7 : Suitability for Road Location: Gombe Land System

Figure 3 : Block Section Showing Labu Land System Malaya, at Junction with Galla Land System

Table 8 : Labu Land System

Table 9 : Facets of Labu Land System

Table 10: Plasticity and Density Characteristics of Granitic Soils

Annex 6

Table 1 : Sahel-Road Needs of Projected Irrigated Areas

Annex 7

Table 1 : Sahel Road Maintanenance/Construction: Some Salient Factors—1978

Annex 9

Table A-1 : Land Areas of the Sahel and the United States

Table B-1 : Zonal Composition of Sahel Countries

Figure B-1 : The Sahelian Countries-Climatic Zones

Table B-2 : Principal Characteristics of Sahelian Climatic Zones

Figure B-2 : Vegetation Map of Africa

Table D-1 : Sahel Population Profile (1975)

Table D-2 : Current and Projected Population in the Sahel

Table D-3 : Sahel Countries-Major Urban/Market Centers

Table E-1 : Effects of Agro-Climatic Conditions on Transport Requirements

Table E-2 : Airphoto Interpretation of Tropical Soils-Summary

Figure E-1 : Distribution of Black Clay Soil in Africa

Figure E-2 : Moisture Regions of Africa

Table E-3 : Weathering Products in Relation to Environments

Annex 10

Table A-1 : Sahel Countries-Consumer Price Index

Table A-1a: Sahel Countries-Agricultural Production, Principal Crops, 1966/67-1974/75

Table A-2 : Real Output in 1973 as % of 1972 Output

Table A-3 : Sahel Mineral Deposits, 1977

Table B-1 : Sahel Main Trade Commodities and Their Transport Routes

Figure B-1 : Sahel-Principal Transport Routes

Table B-1(a) : Cape Verde-Foreign Trade

Table B-1(b) : Cape Verde-Main Trading Partners

Table B-2(a) : Chad-Foreign Trade

Table B-2(b) : Chad-Principal Trading Partners

Table B-3(a) : Gambian Foreign Trade

Table B-3(b) : Gambian Trading Partners

Table B-4(a) : Malian Foreign Trade

Table B-4(b) : Malian Trading Partners

Table B-5(a) : Mauritania-Foreign Trade

Table B-5(b) : Mauritania-Trading Partners

Table B-6(a) : Niger-Foreign Trade

Table B-6(b) : Niger-Trading Partners

Table B-7(a) : Senegal-Foreign Trade

Table B-7(b) : Senegal-Trading Partners

Table B-8(a) : Upper Volta-Foreign Trade

Table B-8(b) : Upper Volta-Trading Partners

Table C-1 : Road Expenditures as a Percentage of GNP and Total Budget Expenditures for Sahel and Other West African Countries

Annex 11

None

Annex 12

Table A 12-1 Summary of Transport Project Performance Audits on IBRD Projects Initiated Between 1964 and 1972

Annex 13

Map 1: Sahel Region Transport Infrastructure

Map 2: Sahel Regional Population Density

Map 3: Sahel Region Land Use

Map 4: Sahel Region Cereal Production

CHAPTER I: SUMMARY

A. GENERAL

The Sahel, consisting of the eight countries Chad, Gambia, Cape Verde, Mali, Mauritania, Niger, Senegal, and Upper Volta, lies in a band stretching more than 4000 km across Western Africa between latitudes of 10 and 25 degrees North. Together, these countries cover an area equivalent to about 60% of the land area of the United States.

Except for the small island nation of Cape Verde, the Sahel is essentially an enormous plain with a large, sparsely inhabited desert in the northern 60%. Moving south one first encounters the dry savannahlike Sahel and Sudan zones with about three-quarters of the population, and then the small Guinea zone (10% of the area) with a rainfall of about 10cm per year.

The variability of rainfall in the Sahel is extreme and the concept of "normal" weather is practically nonexistent. Every year there is some degree of drought in the Sahel, while from time to time, such as in 1972, catastrophic drought affects the whole region.

The Sahel is traversed by three great river systems: the Senegal, the Niger, and rivers feeding Lake Chad. Only a small proportion of the river water is used for irrigated agriculture, and the yields are generally low in the remaining areas cultivated under the uncontrolled flooding technique.

The eight Sahelian countries are among the world's poorest countries. The basic resource is their agricultural and livestock potential. About 80-90% of total population are employed in this sector which contributed almost 50% of the Gross Domestic Product (GDP) in the region. Because of this heavy dependance on agriculture and livestock the drought in 1972 has, in addition to the severe human suffering, caused heavy economic losses to the countries through reduced production and the burden of providing disaster relief to those parts of the population most affected. The loss of cattle has been variously estimated at from 20 to 50% in Mauritania and Niger, 20 to 40% in Mali and Chad, and 10 to 20% in Upper Voïta. Foodcrop production failed over several years in proportions varying from 20 to 30% of normal pre-drought levels, and necessitating emergency food relief to the region of some 600,000 tons in 1972/1973, 1,000,000 tons in 1973/74, and 400,000 tons in 1974/75.

B. OVERVIEW OF TRANSPORT IN THE SAHEL

The function of transport in the Sahel is two-fold: the transport system must accommodate the growth in demand emanating from economic development, and must also have adequate capacity to accommodate the extraordinary demand generated by future emergency relief shipments. For both these functions the region must have an adequate internal collection and distribution system concentrating on population centers, with low-cost links to the sea ports for imports and exports. The latter is especially true for

the four landlocked Sahelian countries that must depend on the variable cooperation of their neighboring coastal countries. The basic transport infrastructure network, though there is some scope for extension, is adequate to meet these needs. Where the transport system is grossly inadequate, however, is in the inefficiency of the transport services, and the failure of maintaining the existing infrastructure in a satisfactory condition; very extensive rehabilitation is required. Both of these problems have their root in the lack of appropriate government policies and procedures. The lack of efficient transport services is a major impediment to further economic development of the Sahel. Upgrading and maintenance of existing systems is a principal need, and considerable technical assistance will be required to strengthen the operational and planning capabilities in the countries and to ensure efficient operation of the transport system.

Roads

In terms of tonnages and passengers moved, road transportation is the most significant mode; there are some 80,000 kms. of tracks and roads, of which 8500 are paved and about 9000 are all-weather earth or gravel surface roads. It is estimated that about 50,000 km of the roads are inadequately maintained or not maintained, and 10,000 km are in deteriorated condition, largely due to lack of maintenance. Sahelian governments focus their inadequate financial and skilled manpower resources on new construction and on the maintenance of a small fraction of primary and secondary roads, and make little or no budgetary provision for tertiary road maintenance.

Railroads

A total of 2,800 kms. of principal railroad lines exist. Of the eight countries, Mali, Mauritania, Senegal, and Upper Volta have railroads; the others do not. Reliance on truck connections with railways of other countries is important to Upper Volta, Niger and Chad. There is little scope for additional railway investment in the Sahel because the existing network is adequate to handle normal traffic volumes. However, there is a considerable need to improve the operational and management efficiency of the existing system.

Waterways

There are about 2,500 kms. of navigable waterways, with populations and farming activity tending to concentrate near the rivers. River transport is of little consequence and is gradually losing ground to road transport as roads are extended and improved. Future development plans for waterways do not appear to have a high payoff relative to road and railroad investments, though there may be some potential on the Senegal river after completion of the Senegal River Basin project.

Aviation

Aviation is presently the least important mode in terms of passenger and cargo movements, and prospects for aviation projects are limited. Approximately 21 publicly-owned commercial aircraft 118 airfields are operative in domestic feeder operations. Though the issue of investment

in aviation ranks low in importance compared to investment in surface transport, further development of domestic air transport may well be the answer to some of the Sahel's needs for transport to remote areas.

Ports

Mauritania, Cape Verde, Gambia, and Senegal are the only Sahelian countries with direct access to the sea. The other Sahel countries are landlocked and must depend upon the capabilities of foreign ports. The capacity of the existing ports is quite adequate, and the main bottlenecks associated with ports are lack of storage capacity and inadequate connecting land transport services.

C. INVESTMENT OPPORTUNITIES FOR AID IN THE SAHEL

When the competitive environment of the transport industry and other considerations such as land tenure are favorable, past experience in other countries demonstrates that expenditures on improving feeder and secondary roads relate closely with the objectives set forth in the Congressional Mandate. Review of a number of case studies in Malawi, Costa Rica, the Philippines, Korea, Honduras, and New Guinea on the impact of feeder and secondary road projects show that such roads have significantly improved the incomes of small farmers, provided increased access, and increased the number of trips taken by the rural poor to educational, health, social, and administrative facilities. In addition, these road improvements facilitated the expansion of government services that were not being provided before the road projects, such as visits to the formerly inaccessable rural areas by health and other

social workers, and agricultural extension agents. This empirical evidence indicates that, contrary to concerns otherwise, rural roads projects can, by themselves, have a beneficial development impact that is more than sufficient to justify their investment cost. Furthermore, provided that the organization of the transport industry is competitive and other considerations such as land tenure are favorable, the small farmer will participate in these benefits. The empirical evidence therefore indicates that, where constraints in funds, time, and skilled personnel inhibit the planning of rural roads as part of an integrated development package with other complementary services and investment such as agricultural extension and rural electrification, AID has a viable option of planning independent secondary and feeder road projects.

However, where it is possible to do so, the integration of road projects into a development package will, in all likelihood, multiply and accelerate the accrual of the potential benefits obtainable from the road project alone. It is therefore recommended that AID focus first on those road improvement projects with planned complementary investment or that are located in areas of ongoing or planned agricultural development projects. It is only after these road projects are exhausted that AID should turn to road projects that must be justified on their own merits.

The impact of primary road improvement projects (and in the Sahel the primary roads are often earth tracks with very low traffic levels of perhaps 15 vehicles per day) on the welfare of the rural poor is also judged to be high, though there is no empirical evidence supporting this as was the case for the secondary and tertiary roads. But evidence collected by traffic surveys investigating the origin, destination, and composition of goods transported on roads indicates that the small farmers rely heavily on primary roads for the transport of their export products and the import of their farm inputs such as fertilizers. Since many of these roads in the Sahel are badly deteriorated due to lack of maintenance, the vehicle operating costs can be significantly reduced, in many cases by more than 100%, by rehabilitation or reconstruction. Road improvement may therefore contribute to increased farm income through higher farm gate prices and lower prices for farm inputs, and the improvement of primary roads therefore meets one of the important objectives of the congressional mandate. In addition, primary roads provide an essential link in the access to the more sophisticated health, social, and administrative services that the rural poor can only obtain in the larger urban centers. Thus, investment in the primary road system in the Sahel will also be in close accordance with the aims of the Congressional Mandate.

Though rail also carries a significant amount of farm outputs, inputs, and rural passengers, the scope for investment by AID is probably very

limited because of the very poor prospects that cost savings would be passed on to the poor in the form of lower tariffs.

Waterways in the Sahel are not very important at present, and seem to have little potential for development. In principle, waterways could be quite relevant to the well being of the rural poor. However, in light of their lack of importance in the Sahel, there appears to be little justification for receiving priority in AID's transport infrastructure investment program though this situation may change if, for example, the Senegal River Basin project generates a significant demand for water transport.

Aviation is also an unimportant mode of transport in the Sahel compared with other modes. And, even though aviation is critical to the development in the Sahel of industries such as tourism, and can promote development in the remote areas of the Sahel, the impact on the rural poor will be only of an indirect nature. There seems, therefore, to be little scope for AID investment in aviation.

There is considerable opportunity for AID and other donors to invest in the development of physical facilities such as upgraded roads. However, such investment prepared in isolation from the effort to improve the operational efficiency of existing facilities and administrative procedures would overlook an important opportunity to reduce the need for capital expenditures or, at least, make it possible to

postpone investment needs. Operational improvements such as enforcement of the axle load limitations on trucks would make existing and future investments more productive. Expenditures on the maintenance of roads or ports, or in a restructuring of the management staffing or procedures for the operation of a railroad, often indicate much higher benefit-cost ratios than similar size investments in new projects. Thus, the identification and analysis of physical infrastructure projects must be undertaken with concurrent analysis of trade-offs for operational improvements. Moreover, the benefits of free competition which makes transport industries more productive and is conducive to the passing on of savings to the small farmers must be promoted by reforming some to the present regulatory practices in several of the Sahelian countries. However, the major constraint inhibiting the achievement of operational efficiency and effective administrative procedures is the serious lack of skilled, trained and experienced manpower at all levels, particularly in the intermediate supervisor sector. Removal of this constraint will require extensive technical assistance and training which may last 5-10 years before satisfactory results are obtained.

D. CURRENT DONOR ACTIVITY IN TRANSPORT INFRASTRUCTURE INVESTMENT

A total of 172 transport projects representing investments accounting for about 1.6 billion dollars are currently being undertaken or planned under the auspices of the Club du Sahel. Of this vast sum,

the predominant part (80%) is for expenditures on road rehabilitation and the upgrading of earth tracks to all-weather capability. Only an insignificant amount is being expended on extension of the existing network. Rehabilitation and improvement of rail lines account for about 10% of the total investment, and with the remaining 10% going for water, airport, and multimodal projects. In addition, the CILSS Member States have, in the 1974-1977 time period, received more than .5 billion dollars in loans and grants from the socialist countries, of which perhaps 20% was allocated to transport. These monies from the socialist countries were not funneled through the Club du Sahel.

Though the emphasis of the donor activity is properly directed toward rehabilitating the existing network rather than its extension (which is not urgent and would increase the already intolerable maintenance burden) there appears to be a considerable lack of coordination with the resulting danger of duplication of effort, and voids in critical areas. The weakness in coordination may stem to a large extent from the very limited, but useful function of the Club du Sahel as a "broker" arranging for multiple donor participation in large projects, and dispensor of information on the status of various bilateral and multilateral agreements and which projects need financing. The Club appears to have little authority over the funds expended, and the neighboring countries to the Sahel that perform the vital function of providing the import and export links via their ports are not represented in the Club du Sahel. Further, there is no technical secretariat available

to provide the technical expertise and to undertake the detailed analysis required to formulate a comprehensive transport investment program in line with the Sahel's development objectives, and the hoped for operational and regulatory improvements in the transport industry.

Though the Club du Sahel is performing an extremely useful function in furthering economic development in the Sahel, there appears to be a need to improve overall efficiency in transportation planning and operation.

For greater weltare in the region, efforts might be considered for a technical assistance program for the preparation of a regional transport system study to more closely relate the region's transport policy objectives to the region's development goals and to the needs of other sectors of the economy, such as agriculture.

II PROBLEM IDENTIFICATION (1)

A. GENERAL

1. Study Objectives

Under a Congressional mandate AID was invested with a multi-year $200 million program of assistance to the eight Sahel countries. Reflecting the "New Directions" legislation, the principal measure of success will be the extent to which the program has a direct impact on the welfare of the rural poor majorities of these nations.

AID requested DOT to assist in developing a sound strategy for assistance to Sahel transportation infrastructure in the next decade. The recommendations contained herein are based upon a home-office survey of available data, supplemented by Department of Transportation in-house knowledge and experience.

Specifically, in determining a strategy for AID investment the following factors were to be addressed:

1. The sense of the Congress reflected in the "New Directions" Foreign Assistance Legislation.
2. The role of transport infrastructure in promoting the welfare of the rural poor element of Sahelian populations.
3. A determination of the conditions necessary for transport infrastructure investments to reach the rural poor, promote employment and more equitable income distribution and reduce risks inherent in Sahelian agriculture.

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(1) This chapter benefited greatly from valuable discussions with and information provided by various staff members of the Western Africa Regional Office of the World Bank.

4. A study of transport modes by type and quality of service (e.g. roads; primary, secondary, and tertiary) and a determination of the extent to which an improvement in a selected mode, alone, or combined with other inputs, will benefit the rural poor and promote development consistent with the AID "New Directions" mandate.
5. In addition, DOT was to provide guidelines to assist USAID personnel in the Sahel in project identification and selection.

2. The Sahelian Status Quo

Sahel transport problems are reflected in the following prevailing conditions:

a. Limited human resource capabilities to undertake and direct change;
b. Insufficient capital resources for transport investment and maintenance.
c. Deteriorating transport networks with current maintenance inadequate to reverse the trend.
d. Inadequate inter-governmental coordination of transportation planning, resulting in high transport costs for imported and exported products and long transit times.
e. Initial coordination of domestic plans for integrating agricultural area and river basin development with road planning and construction requiring increased attention.

With these conditions in view, this study prescribes means for maximizing the effectiveness of AID transportation investments in terms of welfare to the rural poor, while implementing actions to improve transport capabilities. Our recommendations reflect the understanding that greater social equity rather than national income maximization is the primary objective of AID assistance to the Sahel.

B. Historical Background of Sahelian Transport

1. Evolution of Transport. The evolution of transportation in the Sahel is eminently associated with regional commercial development. Until the advent of the colonial powers, indigenous transport in the Sahel was essentially by foot or pack animal. The empires which flourished in the area in the 13th to 18th centuries were often founded on the control of the rich inland camel trade over the Sahara Desert. The slave trade was the first notable exception to this pattern, and from the 16th to the 19th centuries trade routes slowly began to reorient from the Sahara Desert to ports on the Atlantic Ocean such as Goree, Elimina, and Lagos. Slave ships embarked thousands of able bodied Sahelians in exchange for trade goods such as beads, cloth, alcohol and firearms.

European colonization of the Sahel in the latter half of the 19th century led to fundamental modifications in the direction and characteristics of the transport system. New commercial, military, and administrative ties were imposed by the Europeans. A colonial influence spread increasingly inland, and modern forms of transport infrastructure accompanied it. Moden economic development of the Sahel began with the arrival of the railroads, which penetrated far inland, linking major administrative centers to the coast. Colonial administrations encouraged ground-nut and cotton production to develop exportable market crops and to provide Sahelian markets for European goods. Increased rural development necessitated other forms of transport from the rural areas to major railheads; tracks and rudimentary roads were constructed for this purpose. The World War II period marked the start of a new economic era for the West

African colonies, leading to sharply expanded infrastructure development and increased agricultural exports, recognition of African political rights and eventually political independence. Since independence in the early 1960's, transport infrastructure has undergone radical changes, leading to important modifications in both transport philosophy and financing. In general, road infrastructure has evolved into a dominant transport mode, complemented by long-haul railroad links to the sea. It is not unusual for a Sahelian state to spend up to 20 percent of its national budget on transport infrastructure, and major international donors are continuously solicited to provide large sums of capital for the development of the transport sector. Historically, increases in the size and complexity of national economic systems require transportation improvements. Some observers maintain that until late in the colonial period the lack of transport infrastructure and the consequent high cost of transport were the principal impediments to economic development in the Sahel. The Sahelian states now concur in the need for infrastructure development concomitant with other inputs.

2. AID Assistance in Transport Development. Since the early 1960's AID has assisted African countries in transport development. With respect to the Sahel, however, in past years assistance was indirect, being identified with the improvements of Sahelian access routes to the sea which were principally located in neighboring coastal states. Some minor assistance, usually in heavy equipment loans, was extended to the Sahelian states themselves.

The most recent severe drought began in 1968 and within four years had increased in the Sahel to massive proportions. Consequently, a vast internationa

relief effort was mounted by a large number of countries and international organizations, including the U.S., France, Canada, the African Development Bank, the World Bank, the United Nations Development Program, and the Economic Development Fund of the Common Market. Participants also include other countries with African ties, such as the Netherlands, Germany, Belgium, Japan and the OPEC States. A substantial donor relief effort coupled with increased precipitation alleviated the problem, but the economy of the area has stagnated. Per capital income has declined to approximately $100 per annum. As indicated in Table II B-1, the Sahel is at the bottom of the world economic scale, both socially and economically. With present agricultural technology, productivity cannot appreciably rise. Traditional methods of assistance have not been successful in addressing fundamental economic and social problems.

Legislation enacted in FY 76 required the President of the United States to develop a strategy for U.S. participation in the multi-national development now underway in the Sahel. The central mechanism for coordinated planning and management of development efforts in the Sahel is the Club du Sahel, which comprises all the principal donor countries and international agencies as well as the Sahel countries themselves On the donor side, the focus of coordination has been the Development Assistance Committee of the OECD. Together, the donor group and the regional country group form the Club du Sahel, whose purpose is to help plan and coordinate a comprehensive effort to bring about economic self-sufficiency in the Sahel region, possibly by the year 2000. As discussed in Chapter III, current planned and ongoing investment in the Sahel is significant, and runs to about $1.6 billion; of this, $652 million is ongoing.

TABLE II B-1

SAHEL

SELECTED SOCIAL AND ECONOMIC INDICATORS

	CAPE VERDE	CHAD	THE GAMBIA	MALI	MAURITANIA	NIGER	SENEGAL	UPPER VOLTA	NIGERIA	GUINEA	REFERENCE COUNTRIES: VENEZUELA	HAITI	UNITED STATES
Population, Mid-1976 (Millions)	0.29[a]	4.1	0.52[a]	5.8	1.4	4.7	5.1	6.2	77.1	5.7	12.4	4.7	215.1
GNP Per Capita, 1976 (US $)	260[a]	120	180[a]	100	340	160	390	110	380	150	2,570	200	7,890
GNP Per Capita Average													
Annual Growth Rate, 1960-76 (%)	-4.0[b]	-1.1	7.3[b]	0.9	3.7	-1.1	-0.7	0.8	3.5	0.4	2.6	0.1	2.3
Population Average Annual Growth													
Rate, 1970-75 (%)	1.7	2.1	2.4	2.5	2.7	2.7	2.7	2.3	2.5	2.8	3.1	1.6	0.8
Life Expectency at Birth, 1975	n.a.	39	n.a.	38	39	39	40	38	41	41	65	50	71
Population per Physician, 1974	n.a.	44,370	n.a.	33,000	17,770	41,060	15,360	59,570	25,440	22,380	870	6,510	610
Population per Nursing Person	n.a.	6,990	n.a.	2,480	3,790	4,840	1,920	4,520	6,230	4,230	1,280	6,920	160
Adult Literacy Rate, 1974 (%)	n.a.	15	n.a.	10	10	n.a.	10	n.a.	n.a.	n.a.	82	20	99
Numbers Enrolled in Primary School as percentage of Age Group: (1975):													
Total:	n.a.	37	n.a.	22	17	17	53	14	49	28	96	50	104
Female:	n.a.	20	n.a.	16	9	12	42	11	39	18	96	44	n.a.
Numbers Enrolled in Secondary School as Percentage of Age Group (1975)	n.a.	2	n.a.	3	3	2	11	2	10	14	43	4	91
Numbers Enrolled in Higher Education as Percentage of Population Aged 20-24	n.a.	(.)	n.a.	1	n.a.	(.)	2	(.)	1	1	19	n.a.	54

NOTES: a. 1975
b. 1970-75
(.) Less than half the Unit Shown.

3. Present Organization for Development in the Sahel

i. The CILSS

As a result of the recent drought which brought the Sahel States to the brink of disaster, a regional organization headquartered in Upper Volta was established. The "Comité Interetats de Lutte Contre la Sécheresse dans le Sahel" (CILSS), or "Interstate Committee on Drought Control in the Sahel", representing the eight states[1/] has rapidly matured into an organization which is developing long-term development plans for the area.

ii. The Donors

The donor community through the auspices of the Club du Sahel has reached a consensus that the long-term development problems of the Sahel as revealed by the drought can be resolved. There is also agreement that resolution of these problems will require careful planning of mostly integrated programs and massive amounts of external aid.

The major donors have repeatedly stressed that soon they all will be able to program approved projects within the framework of an overall integrated plan which has not existed before.

iii. The Club de Sahel

a) The Club du Sahel was formed in 1976 with the objective of achieving regional food self-sufficiency and sustained economic growth by the Year 2000. A principal thrust of the Club's food self-sufficiency strategy is aimed at reinforcing this survival capacity through development of technology packages for improving traditional rain-fed agriculture.

1/ The Sahel states: Cape Verde, Chad, Gambia, Mali, Mauritania, Niger, Senegal, and Upper Volta.

b) The Club Proposes to:

1) Serve as the forum to coordinate and design an international development program for the Sahel

2) Develop an efficient "critical mass " investment and program approach

3) Implement integrated regional planning

4) Control the management of the entire program

c) The Club du Sahel Institute was created in 1977 to:

1) Coordinate ongoing research, including transportation research

2) Train researchers and specialized technicians

3) Promote and systematize demographic research priorities.

The Club development program is unique in that participants recognize that achieving significant development in the Sahel is a long-term process requiring the close coordination of development efforts.

C. CURRENT CONDITION OF TRANSPORT SECTOR

1. General

The lack of adequate transport infrastructure is a major impediment to further economic development of the Sahel. This is a consequence of the vast area of the region (7/10 the size of the continental U.S.); its underpopulation (equal only to that of New York and Pennsylvania combined); and its present low level of economic activity, which does not support extensive new transport infrastructure investments. Upgrading and maintenance of existing systems is a principal need.

Roads

In terms of tonnages and passengers moved, road transportation is the most significant mode; there are some 80,000 kms. of tracks and roads, largely in deteriorated condition mostly due to lack of maintenance. Sahelian governments focus their inadequate financial and skilled manpower resources on the maintenance of a small fraction of primary and secondary roads, and make little or no budgetary provision for tertiary road maintenance.

Railroads

A total of 2,800 kms. of principal railroad line exist. Of the eight countries, Mali, Mauritania, Senegal, and Upper Volta have railroads; the others do not. Reliance on truck connections with railways of other countries is important to Upper Volta, Niger and Chad. There is little scope for additional railway investment in the Sahel because the existing network is adequate to handle normal traffic volumes. However, there is a considerable need to improve the operational and management efficiency of the existing system.

Waterways

There are about 2,500 kms. of navigable waterways, and populations and farming activity tend to concentrate near the rivers. River transport is of little consequence and is gradually losing ground to road transport as roads are extended and improved. Future development plans for waterways do not appear to have a high payoff relative to road and railroad investments, though there may be some potential on the Senegal river after completion of the Senegal River Basin project.

Aviation

Aviation is presently the least important mode in terms of passenger and cargo movements, and prospects for aviation projects are limited. Approximately 21 (1) commercial aircraft and 118 airfields are operative in domestic feeder operations. Though the issue of investment in aviation ranks low in importance compared to investment in surface transport, further development of domestic air transport may well be the answer to some of the Sahel's needs for transport to remote areas.

Ports

Mauritania, Cape Verde, Gambia,and Senegal are the only Sahelian countries with direct access to the sea. The other Sahel countries are landlocked and must depend upon the capabilities of foreign ports. The capacity of the existing ports is quite adequate, and the main bottlenecks associated with ports are lack of storage capacity and inadequate connecting land transport services.

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(1) Publicly owned aircraft.

2. Overviews of the Transport Sector - by Country

a) Cape Verde

Of this group of islands, some 400 km off the coast of Mauritania, the islands of Sao Antao and Santiago are the most significant and possess 50 percent of the nearly 800 km of roads. The 300 km of paved roads are cobbled. Most movement is on foot or by animal. Ships call at the islands and boats provide intercoastal service.

b) Chad

Chad, a vast impoverished landlocked country, depends upon cotton and livestock production concentrated in the Chari River Basin in the south; the remaining 90% of the country consists of desert and Sahelian grasslands. Trade depends on long external routes using several modes. Internal transport is generally inadequate due to poor, insufficiently maintained roads, and to variations of water transport reflecting the seasonal rise and fall of the rivers. The highway system consists of about 7,300 km. of classified roads (about 250 km. paved), and about 24,000 km. of unclassified tracks. Water transport is concentrated on the Chari River between Lake Chad, the capital city of N'Djamena, and Sarh; this mode accounts for only about 5 percent of total transport. Regular air service is provided to the international airport at N'Djamena, and a local airline company operates scheduled services between the four principal towns. There is no railway. Chad, relying on the following four major transport routes to the sea, pursues

a policy of not depending on any single route:

(i) The Trans-Equatorial rail, river and road system from Pointe Noire (Congo) through Bangui (C.A.E.) to southern Chad;

(ii) The Trans-Cameroon route from Douala to N'Gaoundere by rail, connecting with a road system to N'Djamena via Moundou and Bongor; and

(iii) Two Nigerian routes; the main one from Port Harcourt by rail to Maiduguri and then by road to N'Djamena; the secondary one over the seasonally navigable Benoue River through northern Cameroon by road to the cotton areas of southern Chad.

Before the drought, total annual Chad traffic on these routes was 210,000 MT, of which 145,000 MT were imports and 65,000 MT exports. The Trans-Equatorial route carried about 47 percent of the total, the Nigerian routes about 37 percent, and the Trans-Cameroon 16 percent; this distribution can be expected to change by early 1979, when improvements to the Nigerian routes should be completed. They will then each carry about 40 percent of total Chad traffic. For N'Djamena and the north of Chad, the least expensive route is through Port Harcourt; this is 30 percent less expensive than the next cheapest route, through Douala and N'Gaoundere by rail and road, provided there is no bottleneck on the Nigerian side in Port Harcourt or on the railway.

During the 1966-70 Development Period, transport infrastructure absorbed almost one-quarter of public investment, with over 90 percent allocated to road development, particularly in the south. Unfortunately, although the reliability of service during the rainy season has improved as a result of these expenditures, road transport costs have not been reduced significantly. The high costs of such transport appears to be due largely to the monopolistic structure of the industry in favor of the Cooperative of Chadian Transporters (CTT), and also to an inadequate pricing structure and freight allocation policy. Air transport handles almost exclusively meat exports and high value imports; as far as domestic services are concerned, this mode offers potential for the Chadian economy, but the four secondary airports have generally deteriorated. Since large investments in land transport are not justified in some regions (mostly north and east of the Chari River), primarily because of low traffic levels, air service provides a reasonable alternative to ensure the flow of goods and services to these areas. The development prospects for river transport are limited.

c) The Gambia

The only seaport of the Gambia, Banjul, a small port with 3 deep water wharves, has adequate capacity to handle the country's import and export trade. The port is not well connected by ground transportation with the other Sahelian countries and is therefore not used as a transit port by these countries. The Gambia River is nagivable for about 300 kms., almost up to Georgetown, by smaller ocean going ships, and would seem to be a major transportation asset to the country. However, the seasonality of groundnut traffic, the major commodity for river transport

and the imbalance of transport demand up and down river (the up-river vessels usually return empty) has resulted in high unit costs for river transport. These high costs, combined with poor management of the river transport industry by the Government and private operators, has resulted in substantial loss of traffic to the road transport industry. In addition, the river is not integrated with the general communications network. Instead of being an effective link in the transport system, the river has become a hindrance to road transport and effectively cuts the North Bank from the South Bank due to the absence of briges, the inadequacy of river wharves, and the absence of all-weather connecting roads with the river ports.

Preferences for transportation have shifted gradually from river transport to road. Road building, mainly financed by international lending agencies, has been going at a fast pace since 1970, and the country by 1975 had 320 kms. of bituminous roads and 580 kms. of all-weather gravel roads. Commercial vehicles are largely trucks in the 10-ton GVW range, which are usually old and frequently overloaded. There is no rail network in The Gambia.

The one airport in The Gambia, Yundum Airport, was built to avoid dependence on Dakar. It has turned out to be a major asset in the development of tourism, but can handle only medium-sized jets. Consequently, it is not being expanded.

d) Mali

Extensive areas of the north of landlocked Mali are desert; most of the population lives in the southwest where economic activity is concentrated, and along the Niger River. Because of low population density,

distances are long between towns and traffic volumes are light. The main connections to the Atlantic for overseas trade are provided through Senegal and the Ivory Coast; the land distances through either country are about the same (1,200 kms), but transport costs per ton-km are about one-third higher through Abidjan than through Dakar because of additional ocean freight charges. Alternative routes through Conakry (Guinea), Buchanan (Liberia), and San Pedro (Ivory Coast) show promise of being less expensive than through Abidjan, but none of these has been used so far.

The fairly extensive transport consists of:

(i) A 14,000 km road system, of which about 1,700 kms. are paved, 1,700 kms. are all-weather roads; and the remainder are a scattered network of secondary earth roads and tracks;

(ii) A 640-km railway which links Bamako via the Senegal Railway with the Port of Dakar;

(iii) About 1,650 kms. of inland waterways which are navigable about 7 months of the year, and which, because of the rapids and rock outcroppings beyond Gao, are not navigable all the way to the river mouth in Nigeria; and,

(iv) An international airport at Bamako, and about a dozen airfields for domestic commercial services..

The main traffic flow to and from Mali has traditionally been through the Port of Dakar, via the railway to Bamako. Since 1960, however, part of Mali traffic uses Abidjan, and the Government is interested in keeping

both routes open. In normal years, traffic through Dakar totals about 100,000 MT, about equally divided between exports of cotton, groundnuts and oilcakes and imports of general cargo. Traffic through Abidjan is about 60,000 MT/year, also half imports and half exports. Mali operates bonded areas in the ports of Dakar and Kaolack in Senegal, and has reserved sheds and stacking yards in Abidjan port. A further 4,000 tons of freight annually are transported via the desert route through Algeria, and a similar amount is carried through Lome (Togo). All the above tonnages increased considerable during the recent drought period, when Mali received about 300 MT of grair (160,000 MT through Dakar 100,000 MT through Abidjan, and the remainder by the other routes).

Mali exports cattle, oxen and sheep to neighboring countries; in normal years, about 200,000 head move annually by train, truck, or by walking. The main external traffic flows are to the Ivory Coast (70% of exports), Ghana (10%), Liberia (7%), and Algeria (6%), and are all north-south; domestic flows are mainly on the Kayes-Bamako-Segou-Mopti axis. Other local movements of grain and petroleum products are by water to the northeast region, which has no roads.

The Government has full control over the major transport companies: Mali Railways; a trucking company which carries about 20% of the total road freight; a navigation company handling about 70% of waterway traffic; and air Mali, the domestic air carrier. The key elements of transport regulation are: (i) centralization of transport demand for import, export and all domestic road haulage through Government-administered freight offices; and (ii) control of all freight rates.

e) Mauritania

The transport system of Mauritania was originally designed to connect Mauritanian population centers with the import/export gate, the port of Dakar in Senegal. Most towns located in the flood plain of the Senegal River were served either by river transport or by the Senegal-Mali Railway which passes close to the Mauritanian frontier. The limited demand for onward transport from smaller Mauritanian river ports to more inaccessible areas was serve by road transport and by camel caravans. Particularly, a main road running north from Rosso, the principal Senegal river port, offered access to the sparsely settled semi-desert areas hundreds of kilometers away.

When the new lighterage port at Nouakchott was completed in 1966, traffic movements were diverted from the Dakar-oriented pattern, and there was a considerable reduction in the northward flow over the Rosso-Nouakchott road as imports started to move through Nouakchott rather than Darka. However, traffic movements through the more populated south and southeast remain largely unaffected by this change, because goods destined for these areas have in either case to pass through Rosso, and to utilize the traditional river or road system (or both) to their ultimate destination. This is why the costs of transportation - for example to Kaedi in south-central Mauritania - are presently equivalent whether Nouakchott or Dakar is used as the entry point. Although Mauritania is a costal country, it plays no role in providing access to the Sahel; most traffic flows are north-south, parallel to the coast. An east-west primary route, a 2-lane asphalt concrete highway, has been completed from Nouakchott eastward to Kiffa, with plans for further extension of improvements to Nema.

The road system totals about 7,000 km. of which about 3,100 km are national routes ranging from paved surfaces to dry weather earth and the remainder are dirt tracks. Most of the roads are in poor condition. There is one Government-owned and operated railway which covers the 670 km between the iron ore deposit site near Bir-Moghrein and the export outlet at Nouadhibou port, and carries almost exclusively iron ore, with some imported general cargo. The organized waterway services on the seasonally navigable Senegal River consist of only a few powered craft and barges; manual loading and unloading facilities for these vessels are provided at several small primitive ports. The air service network is relatively well-developed, with 12 airports capable of handling four-engined aircraft, ahd 10 other fields; domestic air services play an important role by compensating for the lack of adequate surface communication to remote or seasonally isolated areas.

Transport development policy has so far been directed largely to the maintenance and progressive improvement of existing roads. The Government is now engaged in re-alignment and paving of the primary road section Kiffa-Nema; the benefits of this project will be in the long term since traffic levels on the east-west axis are generally low, and the road bypasses important agricultural regions. The Government has plans for donor-assisted construction of improved port facilities for ocean vessels at Nouakchott to further lessen the country's dependence on the port of Dakar. However, while the existing wharf at Nouakchott has an annual capacity of 250,000 MT, in 1973 it handled only 150,000 MT of dry cargo traffic. Mauritanian cargo shipped through Dakar totalled only some 10,000 MT in 1973.

f) Niger

Niger, one of the largest landlocked countries in Africa, is in one of the most precarious situations in terms of resources. Moreover, its economy is burdened with high transport costs and long transit times, both problems a result of the great distances within the country and to ocean ports.

There are four main outlets to the sea:

(i) the Benin route (about 1,050 km from Niamey to Cotonou) which connects Gaya by road to Parakou, and by rail to Cotonou; this is the cheapest route; transport costs are 20% to 50% less than on the other routes;

(ii) the Ivory Coast route (about 1,650 km) which connects Niamey by road to Ouagadougou, and by rail to Abidjan; costs are only 20% more than on the Benin route due to cheap rail transport;

(iii) the Nigerian route (about 850 km) which connects the central eastern regions by road to Kano, and by rail to Port Harcourt or Apapa port (20% more expensive);

(iv) the Algerian route through the Sahara desert (3½ times more expensive than the Nigerian route).

About 80% of groundnut exports (120,000 MT) are routed to Kano, and from there via the Nigerian Railway to Lagos; 50,000 MT of import products are also carried on this route. Most of the remaining external traffic goes through Benin under regulation by the Organisation Commune Dahomey-Niger (OCDN) formed by the two countries in 1959. OCDN operates the Parakou-Cotonou railway, and has the exclusive right to charter road transport for evacuation of the portion of the groundnut production routed through

Benin, The Abidjan route carries 15.000 MT of imports and exports (including meat and vegetables to the Abidjan urban area), and the Algerian route about 6,000 MT. Traffic flows have become distored over recent years by the effects of the drought and inadequate management of the Nigerian route. Efforts to establish commercial navigation on the Niger River have failed so far, and much of the traffic during the drought period has therefore been carried through Cotonou.

Niger's internal transport system consists of about 18,400 km of roads of generally low design standards. About 1,700 km of the network are paved, mainly on the so-called "Route de l'Unite" which runs west-east and forms part of the Trans-Sahelian highway. Transport requirements in the sparsely populated north of the country are limited, and the volume of freight carried has been too low historically to justify the cost of modern roads. Recent mining and mineral related developments in the Air and Agadez region may warrant a new look at transport problems of this area. Niger has one international airport at Niamey and four major domestic airports. There are numerous smaller public airports and private airstrips accessible only by small passenger planes.

g) Senegal

Senegal's population is concentrated in the west where economic activity is centered, and a considerably larger proportion live in urban areas (30%) than is the case in the other Sahelian countries (5-10%). This affects traffic patterns in that distances are shorter, especially to the Atlantic port of Dakar, and there are greater flows of food supplies from rural to urban areas. The transport system is fairly well-developed. Most of the 13,200 km of roads and 1,032 km of railway lines are oriented towards Dakar, which is the only protected commercial deep-water port among the Sahelian countries, and which also provides primary external trade access for landlocked Mali.

About 2,500 km of the road network is paved, and 426 km are all-weather gravel and earth roads. Road transport is provided by private firms operating in competition. The railway system, comprised of about 660 km of main trunk line between Dakar and Mali, carries almost 40% of that country's exports and over 60% of its imports; this traffic generates about half the system's gross revenues. There are also 370 km of branch lines. Apart from the Mali traffic, railway freight includes Senegalese phosphates and groundnuts, and accounts for about 65% of total goods carried. Passenger traffic has declined recently with expansion of the road network and the vehicle fleet.

The Senegal and Gambia Rivers have been little used for transport. Coastal shipping is developed between Kaolack on the Saloum and Ziguinchor on the Casamance and Dallar Rivers; because of road competition, however, this mode is not expected to increase its presently low share of traffic. There is a major international airport at Dakar, and a national airline provides service to about 12 outlying centers.

The development of transport infrastructure absorbed about one-quarter of public investment between 1968 and 1977; in the latter year, foreign aid accounted for almost 60% of public investment. Transport investments supported by foreign aid have included, inter alia, highway projects emphasizing maintenance and feeder road construction; railway projects involving the purchase of new equipment and rehabilitation of existing items; and an extension of port facilities at Dakar.

h) Upper Volta

Upper Volta has suffered a heavy trade deficit because of stagnating overall exports and increasing imports. During the last few years, the growth of cotton exports helped diversify the country's export structure

traditionally dominated by livestock sales; concurrently, however, livestock exports declined significantly because of adverse weather and health conditions, as well as lack of investment and operating funds.

Transport within the country is primarily by road. The system consists of almost 5,000 km of classified roads, and about 11,000 km of tracks. The network of primary roads (4,450 km, of which about 900 km are paved) radiates from the capital, Ouagadougou, and from the main commerical center, Bobo Dioulasso. Maintenance is carried out only on the primary network; the other roads have therefore deteriorated over the past decade to little more than tracks, and are passable by heavy trucks and four-wheel drive vehicles only during the dry season. Road transport service is provided by private transporters; the market is free but international traffic is distributed by international agreement on a percentage basis between domestic and foreign carriers.

The most important international transport route is the railway linking Ouagadougou with the seaport of Abidjan, a distance of about 1,145 km. The railway is a semi-autonomous agency jointly owned and operated by the Governments of Upper Volta and the Ivory Coast. Almost 3 million passengers and 1 million tons of goods are carried annually, with Upper Volta accounting for over half of the total passenger-km and ton-km. Purely internal traffic utilizing the 518 km of track within Upper Volta is presently low (60,000 tons in 1973), but increasing rapidly.

Both Ouagadougou and Bobo Dioulasso have international airports. Internal air transport is negligible; a small domestic airline was created in 1967 by the Government and private interests, but its operations are not yet profitable, due mainly to inadequate demand.

The Government has been giving priority in transport investments to the improvement of international road links with Mali, Ghana and Togo. The roads between Bobo Dioulasso and the Mali border, and between Ouagadougou and the Ghana border have recently been paved, and work on the Ouagadougou-Togo border road is underway. The Government's decision to upgrade road links with Ghana and Togo has been based mainly on a desire for alternative outlets to the sea, and to reduce the country's dependence on the railway connection to Abidjan, although this is now the most economic route to the sea for the economically active western and central areas of the country; routes through Tema and Lome are second best alternatives. The Government is also engaged in construction of a road between Bobo Dioulasso and Ouagadougou, and of the international trunk road to Niamey in Niger a part of the Trans-Sahelian Highway.

3. Physical Plant

a) Roads and Vehicles

The network of roads within the Sahel and its access routes to the sea would be reasonably adequate if all roads were maintained to design standards. Limited resources and misplaced emphasis on construction in lieu of maintenance increase the burden. A lack of management and technical ability - a constraint in almost every sector - has contributed to the acute road maintenance problem.

A recent diagnostic study prepared by consultants[1/] for the Club du Sahel noted that a large proportion of the 80,000 km of secondary and feeder roads in the Sahel are improved tracks, a majority of which are in poor condition.

1/ Road Maintenance Diagnostic Study for the Sahel. Louis Berger International, Inc. (1977).

Tables II C-1 to II C-9, obtained from that report, contain the most recent information available on the composition and nominal design features of the road network. Data on the size and composition of the vehicle fleets are also included. Table II C-1 summarizes the area, population and vehicle fleet for each country and relates these to the total and the maintained kms of road network in each country. Indexes are calculated for each country of road kms (total and maintained) per 1000 population and per 1000 square kms of habitable land area. These indexes are compared with those for all of West Africa, East and Southern Africa, and the United States. The Sahel countries and the Sahel region are seen to lag far behind the United States, and significantly behind the rest of Africa. For example, whereas the USA has about 25 kms of maintained road per 1000 inhabitants, the Sahel has only 1.1.

TABLE IB-1: : AREA, POPULATION, ROAD NETWORK, VEHICLE FLEET AND VARIOUS INDEXES FOR THE SAHEL AND OTHER AFRICAN COUNTRIES

Country	Area Sq. km (1000's)	Population (1000's)	Maintained Road Network (km)	Total Road Network (km)	Vehicle Fleet (Public & Private)	Per 1000 Inhabitants: Kms. of Roads (maintained)	Per 1000 Inhabitants: Kms. of Roads (total)	Per 1000 Inhabitants: Number of Vehicles	Per 1000 Sq. Km (Habitable): Kms. of Roads (maintained)	Per 1000 Sq. Km (Habitable): Kms. of Roads (total)	Per 1000 Sq. Km (Habitable): Number of Vehicles
Cape Verde	4	290	758	758	6,800	2.6	2.6	23	190.0	190.0	1,700.0
Chad	1,284	4,035	3,343	31,272	16,046	.8	7.8	4	5.2	48.7	25.0
Gambia	10	519	832	2,960	4,280	1.6	5.7	8.2	83.2	296.0	428.0
Mali	1,204	5,697	4,972	14,045	19,001	.9	2.5	3.3	8.3	23.3	31.6
Mauritania	1,086	1,322	2,529	7,090	11,483	1.9	5.4	8.7	11.7	32.7	52.8
Niger	1,189	4,592	3,772	18,377	13,951	.8	4.0	3.0	9.5	46.4	35.2
Senegal	197	5,000	9,121	13,250	73,143	1.8	2.7	15	46.3	67.4	371.3
Upper Volta	282	6,032	3,654	16,462	7,497	.6	2.7	1.2	13.0	58.4	26.6
West Africa	9,108	146,498	199,254	415,269	1,057,726	1.4	2.8	7.2	21.9	45.6	116.1
East & Southern Africa	13,819	169,490	429,500	800,300	3,878,300	2.5	4.7	22.9	31.1	57.9	280.7
Sahel	5,256	27,487	28,981	104,214	152,201	1.1	3.8	5.5	12.3	44.3	64.8
United States	9,057	203,235	5,134,456	5,134,456	138,549,263	25.3	23.3	681.7	566.9	566.9	15,297.5

NOTE: The "total habitable land area" taken as 1/5 the total land area of Mauritania; 1/3 the total land area of Niger; 1/2 the total land area of Mali and Chad. The utilization of a fraction of total land area attempts to negate the prejudicial effect of large stretches of desert on the density coefficient.

Total road network includes estimated unclassified tracks.

Table II C-2

Cape Verde Road Network: 1977; (km)
Vehicle Fleet: 1975 (units)

Class	Paved	Cobbled	Earth	Ordinary Tracks	Total by Class
Primary	--	--	--	--	--
Secondary	--	313	--	--	313
Feeder	--		162	283	445
Total by Type		313	162	283	759

Half of the roads are on two of the islands:

25% on the island of Sao Antao and 25% on the island of Sao Tiago.

Cape Verde has .19 km of road/sq. km. and 75.0 people/sq. km. Most movement is on foot or by animal.

1975 Cape Verde - Vehicle Fleet

Cars	2,699
Motorcycles	1.530
Lorries & Buses	775
	4,004

Table __ II. C-3

Chad - Road Network 1977;(km)
Vehicle Fleet 1973 (units)

Item	Paved roads	Laterite roads	Ordinary earth roads	Laterite tracks	Improved earth roads	Unimproved tracks	Total
National and District Roads	253	671	374	79	541	5351	7269
Maintained (1)	253	671	321	79	488	1542	3343
% of total	100	100	86	100	90	29	46
Traffic Vehicles /day							
< 10	-	-	190	-	259	4406	4855
10-30	-	190	53	-	150	735	1128
30-60	253	481	131	79	132	210	1286

(1)Maintained at least twice in the last six years.

There is an additional non-classified network consisting of 24,000 kilometers of non-maintained tracks. Chad has .024 km of road/sq. km (including the 24,000 km) & 3.1 people/sq. km.

1973 Chad Vehicle Fleet

Cars	5,770
Commercial Vehicles	6,284
	12,054

Table II C-4

GAMBIA: Road Network: 1977; (km)
Vehicle Fleet: 1973 (units)

Class	Paved road	Gravel road	Earth road all-weather	Earth road dry weather	TOTAL by class
Primary roads	277	425	--	174	876
Secondary roads	27	103	--	--	130
Feeder roads	--	--	1,696	258	1,954
Total by type	304	528	1,696	432	2,960
P.W.D. responsibility	304	528	--	--	832
Maintained by P.W.D.	304	528	--	--	832
% of total network	10	18	57	15	100

Gambia has .26 km. of roads/sq. km. and 48.6 people/sq. km.

1973 Vehicle Fleet: 5,831; no breakdown

Table II C-5

MALI: Road Network: 1977; (Km.)
Vehicle Fleet: 1974 (units)

Classification	Paved road	Ordinary earth road	Improved track	Seasonal track	Total by class
National roads	1501	1161	1076	1894	5632
Regional roads	97	543	936	4019	5595
Local roads	9	-	40	1664	1713
Non-classified tracks	56	-	1049	-	1105
Totals by type	1663	1704	3101	7577	14045
Government responsibility	1607	1704	2052	7577	12940
Maintained % of total network	1135 68 %	1413 83 %	1146 37 %	1278 17 %	4972 35 %
Average daily traffic (Veh/d)					
<10	51	134	1933	6176	
10-30	89	873	1068	1325	
30-60	162	437	30	76	
60-100	284	138	63	-	
100-200	582	122	7	-	
200-400	367	-	-	-	
> 400	128	-	-	-	

Mali has .01 km. of road/sq. km and 4.2 people/sq. km.

1974 Vehicle Fleet: 16,3[illegible]; no breakdown of figures

Table II C-6
MAURITANIA: Road Network: 1977 (Km.)
Vehicle Fleet: 1977 (units)

Classification	Road type					
	Paved	Improved earth	Ordinary earth	Improved track	Existing track	Total by class
National roads	465	433	1.821	945	1.041	4.705
Regional roads	150	-	120	-	1.460	1.730
Secondary roads	-	-	125	140	390	655
Totals by type	615	433	2.066	1.085	2.891	7.090
Govt. resp.	465	1.341		3.279		5.085
Maintained	465	994		1.070		2.529
% total network	9	6	29	15	41	100
	9%	35%		56%		
Average Daily Traffic (VPD)						% of network
<10 A		120	1314	805	2.265	63
10-30 B			382	210	512	15
30-60 C		313	155	70		8
60-100 D	150		215		114	7
100-200 E						-
200-400 F	459					7
> 400 G	6					-

Mauritania has .007 km. of road/sq. km. and 1.0 people/sq. km.

1973 Vehicle Fleet

Cars	5,654
Vans & Trucks	5,590

Table II C-7

NIGER: Road Network: 1977; (Km.)
Vehicle Fleet: 1973 (units)

Class	Paved roads	Improved earth roads	Ordinary earth roads	Tracks	Total
National roads	1739	2091	438	2655	6923
Non classified	22	49	383	11000	11454
Total	1761	2140	821	13655	18377
Gov. resp.	1761	2140	438	2655	6994
Maintained network (%)	1673 (95)	1712 (80)	263 (60)	124 (5)	3772 (54)
Average vehicles per day (VPD)					
< 10	428	115	8	1989	2540
10 - 30	-	340	65	289	694
30 - 60	120	773	219	299	1411
60 - 100	108	218	35	6	367
100 - 200	310	694	111	72	1187
200 - 400	724	-	-	-	724
> 400	71	-	-	-	71

Niger has .015 kms. of road/sq. km and 3.3 people/sq. km.

1973 Vehicle Fleet

Cars and Vans	13,138	Trailers	476
Buses and Coaches	249	Tractors (non-Agri.)	652
Goods Vehicles	2,241	Motorcycles & Scooters	766

Table II C-8

SENEGAL: Road Network: 1977;(Km.)
Vehicle Fleet: 1976 (units)

Classification	Paved	Im-proved earth	Ordi-nary earth	Im-proved track	Ordi-nary track	Total
National roads	2001	426	1153	0	0	3580
Regional roads	370	0	450	110	0	930
Departmental roads	165	0	3420	1625	0	5210
Inventoried roads	-	-	-	2240	1290	3530
	2536	426	5023	3975	1290	13250
Average daily traffic						
< 10	-	-	7185		1290	8475
10 - 30	-	-	260		-	260
30 - 60	-	-	420		-	420
60 - 100	20	-	540		-	560
100 - 200	130	426	305		-	861
200 - 400	1368	-	288		-	1656
> 400	1018	-	-		-	1018
	2536	426	8998		1290	13250

Senegal has .07 km. of road/sq. km and 25.5 people/sq. km.

1976 Vehicle Fleet

Cars	49,257
Goods Vehicles	22,071
Buses & Coaches	4,329

Table II C-9

Upper Volta Road Network: 1977 (km)
Vehicle Fleet: 1975 (units)

Classification and type of road	Paved	Ordinary earth	Improved tracks	Ordinary tracks	Total
Total network (km)	857	1205	2864	11536	16462
Network under ministry	857	1205	1988	4652	8702
% of classified network maintained	100%	100%	52%	12%	42%
Traffic Vehicles/day					
< 10	-	-	407	3838	4245
10 - 30	-	-	549	522	1071
30 - 60	-	260	347	200	807
60 - 100	-	76	489	92	657
100 - 200	482	617	196	-	1295
200 - 400	375	252	-	-	627
> 400	-	-	-	-	-
National roads	857	919	1396	1288	4460
Departmental roads	-	160	210	1550	1920
Regional roads	-	126	382	1814	2322
Non-classified roads	-	-	876	6884	7760

Upper Volta has .06 km. of roads/sq. km. & 20.8 people/sq.

1975 Vehicle Fleet

Cars	9,530
Buses	215
Lorries	9,901
Tractors	499
Motor bikes	2,074

Transport of Livestock

Existing livestock marketing systems are usually inefficient. Livestock marketing systems involving the trucking of animals over long distances to markets often have been unprofitable to farmers. Considerable loss of animal weight occurs if the animals are not cared for enroute to market by proper watering and grazing. As a consequence, herders' incomes and the foreign exchange earnings of the Sahel countries are reduced. Livestock and meat products transported by this means to coastal countries no longer appear to be competitive with imports from outside West Africa. Improved rural roads, decreasing vehicle transit time, and greater care with livestock in transit would help reduce transport costs and increase small farmer profits, as an alternative to rail transport or walking the animals over long distances.

b) Railroads and Rolling Stock

The rail systems serving the Sahel countries are indicated in Table II C-10. The main railway systems used for the transport of goods and passengers within and outside the Sahel countries are the Dakar-Bamako line (ownership and operation divided between Senegal and Mali); the Abidjan-Ouagadougou (RAN) line (owned and operated jointly by the Ivory Coast and Upper Volta); and the Cotonou-Parakou line (Benin). The Nigerian railway has been the traditional outlet for exports from eastern Niger, but its effectiveness has been seriously restricted by poor service on the railway and congestion in Nigerian ports. The Ghana railway system is similarly inefficient. The Conakry-Kankan line in Guinea, which theoretically offers the shortest route to Bamako (920 kms, supplemented by road connections), is in serious need of rehabilitation, and cannot be considered a competitor for Sahel traffic. The Cameroon railway, recently extended to N'Gaoundere, Cameroon, offers service into southern Chad with some road connections. In addition, a relatively new line in Mauritania carries iron ore exports from a mine at F'Derik to the Port of Nouadhibou, north of Nouakchott. The Gambia and Cape Verde have no railroad service.

Geographic areas suitable for farming in the Sahel are limited and agricultural production is therefore concentrated. As Table II C-10 indicates, groundnuts grown in Senegal and Mali are a major commodity on the railroad, and some Malian imports (especially foodstuffs) may be delivered ultimately to farmers. The Upper Volta line is one for which agricultural products are important commodities (oil seeds, livestock, cotton).

Table II C-10 also indicates the major mineral extraction activities in the Sahel. By far the largest activity involves iron ore fields near F'Derik, Mauritania, for which rail service to a seaport has been provided. The aluminum and phosphates of Senegal are moved by rail, and cement is a major domestic commodity for shipment in Mali. Of all major mineral extraction activities, only Mauritania's copper at Akjoujt is distant from a railroad. Table II C-10 also lists a mineral extraction prospect, the manganese deposits near Tambao in Upper Volta; for which an extension of the existing railroad is being considered.

Provision of passenger service can be an important function of railroads in an area where all modes of transportation are severly limited. The greatest source of passenger growth is in the Ivory Coast/Upper Volta where there has been a steady increase (1960-75), especially for passengers moving greater distances.

In other cases, however, (including short trips in Upper Volta), there is a downward trend in the number of passengers using the systems, especially as the countries' road networks are developed.

Performance Measures for Sahel Railroads

Table II C-11 indicates ton-km traffic growth rates from 1968 to 1976. Traffic showed a decline in 1975, reflecting the completion of drought relief shipments.

Table II C-12 shows proposed percentage distributions among major railway improvement costs, illustrating that track improvement, locomotives and freight cars and bridge repair are the most significant expenditure items, in that order.

Operating Problems

The shortcomings of the railways serving the Sahel were apparent during the drought relief operations. Most were unable to carry the volumes offered, and even to carry the amounts actually handled they had to relinquish other traffic to road services. This situation was attributable not to a lack of track or equipment capacity, but rather to operational inefficiencies, poor equipment maintenance, and an overall lack of management competence. Most of the railway systems are finacially weak, and are increasingly threatened by competition from road transport. The critical underlying problems are discussed below.

Table II C-10

Principal Rail Lines, Sahel Countries, 1978

Country	From/To	Length (km)	Principal Commodities with tonnage	Passenger Data	Special Notes	Port Connections
Mauritania	Nouadhibou/ F'Derik	650	Iron Ore 11.1 th tons (74) small am't gen. freight	Limited am't	Iron ore shipments estimated, assumed to equal mine productions	Nouadhibou
Senegal	Dakar/Kidiri Dakar/St. Louis Branch to Linguera	643 262 129	Phosphates 1,196 th tons (75/76) Mali Exports 97 th tons (") Mali Imports 166 th tons (") Groundnuts 105 th tons (") Other 42 th tons (")	1,850 th pass (75/76)	International passengers from/to Mali double-counted with Mali estimate below (Links with railway in Mali)	Dakar
Mali	Koulikoro-Bamako/Kidiri	642	National: Cement 46.4 th tons (75) Other 49.9 th tons Exports: Groundnuts & related prod. 27.4 th tons Cola nuts 17.3 th tons Other 33.0 th ton. Imports: Foodstuffs 65.4 th tons Petro. prod. 31.6 th tons Salt 24.7 th tons Other 53.2 th tons	491.6 th pass. (75)	See Note For Senegal Above.	Dakar
Upper Volta	Ouagadougou/ Ivory Coast Border (to Abidjan)	517	Southbound: Oil seeds 43.1 th tons (75) Livestock 31.9 th tons (75) Cotton 31.0 th tons (75) Other 61.3 th tons (75)	Upper Volta 398 th. (75) Ivory Coast 1,755 th. (75) Interstate 678 th. (75)	Freight is total for Upper Volta and Ivory Coast one source says Upper Volta provides ¼ of traffic	Abidjan

Table II C-10 (cont'd)

Country	From/To	Length (KM)	Principal Commodities with tonnage	Passenger Data:	Special Notes:	Port Connections
Upper Volta	Ouagadougou/ Ivory Coast Border (to Adidjan)	(517)	Northbound: Petroleum products 109.8 th tons(75) Food & sever 91.0 th tons Cement 80.1 th tons Other 87.5 th tons	See 1st page	Passenger data are for passengers buying ticket at station.	Abidjan
TOTAL		2,853				

Table II C-11

A COMPARISON OF FREIGHT TRAFFIC (Index of Ton-km
RAILROADS OF WEST AFRICA
(1968 -1976)

Country	YEAR								
	1968	1969	1970	1971	1972	1973	1974	1975	1976
Cameroon	61	72	84	89	100				
Mali					100	124	133	122	123
Senegal				97	100	109	102	93	103
Ivory Coast/ Upper Volta			86	94	100	105	102	82	

Notes: 1972 or 1972/73 = 100

Table II C-12

TOTAL COST AND DISTRIBUTION OF PROJECT COSTS
FOR PROPOSED RAILROAD PROJECTS; WEST AFRICA

Project Distribution (Percent of Total)	Cameroon	Mali	Senegal	Ivory Coast/ Upper Volta
Track Improvement	22	17	60	51
Bridge Repair	17	29	0	0
Locomotives	23	51	21	25
Freight Cars	32			19
Passenger Cars	0	0	0	0
Telecommunications	2	neg.	0	0
Training	0	1	14	3
Consultation & Study	4	2	5	3

Management Issues

The railways are plagued by three major difficulties:

1) Short-term problems of low productivity, inadequate commercial operations, low equipment availability, high accident rates, and insufficient maintenance. The governments are weak, if not powerless, in the face of railway unions which impede remedial action. Discipline is low, discouraging both staff and technical assistance experts. Consequences of these factors are losses of traffic to road transport, with related losses of revenues and increased unit operating costs.

2) A long-term problem of policies; governments' indecision between the concept of railways as a public service and as an industrial enterprise; they do not follow the best rules applicable to either system. While the principle is generally accepted (and stipulated in statutes) that railways should be run on a fully commercial basis, current practices and approved legislation strip that principle of its consequences; and board appointments are largely restricted to

government representatives, with little room or role for representation of the industrial and commercial sectors. Legislation appears mainly a code of procedure for government control. The financial situation of all the railways is weak; losses are mounting.

3) Consequences of the poor performance of other government agencies, including those which are supposed to control the railway companies. For example, debts owed by the government to the railway are paid late or not at all; the treasury, when acting as a bank for the railways, delays payment and transmittal of documents; financial controls make it impossible to plan the purchase of spare parts. These are all basic governmental problems over which the so-called "autonomous" railway has no power or influence, and they cannot be solved merely by pouring in additional funds; the more fundamental requirement is for the adoption of vigorous measures, and the will of all concerned to enforce them.

Several consultants' studies have been carried out on railway operations, and considerable donor financial and technical assistance has been provided to the railways in a concerted effort to solve their problems, but the results have all been disappointing. The effort has failed primarily because actual conditions have not been faced forthrightly, and because no fundamental step has been taken to solve the basic conceptual policy problem, i.e., what is the function of the railway.

Loans have been made without requirements for changes in basic railway legislation, although this legislation appears quite inadequate.

Coordination Issues

Although the understanding between the Senegal and Mali railways has improved over recent years, much remains to be done. Most importantly, the decision to amalgamate the two railways on the RAN model was taken in Bamako in December 1971, but has not been executed. The Senegal railway has lost significant groundnut and phosphate traffic to road transport, and the proposed construction of a bulk-loading phosphate berth near Dakar will deprive it of the remaining traffic in this commodity. Only international traffic would then remain important, and action is necessary at the management level to prepare the railway for serving this traffic. In the meantime, the first step to be taken for catering to the international traffic would be to establish a pool of wagons and locomotives operating out of a central dispatching center, and to apply the above-mentioned Bamako agreement.

Governments and donors should adhere to the following guidelines:

(i) priority should be given to improving productivity, with the necessary efforts made in staffing, training, and maintenance; long-term policies must be established, and existing legislation revised accordingly. Broad lines of policy should include:

- flexibility in terms of benefits to permit the railway not only to increase tariffs when necessary, but also to differentiate between users, adjusting tariffs according to seasonal peaks to encourage off-season traffic, etc.
- closing down of unprofitable branch lines;
- changing from the rigid budget concept to the more flexible one of open estimates;
- staffing railways with former executives of the private transport sector.

Solutions to the railways' institutional and management problems are the most pressing need in the sector, and foreign financial aid should in the future be contingent upon major changes being made from present practices.

c) Ocean Ports

The economic lifelines of the Sahelian countries are the routes which provide access through neighboring coastal countries to import/export outlets for overseas trade. These routes are doubly important because, in many cases, they also serve the modest flow of exports from the region to local markets in these neighboring countries. There are at present several access routes which cover distances of between 1,000 and 1,200 kms. These routes have proliferated in recent years as each country, for political or commercial reasons, has adopted the policy of avoiding dependence on any single route. As a result, routes now in service or under active construction, while costly in terms of investment and maintenance expenditures, ensure the "desenclavement" of the Sahelian countries.

The primary import/export arteries for the landlocked countries of the Sahel are the following:

Mali (Bamako): - to Dakar (rail)
- to Abidjan (road or road/rail)

Upper Volta (Ouagadougou): - to Abidjan (rail)
- to Lome (road)
- to Tema (road)

Chad (N'Djamena): - to Port Harcourt (road/rail)
- to Douala (road/rail)

Mauritania, Senegal, Gambia and Cape Verde have direct access to the sea; for the four landlocked countries adequate productivity in a foreign port is of major importance. The critical port situation during the emergency drought period (when traffic for the region increased by 50% at Dakar and 40% at Abidjan over two years) was attributable largely to the lack of adequate storage capacity both in the ports and in the recipient countries, as well as to congestion in the land transport services. Basically, the ports performed well in the loading and unloading of ships, and waiting time was held to a minimum.

Efforts have been made in the coastal countries of Cameroon, Benin, the Ivory Coast, Senegal, and Togo to associate the enclave countries with their port administrations, and to provide special facilities such as bonded sheds and zones, or preferential tariffs. Nigeria and Ghana have not participated to any significant extent in this effort, which probably explains in part why the routes through these countries are underutilized although they may actually be more economical than some routes through the French-speaking countries.

Authorities have in the past been very lenient in accepting storage of transit goods, and this discouraged consignees of cargo from developing their own storage facilities outside the port customs areas. Storage facilities can be provided either by the port authority and leased to users at appropriate rates, or directly by the consignee or forwarding agent. All three alternative solutions are utilized in ports serving the Sahel.

However, under normal traffic conditions, the total area available appears inadequate, and sheds or warehouses are congested during the peak produce trading period, although they remain half-empty for the other six months of the year. All the storage operators, whether private, as in Dakar and Abidjan, or public, as in Cotonou, are reluctant to invest in storage space or facilities that might be underutilized; on the other hand, they are not always willing to pool their equipment and facilities, an arrangement which would permit more efficient use of overall storage capacity. The large number of public corporations (from both enclave and coastal countries) which utilize port storage facilities also creates problems, since they frequently claim immunity from normal restrictions on storage use, and are quick to exercise pressure on port authorities. This situation natually does not allow coordination among users.

Some inadequacies in port operations stem from a lack of properly trained personnel. In many cases, staff members originate from the public service, and consist mainly of civil engineers without the necessary expertise to control the complexities of the shipping industry. In this respect, ports in the region suffer the same shortcomings as the railways.

d) River Transport

Table II C-13 presents the major navigable rivers in the Sahel. While river transport holds promise in terms of low operating costs ranging from 2.5 cents to 4 cents per ton/km on annual volumes of 1 million to 50,000 tons, there is limited scope in the Sahelian region for such services. The notable exceptions are:

(i) The Senegal River from Saint Louis (Senegal) or Rosso (Mauritania) to Kaedi (Mauritania). This once-active service was operated by a small fleet of shallow-draft craft when Dakar was the main port of entry for Mauritanian traffic. However, since Nouakchott has become in recent years the port of entry for this traffic, river transport has dwindled to an erratic service with a few old craft, and road transport direct from Nouakchott is now the cheapest solution[1/]. It is unlikely that river service can be economically revived on any scale until and unless the Senegal River is dammed and substantial volumes of mineral ore and agricultural produce are generated in its basin.

(ii) The Niger River from Bamako to Gao in Mali during the seven-month navigational season. This route is the principal domestic artery into northeast Mali, and is estimated to provide the required transport at a cost 70% less than road service. Rapids on the river preclude service beyond Gao. Considerable investments are required to modernize the existing fleet.

1/ The railway service from Dakar to Saint Louis connecting with the river services is still 10% cheaper than road service direct from Dakar.

Table II C-13

Principal Inland Waterways; Sahel Countries

River Name	Countries Affected	Length (km)	Navigation Season	From/To	Notes
Casamance	Senegal	270	Full year		
Chari	Chad	580	August-December	Sarh/N'Djamena	
Gambia	The Gambia	288	Full year	Banjul/Busse or Fatoto	Distance upriver depends on ship's draft
Logone	Chad	540	August-December	Mondou/N'Djamena	
Niger	Niger Mali	1782	August-April July-January	Gaya/Port Harcourt through Mali	Gaya/Niamey for part of season
Saloum	Senegal	140	Full year		
Senegal	Senegal, Mauritania; and Mali	700	Full Year	Kayes/St. Louis	May be limited to small vessels.

(iii) Lake Chad - A number of small private operators service points around the lake.

Considerable efforts have been expended on attempts to develop permanent long-haul river services on the Niger from its mouth north to Niamey. Trials have been completed, but commercial development of the route is not promising because of the operational difficulties and cost involved in negotiating the locks of the Kainji dam, and also because of the existence of rapids in the north. The scope for water transport services is very limited, and planning for further investment in the mode should for the time being be restricted to the Niger River in Mali, and on a lesser scale, to the Lake Chad area.

The only organized river services of any consequence are the seasonal barge operations on the Senegal River between Saint Louis (Senegal) and Kaedi (Mauritania) and up the Gambia river to Georgetown; and long-distance haulage of bulk goods on the Niger River between Bamako and GAO. All of these services are gradually losing ground to road transport as land routes are extended and improved. Some improvement in the Niger River operations could be expected following rehabilitation of its somewhat antiquated fleet and facilities, and a project is now being considered for financing by the Canadian International Development Agency (CIDA).

Small private craft are active throughout the Senegal and Niger River systems on short haul-activities (about half of total river traffic in Mali), but there is little scope for extending commercially viable river services in the Sahel region until results are available on the OMVS studies associated with development of the Senegal River basin.

e) Aviation

Projects for aviation development in the Sahel are limited, except for the transport of high-value cargo, which is in any case not abundant in the Sahel. Existing facilities have the capacity to receive any additional traffic that may materialize.

Aviation in the region is better coordinated than other modes because of the existence of an international infrastructure/navigational aid agency (ASECNA), which provides the necessary services at international airports, and also trains personnel. International air transport services are provided mainly by the Air Afrique/UTA Group which enjoys a de facto monopoly position. In this respect, other carriers have claimed that they are given little chance to obtain traffic right on African lines, and that this has contributed to the isolation of the Sahel. It is not clear, however, whether foreign airlines are actually eager to call in the Sahel; so far, their efforts have focussed on obtaining rights to high-traffic cities like Abidjan, Lagos, Dakar, and Monrovia, but not for service in the hinterland. Moreover, unless trade prospects develop considerably, these carriers are unlikely to insist on traffic rights in the Sahel region.

In addition to the Air Afrique service, domestic airlines of the countries provide local and some international services, mostly in West Africa. Better coordination or even integration of the existing domestic lines into a multinational regional airline would most likely produce substantial economies in the form of standardized equipment, better utilization of such equipment with improved schedules, additional stop-overs, and elimination of partially duplicated services.

Aircraft and Ground Facilities

Domestic Air Service

Table II C-14 describes existing domestic feeder services and aircarft and ground facilities, for each of the Sahelian countries.

Chad

The full potential of air transport in domestic services has not been seriously studied. Air transport is used for exports of refrigerated meats, and occasionally for cotton. With all the difficulties of surface transport in Chad, air transport has sometimes been found to be an economically acceptable alternative.

Air Chad serves the interior of the country with flights to seven towns. The country's seven main airports and six smaller fields are operated by the International Agency for Air Navigation Safety in Africa and Malagasy (ASECNA), which also operates a weather recording network.

In 1971, only the airport at N'Djamena was equipped to handle jet aircraft and DC-6 propeller craft could land at Abeche, Sarh and Moundou. The airports at Bongor, Largeau, Mongo and Pala accommodated DC-4s and some 24 smaller airstrips could take Douglas DC-3s (Dakotas). Other small strips are suitable for light aircraft only. The airport at N'Djamena became very important in World War II, and, after Paris, was the largest airport in the former French Union. In 1971, five foreign airlines provided regular service.

TABLE II C-14

SAHEL
DOMESTIC FEEDER SERVICES,
AIRCRAFT AND GROUND FACILITIES
(1971)

COUNTRY	DOMESTIC AIR SERVICE			No. of Commercially Useable Domestic Airfields (1971-72)
	No. of Transport Aircraft	Passengers/Annum	Tonnage/km (000's)	
Cape Verde	N.A.	N.A.	N.A.	N.A.
Chad	5 (1970)	25,637 (1970) 89,000 (1971) 44,000 (1972) 108,000 (1973)	460 (1969) 7783 (1971) 8700 (1972) 4100 (1973)	32 including 7 principal airports and 6 small fields
Gambia	n.a.	n.a.	n.a.	n.a.
Mali	4	n.a.	20 (1969)	n.a
Mauritania	5	n.a.	20 (1969)	22
Niger	2	n.a.	30 (1969) 1679 (1971) 1903 (1972) 2556 (1973)	n.a.
Senegal	3	9,000	10 (1969)	17 (13 used regularly)
Upper Volta	2	n.a.	n.a.	47 small airports
Totals	21			118

n.a. - not available

Mauritania

The largest number of commercial transport flights and passengers in Mauritania (1971) were handled at Nouakchott Airport. One of the country's 22 airports, Nouadhibou was the only field served by commercial jet aircraft. The national carrier, Air Mauritania, had five aircraft in regular service in 1971, and some airports in Mauritania were also served by foreign carriers.

Senegal

Senegal had seventeen airports or landing fields in 1972, of which the International Airport at Dakar (Yoff) was the only modern, fully equipped facility. Dakar is a hub airport between sub-Saharan Africa, Western Europe and the Americas. In 1971, 347,000 passengers of whom 97% were in transit, utilized Yoff International. In 1973 17 international carriers used the Dakar airport regularly, and studies were underway to expand Yoff runways to accommodate DC-10 size jets. In 1973, Yoff could accommodate Boeing 707s. Domestic service was provided by Air Senegal, a government owned carrier. The most air traffic in domestic service was from Dakar northward to Saint-Louis, eastward to Tambacounda, and southward to Ziguinchor. Small passenger aircraft provided regular service to about 13 of the 17 airfields.

ii. International

Recent data on air carrier movements and traffic for six Sahel countries are shown in Tables II C-15 and II C-16. Along the Western African coast. airline traffic is increasing fairly rapidly, and aviation policies of protectionism may be limiting even greater expansion. With the inland countries, it is a different story; the land-locked countries have a minimum of air access to the sea, and according to the ICAO March, 1977 report, most of their domestic networks are inadequate. Modest progress toward solutions to these problems is being made.

Airline Traffic

Upper Volta, Niger, Chad, Mauritania and Senegal
1972-1977

COUNTRY: UPPER VOLTA

AIRLINE: (RK) AIR AFRIQUE

international traffic only

TYPE OF OPERATION	SCHEDULED FLIGHTS REVENUE													
	AIRCRAFT GALL METRES	AIRCRAFT DEPAR TURES	AIRCRAFT HOURS	PASSENGERS CARRIED	FREIGHT TONNES CARRIED	PASSENGER KILOMETRES PERFORMED	SEAT KILOMETRES AVAILABLE	[illegible]	TONNE KILOMETRES PERFORMED				TONNE KILOMETRES AVAILABLE	[illegible]
									PASSENGERS AND BAGGAGE	FREIGHT	MAIL	TOTAL		
	1	2	3	4	5	6	7	8	9a	9b	9c	9d	10	[illegible]
YEAR MONTH	THOUS.	UNITS	UNITS	UNITS	UNITS	THOUS.	THOUS.	%	THOUS.	THOUS.	THOUS.	THOUS.	THOUS.	%
INTERNATIONAL														
1972	1 383	1 042	2 050	25 896	2 966	77 506	158 483	49	7 011	7 968	924	15 903	27 912	5[illegible]
1973	1 371	1 092	1 972	28 122	2 469	90 833	180 153	50	8 175	8 893	940	17 008	30 835	55
1974	1 517	1 022	2 195	31 452	3 348	101 134	193 400	52	9 187	10 807	479	20 473	36 067	57
1975	1 687	1 080	2 506	35 006	3 600	107 002	200 089	53	9 769	11 807	593	21 869	40 185	[illegible]
1976	1 838	1 154	2 721	40 414	4 003	124 [illegible]	224 660	55	11 214	13 124	657	24 995	44 858	[illegible]
1977 (10 M)	1535	934	2 253	37 198	2 369	117 757	206 919	57	[illegible]	[illegible]	533	[illegible]	39 070	57
1976 (10 M)	1535	964	2 257	37 451	3 467	105 946	187 634	56	9 477	[illegible]	533	[illegible]	36 873	56

TYPE OF OPERATION	NON SCHEDULED FLIGHTS REVENUE						NON REVENUE	TOTAL ALL SERVICES REVENUE					
	AIRCRAFT GALL METRES	AIRCRAFT DEPAR TURES	AIRCRAFT HOURS	TONNE KILOMETRES PERFORMED	TONNE KILOMETRES AVAILABLE	PASSENGER KILOMETRES PERFORMED	AIRCRAFT HOURS	AIRCRAFT GALL METRES	AIRCRAFT DEPAR TURES	AIRCRAFT HOURS	PASSENGER KILOMETRES PERFORMED	TONNE KILOMETRES PERFORMED	TONNE KILOMETRES AVAILABLE
	12	13	14	15	16	17	18	19 = 11 + 12	20 = 12 + 13	21 = 13 + 14	22 = 16 + 17	23 = 16 + 15	24 = 16 + 16
YEAR MONTH	THOUS.	UNITS	UNITS	THOUS.	THOUS.	THOUS.	UNITS	THOUS.	UNITS	UNITS	THOUS.	THOUS.	THOUS.
INTERNATIONAL													
1972	114	35	167	1 123	2 116	8 347	22	1 497	1 077	2 212	85 873	16 626	29 621
1973	169	44	242	2 095	3 287	9 783	16	1 540	1 138	2 214	99 616	19 103	34 12[illegible]
1974	137	61	246	1 901	4 724	8 913	12	1 654	1 083	2 441	110 047	22 376	42 75[illegible]
1975	217	75	303	2 521	4 850	15 091	16	1 904	1 163	2 809	122 993	24 690	45 03[illegible]
1976	178	89	247	2 381	4 527	12 225	15	2 016	1 213	2 968	136 631	27 376	49 18[illegible]

Note: Air Afrique also serves Niger, Chad, Mauritania and Senegal of the Sahel nations. The data above pertain to the operations of the carrier Air Afrique and not to its operations in any single country.

Source: ICAO, Airline Traffic - Vol. 1, 1972-1976, Digest of Statistics No. 218-A, and Supplement

Table II C-16

Airline Traffic
Mali
1972- 1976

International and domestic traffic

COUNTRY: MALI

AIRLINE: (MT) AIR MALI

TYPE OF OPERATION	SCHEDULED FLIGHTS REVENUE: Aircraft Km Details	Aircraft Departures	Aircraft Hours	Passengers Carried	Freight Tonnes Carried	Passenger Kilometres Performed	Seat Kilometres Available	Passengers Carried	Tonne Kilometres Performed: Passengers and Baggage	Freight	Mail	Total	Tonne Kilometres Available	[illegible]
	1	2	3	4	5	6	7	8	9a	9b	9c	9d	10	11
YEAR MONTH	THOUS.	UNITS	UNITS	UNITS	UNITS	THOUS.	THOUS.	%	THOUS.	THOUS.	THOUS.	THOUS.	THOUS.	%
TOTAL														
1972	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1973	1 716	2 559	3 352	46 818	772	73 069	133 116	55	7 466	1 718	96	9 280	18 639	50
1974	1 723	2 615	3 364	45 818	772	80 284	129 096	62	8 209	1 593	124	9 926	18 380	54
1975	1 714	2 566	3 236	50 463	992	84 616	132 983	64	8 766	1 186	138	10 110	17 704	57
1976														
INTERNATIONAL														
1972	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1973	1 300	1 175	1 844	29 222	723	62 312	114 770	54	6 366	1 674	84	8 124	16 442	49
1974	1 286	1 161	1 830	32 594	732	69 725	111 730	62	7 236	1 559	112	8 857	16 357	54
1975	1 294	1 165	1 929	36 661	982	74 931	120 196	64	7 962	1 360	133	9 275	16 338	57
1976	1427	1345	2033	42119	482	82661	145771	61	9101	821	108	10 037	17730	57
DOMESTIC														
1972	..	..	..	..	..	..	..	..	..	..	..	..	..	..
1973	416	1 384	1 508	17 466	95	10 757	18 346	59	1 100	44	12	1 156	2 197	53
1974	437	1 454	1 564	17 224	40	10 561	17 366	61	1 073	34	12	1 119	2 023	55
1975	420	1 401	1 307	13 [illegible]	10	8 085	12 387	65	824	6	9	835	1 366	61
1976	471	1594	2001	17269	5	9622	17296	69	980	5	3	989	1543	64

TYPE OF OPERATION	NON SCHEDULED FLIGHTS REVENUE: Aircraft Km Details	Aircraft Departures	Aircraft Hours	Tonne Kilometres Performed	Tonne Kilometres Available	Passenger Kilometres Performed	OTHER REVENUE: Aircraft Hours	TOTAL ALL SERVICES REVENUE: Aircraft Km Details	Aircraft Departures	Aircraft Hours	Passenger Kilometres Performed	Tonne Kilometres Performed	Tonne Kilometres Available
	12	13	14	15	16	17	18	19 = (1 + 12)	20 = (2 + 13)	21 = (3 + 14)	22 = (6 + 17)	23 = (9a + 15)	24 = (10 + 16)
YEAR MONTH	THOUS.	UNITS	UNITS	THOUS.	THOUS.	THOUS.	UNITS	THOUS.	UNITS	UNITS	THOUS.	THOUS.	THOUS.
TOTAL													
1972	..	..	..	..	..	..	..	..	..	..	..	..	..
1973	724	473	1 321	3 818	8 353	21 361	160	2 440	3 032	4 673	94 430	13 098	26 992
1974	724	428	1 248	3 878	6 644	25 085	30	2 447	3 043	4 642	106 171	15 804	25 824
1975	877	874	1 905	3 710	8 418	30 771	25	2 591	3 440	5 141	115 387	13 820	26 122
1976	..	..	..	..	..	..	..	..	..	..	..	..	..
INTERNATIONAL													
1972	..	..	..	..	..	..	..	..	..	..	..	..	..
1973	648	275	1 052	3 603	7 025	19 306	70	1 940	1 438	2 982	81 618	11 727	24 267
1974	606	254	695	2 812	6 963	23 326	-	1 692	1 3[illegible]	2 525	93 851	11 619	22 420
1975	623	207	974	3 293	7 347	26 673	-	1 919	1 462	2 903	103 286	12 965	25 905
1976	..	..	..	..	..	..	..	..	..	..	..	..	..
DOMESTIC													
1972	..	..	..	..	..	..	..	..	..	..	..	..	..
1973	84	198	269	215	328	2 055	90	500	1 582	1 771	12 812	1 371	2 725
1974	118	174	553	266	681	2 359	30	555	1 725	2 117	13 120	1 555	2 624
1975	252	177	931	417	891	4 096	25	672	1 978	2 238	12 101	1 292	2 217
1976	..	..	..	..	..	..	..	..	..	..	..	..	..

Source: ICAO, Airline Traffic - Vol. 1, 1972-1976, Digest of Statistics No. 218-A, and Supplement

4. Human Resources

General

These are some of the world's poorest people; some 80%-90% of the economies are based upon subsistence farming and nomadic herding. Sahel countries have as many as 70% of their populations nomadic. The average GDP per capita ranges from $90 in Mali to $360 in Senegal and literacy ranges from 5 to 10 percent. With the Sahara accounting for 50 percent of the land area populations are small; there are only 28 million people in an area which is 70% the size of the continental United Sates, and they are not evenly distributed. There are areas in the Guinea zone where the land is overpopulated; Senegal for instance, had a population density of 1236 persons/km^2 in one region. It is believed that this population would be available at minimum wage for construction and maintenance work through community/DPW liaison.

Our limited research on cultural features of these fragmented populations indicates strong tribal affiliations and political organization that would be favorable to labor-intensive employment.

Public Sector Institutions

Public sector institutions in the Sahel countries vary considerably in organizational structure and management capability.

- Ministerial organization and inhouse capabilities are largely inadequate and incapable of assuming expanded roles without considerable support. In conjunction with projects they are undertaking in the Sahel other donors are financing the

training of staffs.

- Financial and human resources are scarce
- A general lack of adequate management systems limits progress and increases costs.
- There is a substantial pool of human resources in the rural areas remaining underutilized. Steps to engage underemployed agricultural workers in road upgrading and maintenance as a means of better utlizing the countries' most significant asset - the people - and of improving rural transportation, should be considered.

Domestic Contractors

Domestic contractor road building and maintenance capabilities are extremely limited. Some countries have no domestic contractor capabilities for road building; a few have had subcontract work for supplies of concrete and other types of material. The majority of the work is done by foreign contractors (70%) or force account.

A profile of local construction contractors reveals the following:

- Only a few firms are of any size. Some of them lately have handled subcontracts for fill material, etc.
- There are a large number of small construction firms that are not involved in highway construction.
- The largest domestic contractor has the capacity to handle medium-sized civil works (up to U.S. $ 2 million).

Among the handicaps that domestic contractors throughout the Sahel face are the following:

- Skill shortages at all levels.
- Shortages of working capital and credit.
- An insufficient volume of contracts.
- High transport costs
- Restrictive government bureaucracies.

Under present conditions local contractors can best be used for highway work to provide limited services and local materials.

Skilled and Unskilled Labor

The relative proportion of the Sahel population in agriculture, their literacy and living standards are reflected in Table II C-17

Table II C-17

AGRICULTURAL LABOR FORCE AND LITERACY
SAHEL COUNTRIES

Country	Approximate Gross Domestic Product Per Capita	% Labor Force in Agriculture	% Literacy
Cape Verde	$ 120	80	---
Chad	120	91	5-10%
Gambia	180	84	---
Mali	90	80	5%
Mauritania	320	85	5%
Niger	130	91	5%
Senegal	360	7[illegible]	5-10%
Upper Volta	110	89	5-10%

Observations:

- The labor force in agriculture is largely devoted to subsistence level farming and livestock grazing. In an economic environment such as that of the Sahel unskilled work for pay would be both more attractive and more equitable than free voluntary labor.

- Seasonal shortages of labor will develop during the harvest and planting seasons. This issue has received almost no attention in the available literature. Rural road construction and maintenance work plans must take into account the harvest and planting process and

periods of heavy rainfall.

- Technical and management skills are in short supply throughout the population and at all levels in government.

- Some ministry staffs are more efficient than others; all are in need of improvement. Training and advisory services are needed in all the Sahel countries, especially in the maintenance activities of the government units.

5. Organization of Road Transport Industry

The organization of the road transport industry in the Sahel has considerable bearing on the extent to which savings from reduced vehicle operating costs will be passed on to the farmer. For example if the road transport industry is composed of many small truck companies freely competing and negotiating tariffs directly with shippers, there usually is no question that most of the benefits are passed on to t farmers or consumers. On the other hand, if the road transport industry is monopolistic with only a few large trucking companies dominating the market, and if transportation tariffs are regulated by the government, it will not be likely that road user cost savings are passed to the farmer. Furthermore, if the transport sector is owned and operated by the government or by government controlled companies, the user savings may or may not be passed on to the farmers depending upon the efficiency with which the government operates these enterprises and the consistency of the tariff structure.

For example, government owned transportation companies are sometimes operated so inefficiently (due to lack of management skills, overstaffing and other institutional constraints) that extensive subsidization by the government is required to meet their operating deficits. Savings in vehicle operating costs brought about by road improvement are then mostly used to reduce the operating deficit, rather being passed on to the customers. Furthermore, unless the government agency that develops the tariff structure has the technical expertise required to formulate a comprehensive and consistent

tariff structure, tariffs may have little relation to the actual transportation costs over different road environments. Thus, the tariff for transport over a road classified as "poor" could be incorrectly calculated as only 10% higher than the tariff over a road classified as "good". Since the transport cost over a poor road may be 200% higher than that for a good road (See Table ___?___, Chapter VII), reclassification of the road after improvement to "good" condition would in this case return to the consumer only a very minor part of the potential 200% saving.

This section of the report discusses the organization of the transport industry in each of the countries of the Sahel, and the results are summarized in Table II C-18. For each country this table presents the exten to which tariffs are regulated by the government; the organization of the trucking industry in terms of the number of companies and the number of vehicles owned by each company; and, based on our impression of the efficiency of the industry and its competitiveness, an estimate of the extent to which road improvement savings may be passed on to farmers.

Chad

Transport tariffs are established by the government and are a function of the freight category and the difficulty of the route. For example, on some of the fairly good roads the tariffs vary between CFAF 10 to 22 per ton-km for dry goods, whereas on difficult routes such as tracks in the Sahel zone, the tariffs vary between CFAF 25 and 66 per ton-km. Tariffs have not been changed since December 1974; therefore most transporters consider the official tariffs as too low. The trucking

industry is organized into four large companies. In October 1976, the government granted exclusive rights to the Cooperative des Transporteurs Tchadiens (CTT) for both international and domestic public road transportation. CTT now has a fleet of approximately 660 vehicles. The three other companies consist of semi-public and government agencies which have exclusive rights for transporting certain types of commodities. COTONTCHAD is a semi-government cotton processing and marketing agency that operates its own fleet of about 300 tractor-trailers on specially constructed frames to transport cotton from the purchase point to the cotton gins. Another agency that operates its own truck fleet is Societe Nationale de Commercialisation du Tchad (SONACOT) for collection and transport of gum arabic, onions, and hibiscus flowers; and the Direction de la Lutte Contre les Calamites Naturelles (DLCCN) which is responsible for the distribution of essential commodities to regions affected by drought and other calamities.

Thus, the Government has pursued a road transport policy which has reduced the level of competition between truckers, and which has firmly established the monopoly of CTT. This company now controls freight allocation for both domestic and external transport (except for the special commodities such as gum arabic controlled by the other three companies), and serves as a lobby group for the trucking industry. Staffed and operated by members of the transport industry, CTT is an operationally effective organization with a large membership, and there is probably little incentive to provide the Government, which sets the tariffs, with the cost and operating information that would enable the Government to reduce tariff levels after roads are improved.

Table II C-18 ORGANIZATION OF THE ROAD TRANSPORT INDUSTRIES IN THE SAHEL COUNTRIES

Country	Tariffs	Truck Companies & No. of Vehicles	Extent to Which Road Improvement Savings Will be Passed on to Farmers
Mali	Gov't controlled	1 cooperative, 550 vehicles 1 state owned, 250 vehicles Many small firms	Probably unfavorable
Niger	Competitively set	1 49% govn't-owned, 260 vehicles 1 syndicate, 180 vehicles Many small firms	Favorable
Senegal	Partly regulated	Mixture of large, medium, and small firms	Probably favorable
Upper Volta	Gov't controlled but not enforced.	1 mixed public/private firm Many small firms	Favorable
Gambia	Unknown	Unknown	Unknown
Chad	Gov't controlled	1 cooperative, 660 vehicles 3 semi-public with monopolies for cotton and other special commodities	Probably unfavorable
Mauritania	Max. tariffs set by gov't	1 trucking syndicate	Probably unfavorable
Cape Verde	Unknown	Unknown	Unknown

There are several ways to improve the efficiency of the road transport industry, and to ensure that lower transport costs are passed on to the farmers. One possible alternative consists of providing technical assistance to the Government enabling it to set tariffs on a rational basis, without being dependent on cost information submitted by the truck operators. The Government would need to focus its efforts also on the setting of appropriate user charges. This would require further technical assistance and general strengthening of the bureaucracy to enable it to study and make recommendations on matters such as the effects of import duties on the relative costs of operating vehicles, the assessment of the effective capacity available for the transport of domestic and international goods, and the relative importance of transport costs and other distribution margins in the domestic prices of imported goods. Inner-city passenger transport should also be studied.

After the tariffs and user charges have been rationalized, and the industry has operated under conditions that would have been approximated under free and equitable competition, it may be possible for the Government to de-regulate the transport industry without creating the severe temporary imbalances that might have been introduced by the premature introduction of de-regulation.

Cape Verde and Gambia

Information on the organization of road transport in these two countries was not obtainable.

Mali

The Government administers the road transport industry in Mali, and controls tariffs as well as the distribution of international and important domestic freight. There are many trucking organizations, ranging in size from a very large cooperative with 550 vehicles, a State owned company with 250 vehicles, a number of private companies which have about 10 to 30 trucks, and many independent small firms with up to about 4 trucks. The market is thus well fragmented, but the efficiency of the trucking industry is low because of problems such as poor management organization and a seasonal work cycle based on the agricultural calendar, all of which have resulted in a low average load factor. Part of the efficiency problem seems to stem from the low freight rates allowed by the Government, which are insufficient to cover the high operating costs resulting from increased fuel costs and high inflation rates.

Fragmentation of the trucking industry promotes competition, and favors the passing on of cost savings to farmers. However, the inefficiency of the trucking industry, the inappropriate tariffs and the inability of the government at this time to develop a rational tariff structure based on vehicle operating costs is an inhibiting factor It is not believed that, under present conditions framers would receive much of any savings in transport costsdue to road improvements and the same comment as made for Chad regarding technical assistance applies to Mali.

Mauritania

The Government of Mauritania in collaboration with trucker representatives sets maximum tariffs chargable for different routes. Vehicle operators have formed a syndicate which performs the function of organizing and regulating road transportation, except for the setting of maximum tariffs which is done by the Government. The syndicate negotiates transport prices with shippers, including the Government and subject to the ceilings set by the Government. In principle, this type of organization could make sure that each route, irrespective of the road conditions, would be adequately served at transport prices which, while guaranteeing some profit to truckers, still provide the least cost of transportation for the users. However, the syndicate lacks capable management and the technical and administrative expertise to properly set these tariffs. In addition, a monopoly such as represented by the syndicate will probably set tariffs at the highest level the market can bear rather than on the basis of the economics of marginal cost pricing, such as would be set by free competition and rational road user charges. It is therefore unlikely that the farmers in Mauritania will participate directly from savings in vehicle operating costs brought about by road improvements. The same conditions regarding technical assistance for Chad and Mali apply to Mauritania.

Niger

Freight transportation in Niger is handled by more than 250 transporters, about half of them located in the capital city, Niamey. The largest transporter is a company with mixed capital (Government 49 percent;

foreign 47 percent; and Niger private, 4 percent). This company handles about 60 percent of the freight tonnage in Niger. The other trucking companies are organized in a syndicate which accommodates the remaining 40 percent of the tonnage traffic rate.

There is little direct government intervention in road transport operations and there are no official tariffs. Though there are only two firms, they appear to be competing and the lack of tariff regulation means that tariffs can be set competitively and much of the decrease in vehicle operating costs resulting from road improvements will probably be transferred to the producers and the consumers.

Senegal

The road transport industry in Senegal is comprised of three major segments: (1) a few large firms, generally with significant foreign ownership, operating in the modern private sector. These firms have their own maintenance and repair facilities and carry the products (petroleum, logs, refrigerated products, etc.) of the freight companies and modern businesses; (2) a large number of owner-drivers and small firms that are highly competitive in the traditional private sector. Traffic is highly seasonal depending to a large extent on the groundnut harvest and many firms support themselves only by overloading vehicles, neglecting maintenance and insurance, deferring vehicle replacement, and underpaying drivers; and (3) vehicles owned by public and semi-public agencies, such as the Office National de Cooperation et d' Assistance au Developpement (ONCAD), and responsible for most primary and secondary groundnut transport.

Road transport tariffs are partly set by the Government and partially free. Groundnut tariffs are set by ONCAD, and vary widely according to the quality of the road travelled. This tariff structure adequately reflects relative differences in vehicle operating costs, travel times, and the need to use small vehicles on poor roads. The official tariffs tend to be respected by the traditional sector of the trucking industry only when hauling commodities for public and semi-public agencies. Rail tariffs are also set by the Government, and in some instances where there is road competition, appear to be set lower than marginal cost in order to capture traffic from trucks. The traditional sector of the road transport industry, the sector of most importance to farmers, therefore appears to be quite competitive, and it can be expected that savings in vehicle operating costs will be passed on to farmers and consumers. However, as discussed above, the traditional sector of the trucking industry is operated inefficiently and at a higher cost than necessary because of road damage due to truck overloading, and due to accidents caused by lack of maintenance and by violations of safety regulations. Though the regulations limiting vehicle weights and dimensions are satisfactory, the regulations are not adequately enforced. Since enforcement of safety, vehicle maintenance, and weight regulations will significantly lower vehicle operating costs, and will increase the savings in vehicle operating costs that can be passed on to the farmers and consumers, technical assistance aimed at strengthening government bureaus responsible for enforcing these regulations should have a high payoff.

Upper Volta

The road transportation industry in Upper Volta is highly fragmented and consists of one large mixed public/private firm operating in competition with a large number of small firms and owner-operators. The large firm carries about 1/5 of, total goods traffic and handles all the traffic which requires specialized vehicles. The remainder of the industry carries most of the passengers, agricultural products and small loads, generally in small vehicles. Because of excess truck capacity generated by the large numbers of trucks imported to transport drought relief supplies, competition is fierce, particularly during the period of the year when there is little agricultural traffic. Though tariffs are set by the Government, they are ignored in practice, and the industry operates essentially in a free market environment. Government regulations primarily concern vehicle safety. Therefore, road improvements in Upper Volta will in all likelihood produce vehicle operating cost savings that are passed on to the farmers and consumers.

Passenger Transportation in the Sahel

The transportation of passengers in the Sahel appears to be freely competitive. There are no established passenger tariffs in the rural areas, and there do not appear to be any scheduled passenger services. Passengers get rides on a "when-available" basis on trucks that are returning with empty backhauls or that are only partially loaded with freight. The rates for transportation are usually negotiated between the passenger and the trucker. Thus, for all of the countries in the Sahel, passengers probably participate in the savings in vehicle operating costs brought about by road improvements.

Management of Financial Resources

The weakness in maintenance resources stems essentially from a lack of management and technical expertise, equipment, and local funds for recurrent expenditures. The IBRD and other donors have provided assistance with the first two elements, but the success of these efforts has been limited by a chronic shortfall in local budgetary support. Generally, a shortfall in local funds occurs either because road-user charges are set too low, or because proceeds from such charges are used for purposes other than road works; in the Sahel, both situations exist. If road-user charges are lower than appropriate, road transport is in effect subsidized, and the modal demand for transport may in some instances be distorted; on the other hand, if road user charges are adequate but funds are misallocated, Government priorities are favoring other elements in the economy. In the Sahelian countries, it is difficult to establish the degree to which either case is applicable, since none of them has yet projected road maintenance budget requirements over an extended period (say, five to ten years) taking into account inflationary pressures and maintenance needs of existing and planned roads.

Government budgets and accounts on an annual cash basis are not an adequate mechanism for planning operations and determining the costs of providing technical services. Budgetary and disbursement procedures are generally slow and complex, and much waste is incurred under the guise of financial orthodoxy; also, these procedures tend to escalate the cost of services as contractors hedge against payment uncertainties. Since the magnitude of the problems involved make a solution appear impossible, the tendency has been to avoid Government

procedures by establishing Road Maintenance Funds or Road Authorities (on the model of Port Authorities) which are supposed to operate on a commercial basis.

The Road Fund system has advantages: it provides a better accounting of revenues and expenses related to road infrastructure; it permits some long-term planning; and it may give a guarantee that money will be available when needed. However, there are also disadvantages. Establishment of a Road Fund is, like that of many autonomous government agencies, a recognition of inability to modernize current government techniques. The Road Fund does not improve the functioning of standard Government departments, but may duplicate them; in terms of expenditure of manpower, time, and money, it may be a costly system which can hardly be borne by poor countries. Moreover, it does not solve the basic problem of Treasury liquidity. Significantly, Governments tend to maintain tight control over Road Funds, and the Ministry of Finance may allocate monies from the Fund for purposes other than road maintenance.

CHAPTER III

CURRENT ACTIONS AND PLANS OF USAID AND CLUB DU SAHEL IN THE TRANSPORT SECTOR

A. Summary

Table III A-I is a detailed presentation of USAID and Club du Sahel current activities and plans in the transport sector as of November 1978. They include a total of 172 projects and programs, representing investments amounting to $1,632.637 million.[1/]

In Table III A-2 the modal split in investments is indicated. Reflecting the relative importance of road transport over other modes in the Sahel countries, Table III A-2 identifies a total of 116 projects and programs dealing with road construction, rehabilitation, maintenance and other highway related investments. They represent $1,311.305 million, or about 80.3 percent of all current and planned investments by Club du Sahel donors in the transport sector. Eleven railway projects account for $161.343 million. Twenty water transport projects are included for a total of $87.751 million. Twelve air transport projects represent investments totalling $34.547 million. Finally, 13 multimodal projects are expected to receive $37.691 million.

The following definitions apply in regard to Club du Sahel transport investments:

1) Funding Committed:

These are funds which have already been committed or disbursed by donors for projects currently under implementation ($652.535 million, see Table III A-2);

1/ Dollar amounts for 19 of the 172 projects and programs identified in Table III-1 are not yet available. However, the DOT team estimated the cost of the 19 projects (See Section C of this chapter) and they are included in the $1,632.637 million above. All amounts are given in constant 1978 US dollars.

2) Funding Under Consideration:

These are additional funds necessary to fully finance the total cost of a project, and for which donors are currently seriously contemplating financing ($607.255 million, see Table III A-2);

3) Additional Funding Required:

These are additional funds necessary to fully finance the total cost of a project, but for which donors have not yet expressed interest in financing (372.847 million, see Table III A-2);

Of the 172 projects and programs, 101 are currently being implemented in whole or in part and 71 are now under active consideration by one or more donors. Fifteen projects still require additional co-financing donors in order to cover total costs and be implemented fully. The total amount of additional co-financing required ($372.847 million) is broken down by mode in Table III A-3. The table also indicates how much is still required for partially committed projects and for projects under consideration.

The distribution of Club du Sahel donor investments in the highway sub-sector according to the type of road work (construction, rehabilitation, maintenance) is given in Table III A-4. The "other" category included in Table III A-4 refers to highway transport projects involving no road work (e.g., provision of vehicles, vehicle repair service stations, etc.).

Table III A-5 breaks down current and planned highway investments by type of road (primary, secondary, feeder).

The time stream of funding committed, under consideration, or required for transport infrastructure projects between 1970 and 1990 is given in Table III A-6.

Graphical representations of the time stream are provided in Figure III A-1 (for all transport modes: funding required, under consideration and committed), Figure III A-2 (for all transport modes: funding required), and Figure III A-3 (for road transport: all funding for construction, rehabilitation and maintenance).

Table III A-7 shows the distribution by recipient country of Club du Sahel current and planned transport investments.

It should be noted that in addition to development aid from Club du Sahel donors, the eight Sahel countries currently receive substantial assistance from the socialist countries. Table III A-8 shows that during the 1954-1977 period CILSS Member States have received $543 million in loans and grants from the socialist countries. Although no sectoral breakdown of this assistance was available to the DOT team, we estimated that roughly 20% of this aid is for development projects and programs in the Sahel Transport sector. More precise information on socialist countries' assistance should be developed in order to adequately assess the external aid requirements of Sahelian transportation.

B. USAID Participation

As shown in Table III B-1, USAID is currently participating or considering participation in 20 of the 172 projects and programs in the Sahel transport sector. Of these, 7 are already being implemented with USAID financing for a total of $23.238 million. USAID is also considering participation in 13 projects and programs for an additional financial contribution of $85.450 million. The total value of current and planned USAID activities is $108.688 million.

USAID is now committing $3.0 million for construction of feeder roads in Senegal; $11.98 million for joint feeder and secondary road projects in Chad and Upper Volta; $2.458 million for a road maintenance program in Niger; $1.55 million for secondary roads in the Lake Chad Basin area; $3.25 million for the provision of road building and maintenance equipment in Mali; and about $1.0 million for a transport Master Plan of the Casamance region in Senegal.[2/]

Under consideration by USAID are three primary road projects in Chad, Niger and Upper Volta ($26.35 million); three projects dealing with construction and rehabilitation of secondary roads in Mali, Mauritania and Upper Volta ($28.0 million); three feeder road projects in Gamgia, Mauritania and Niger ($23.1 million); two multimodal projects in Cape Verde and Senegal ($3.0 million); and one Sahel Regional transport planning project ($5.0 million).

In the course of various conversations with international development assistance officials in Washington, the DOT team heard critical comments about poor coordination and lack of comprehensive planning within the Club du Sahel framework, in the transportation and other sectors. The accuracy and validity of those criticisms could not be readily confirmed without a more detailed examination of the Club's performance so far. Nevertheless,

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2/ The Transport Master Plan for Casamance is part of an overall, multisectoral Master Plan of interrelated needs in that rural region of southern Senegal. Although no breakdown of the funds allocated to each sector (agriculture, health, transport) is available, it is estimated that the cost of the transport Master Plan will be approximately $1.0 million.

one thing is certain: The Club has not achieved its original objective of integrating the entire international development assistance effort for the Sahel into a comprehensive program in line with the region's development objectives. It appears to lack the institutional and organizational structure required to achieve such an ambitious objective. For example, the Club appears to have little authority over the expenditure of funds, and the neighboring countries to the Sahel (Ivory Coast, Togo, Nigeria, etc.) that perform the vital function of providing the import and export links via their ports are not represented in the Club. Further, there is no technical secretariat available to provide the technical expertise and to undertake the detailed analysis required to formulate a comprehensive transport investment program. At the present time, the Club du Sahel essentially serves as a "loose" forum to coordinate international donor assistance to the Sahelian countries.

The DOT team feels that AID should carefully examine and evaluate the institutional capabilities and functions of the Club du Sahel. That examination would allow AID to assess the Club's adequacy and effectiveness as the central mechanism for coordinating the planning and management of development efforts in the Sahel. If that assessment should reveal serious defficiencies, then AID might consider providing a technical assistance program for the preparation of a regional transport system study to more closely relate the region's transport policy objectives to the region's development goals and to the needs of other sectors of the economy, such as agriculture.

C. Estimating the Costs and Completion Times of 19 Transportation Projects

Cost figures and completion dates are not yet available for 19 of the 172 projects and programs identified in Table III A-1. The DOT team, however, has estimated the costs and completion dates of these 19 projects. These estimates are presented in brackets or parenthesis in Table III A-1.

The basic source for estimating the road project costs was a sample of 33 road projects for which these data were available. The available costs were averaged for each type of project and this average cost was assumed as representative for the uncosted road projects.

For construction and rehabilitation of primary roads, from a sample of 13 projects, the average cost worked out to approximately $89,000 per km. There was no significant difference between projects that were identified as construction projects and projects that were identified as rehabilitation projects, and the same cost of $89,000 per km. was applied to both.

The construction and rehabilitation cost of secondary roads, from a sample of 9 projects, worked out to $31,000 per km. As with primary roads there was no significant difference between construction and rehabilitation projects. The cost of feeder road maintenance and rehabilitation, from a sample of five feeder road projects, worked out to an average of $3,800 per km.

Project execution times were estimated from an analysis of project completion times of 22 road projects funded by the IBRD. These projects included road maintenance, rehabilitation, construction and upgrading of all types of roads. The most significant variable that seemed to affect the project completion time was the project cost, and the following relation was derived from the analysis. For projects that cost less than $5 million the execution time was estimated at three and one-half years; for projects costing between $5 and $10 million the execution time was estimated at five and one-half years. It may be of interest to note that the shortest project completion time recorded was two years for a highway project in Senegal costing $2.5 million. The longest time recorded was ten and one-half years for a national highway project in Ecuador costing about $70 million.

For the 9 uncosted water and multimodal transport projects the available information on project description was too vague to permit development of quantitative estimates as used above for the road projects. Estimates were

therefore made on a purely judgemental basis and, though lacking precision, should nevertheless be adequate for purposes of approximating future funding requirements.

D. Data Sources

The information contained in Table III A-1 was gathered from a variety of sources. It was augmented and double-checked for accuracy whenever possible through personal conversations with USAID country desk-officers and IBRD loan officers. Unfortunately, it was not feasible to contact directly other Club du Sahel donors. The basic sources of information for the data presented in this chapter were the following two Club du Sahel documents:

1) Club du Sahel, Financing of First Generation Programme Within the Overall Sahel Development Programme, 2 Vols, OECD-Paris, November 1978. This document provides detailed information on all Official Developmental Assistance commitments made by Club du Sahel donors to each of the 8 member states of the CILSS, and also to regional activities under which such CILSS member States benefit for the years 1975 through 1977 and including partial and preliminary data for 1978. In addition, this source includes information on projects currently under consideration by donors, but subject to further appraisal, negotiation and approval by both the donor and recipient.

2) Club du Sahel, "Donor Transport Activities in the Sahel," Transport Meeting held at OECD-Paris on 27-28 April, 1978,

mimeo. This is essentially a list of projects and programs being implemented and under consideration based on information provided by the donors as of April 1978.

Additional data sources for this chapter were IBRD project appraisal reports and USAID project papers.

E. Map III E-1 shows the existing major transport routes in the Sahel and the following current and planned Club de Sahel projects in the transport sector:

1) Chad, feasibility study for the GUELENDENG-BANGOR primary road (0.444 million).
2) Chad, Local rehabilitation of SARH-BANGUI primary road ($1.2 million).
3) Chad, Construction of the MOUNDOU-GUIDJIBA and BANGOR-LAI primary roads ($139.0 million).
4) Chad, Study for the MOUNDOU-DOBA primary road ($0.4 million).
5) Chad, Modernization of secondary airports ($0.28 million).
6) Chad, Extension of N'DJAMENA International Airport ($0.785 million).
7) MALI Construction of the KOUTIALA-SIKASSO major road ($17.18 million).
8) MALI Study and design of BAMAKO-KAYES major highway ($0.401 million).

9) Mali, Construction of the SIKASSO-DIOILA secondary road (250km. plus bridge over BAGOE River) ($5.5 million).

10) Mali, Fourth Highway Project: maintenance and rehabilitation including work on DIOULASSO-BOGOUNI trunk road ($40.0 million).

11) Mali, Construction of the KAYES-NIORO secondary road linking into KAARTA CIDA IRDA area ($15.0 million).

12) Mali, Construction of the MARKALA-NIONO secondary road ($15.0 million).

13) Mali, Construction and maintenance of GAO-MOPTI major road; work brigade; materials and experts ($50.1 million).

14) Mauritania, Construction of NOUAKCHOTT-KIFFA major highway ($74.86 million).

15) Mauritania, Participation in multidonor financing of the NOUAKCHOTT-NEMA road (section to link KIFFA-ATOUN EL ATROUSS) ($19.92 million).

16) Mauritania, NOUADHIBOU Port expansion ($22.079 million).

17) Mauritania, Extension of ferry service and construction of a pier at ROSSO ($1.469 million).

18) Mauritania, Construction of a domestic airport at NEMA ($6.753 million).

19) Niger, Maintenance and rehabilitation program:

a) 4-year road maintenance program;

b) reconstruction and improvement of the ZINDER-NIGERIAN BORDER and MARADI-NIGERIAN BORDER primary roads ($26.266 million).

20) Niger, Modernization of the NIAMEY-ZINDER major highway ($29.95 million).

21) Niger, Construction of the ZINDER-GOURE major road ($30.66 million).

22) Niger, Construction of NIAMEY-UPPER VOLTA BORDER major road ($14.7 million).

23) Niger, Study for the KANO-MARADI railroad ($0.821 million).

24) Senegal, Construction of the 71 km. CAP SKIRRING-ZIGUINCHOR major road in the Casamance area ($12.25 million).

25) Senegal, Improvements and paving of the KOLDA-VELINGARA major road ($12.55 million).

26) Senegal, Construction of the TAMBACOUNDA-MALI BORDER secondary road ($5.6 million).

27) Senegal, Construction of TAMBACOUNDA-KEDOUGOU secondary road ($7.3 million).

28) Senegal, Dakar fishing port extension; technical assistance ($19.305).

29) Senegal, Expansion of Dakar Port ($10.0 million).

30.) Senegal, Strengthening of Dakar International Airport plus technical assistance for small airport development ($12.0 million).

31.) Upper Volta, Study for the section FADA N'GOURMA on the NIAMEY road ($1.141 million).

32.) Upper Volta, Improvement and paving of the OUAGADOUGOU-KOUDOUGOU major road ($14.3 million).

33.) Upper Volta, Construction of the DORI-DJIBO major road in the ORD du Sahel ($7.222 million).

34.) Upper Volta, Construction of KONGUSSI-DJIBO SECONDARY road ($1.2 million).

35.) Upper Volta, Reconstruction of the BANFORA-BOBO-HOUNDEE primary road; equipment; technical assistance ($22.1 million).

36.) Upper Volta, Reconstruction of the SOLENZO-KOUDOUGOU primary road ($4.15 million).

37.) Upper Volta, Upgrading of the KOUPELA-N'GOURMA-NIGER BORDER major road ($60.0 million).

38.) Upper Volta, Rehabilitation of OUAGADOUGOU-KAYA primary road and KAYA-DORI primary road ($46.0 million).

39.) Upper Volta, Reconstruction of the OUAGADOUGOU-KASOLO link on major road to KAYA ($2.5 million).

40.) Upper Volta, Study of DORI-SEBBA-GOROM GOROM road ($1.0 million).

41) Upper Volta, Development and paving of the section SAKDINEE-HOUNDE on the main OUAGADOUDOU-BOBO road ($6.5 million).

42) Upper Volta, Construction of HOUNDE-SAKOINCE primary highway (2.2 million).

43) Upper Volta, Construction of a railroad line to link the proposed manganese mine at TAMBAO with OUAGADOUGOU ($90.0 million).

44) Upper Volta, Construction of bonded warehouses for Upper Volta at the port of LOME, TOGO ($0.69 million).

45) Regional, Development of the regional road SABONGARI-GAYA to link Benin and Niger ($5.168 million).

The total value of the projects shown on Map III-E1 is $855.944 million, or 52.4 percent of all the projects identified in Table III-A1. 52.7 percent of all road projects and 57.5 percent of all road construction and rehabilitation projects are shown. Other projects could not be shown on the Map because of insufficient information regarding their location.

TABLE III A-1

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
CAPE VERDE	Road	Provision of equipment, spare parts & technical assistance for road work	UNSO	0.25	Being implemented	Financed	N.A. /1978-79/
CAPE VERDE	Road	Purchase of ten buses	Belgium	0.401	Being implemented	Financed	1978- /78/
CAPE VERDE	Road	CILSS /UNSO 401 Program: Construction of 100 km. of feeder roads	Via UNSO	10.0	Under active consideration	Financing requested by CILSS/Govt. of Cape Verde. Participation is being considered by Kuwait and the Netherlands.	N.A. /1979-84/
CAPE VERDE	Road	Furnishing of road construction equipment	FED	0.74	Under consideration	Under consideration	N.A. /1980-1980/
CAPE VERDE	Water	Provision of a combination freighter/passenger ship	FRG	0.83	Being implemented	Financed	1977-1980
CAPE VERDE	Water	Training of maritime administrators and shipping inspectors	Norway	0.043	Near completion	Financed	1978-1978
CAPE VERDE	Water	Assistance for navigational aides (first tranche)	Norway	0.077	Being implemented	Financed	1978-78

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
CAPE VERDE	Water	Assistance for shipping reorganization (first tranche)	Norway	0.109	Being implemented	Financed	1978-1978
CAPE VERDE	Water	Financing part of ferry-boat requirements	Belgium	N.A. (5.0)	Under consideration	Under considera-tion	N.A. (1981-1983)
CAPE VERDE	Water	Janela Harbor improve-ments on Santo Antao	Netherlands	N.A. (12.0)	Under consideration	Under considera-tion	N.A. (1981-1985)
CAPE VERDE	Water	Participation in the engineering, design and supervision for the extension of the harbor at Mindelo, and for establishing a ship repair facility.	Netherlands	0.7	Under consideration	Under considera-tion	N.A. (1980-1981)
CAPE VERDE	Water	Passenger and cargo ship for inter-island transportation	FRG	2.0	Under consideration	Under considera-tion	N.A. (1980-1983)
CAPE VERDE	Water	Studies for Praia Port-Phase III	ADF	0.278	Under consideration	Under considera-tion	N.A. (1980-1981)
CAPE VERDE	Air	Development of National Civil Aviation Depart-	UNDP/ICAO	1.11	Being implemented	Financed	1976-1981

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
CAPE VERDE	Inter-modal	Artisanal fishing project with maritime transport components plus feeder roads to market center	Abu Dhabi Fund Possibly others	N.A. /3.0/	Under consideration	Under consideration	N.A. /1981-1983/
CAPE VERDE	Multi-modal	Technical assistance for transport planning	USAID	N.A. /1.0/	Under consideration	Under consideration	N.A. /1980-1981/
CHAD	Road	Completion of road studies	FED	0.013	Near completion	Financed	1978-1978
CHAD	Road	Minor rehabilitation for 1,200 km. of cotton feeder roads (part of Rural Projects Fund)	IDA/IBRD	1.2	Being implemented	Financed	1977-1980
CHAD	Road	Five-year maintenance and rehabilitation of cotton feeder roads: maintenance of ferries; training	IDA/IBRD	3.5	Being implemented	Financed	1975-1980
CHAD	Road	Road maintenance and rehabilitation program for about 5,300 km. of unpaved roads and tracks; technical assistance; equipment; training	USAID ADF IDA/IBRD	USAID 9.0 IDA/IBRD 7.6 ADF 5.1 Total 21.7	Being implented	Committed	1978-1983

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
CHAD	Road	Feasibility study for the Guelendeno-Pangor primary road. (108 km)	FRG	0.444	Being implemented	Financed	1977-78
CHAD	Road	Maintenance of asphalt roads: establishment of a brigade for 200 km. of existing hard-surfaced roads	FED	3.757	Being implemented	Financed	1978-1982
CHAD	Road	Local rehabilitation of Sarh-Bangui primary road. (580 km, of which 120 km in Chad)	FAC	1.2	Being implemented	Financed	[1978-80]
CHAD	Road	CILSS/UNSO 401 Program: Construction and rehabilitation of 470 km. of secondary roads.	UNSO	UNSO 7.41 Required 7.00 Total 14.41	Work on 260 km. is being implemented	210 km. require financing. 260 km. are being financed.	N.A. /1978-83/
CHAD	Road	Road maintenance program in Lake Chad area	FRG	N.A: /3.0/	Under consideration	Under consideration	N.A. /1980-82/
CHAD	Road	Construction of the Moundou-Guidjiba(305 km.) and Bangor-Lai (200 km.) primary roads.	USAID IDA/IBRD FED	USAID 9.000 FED 22.713 IDA/IBRD 10.000 Required 97.287 Total cost 139.000	Under consideration	Under consideration. Co-financing required.	1979 -1984
CHAD	Road	Study for the Moundou-Doba primary road	FAC	0.4	Under consideration	Under consideration	N.A. /1979-80/

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$ million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
CHAD	Road	Study for the Djemaya-Djintelo secondary road.	ADF	0.376	Under consideration	Under consideration	N.A. /1979-80/
CHAD	Road	Study of the rural road transport system in the Moyen-Chari region.	Switzerland	0.3	Under consideration	Under consideration	1979-1980
CHAD	Air	Modernization of secondary airports	FAC	0.28	Being implemented	Financed	1977-/78/
CHAD	Air	Extention of N'Djamena International Airport	FAC	0.785	Being implemented	Financed	1976-/78/
CHAD	Air	Training of civil avaition personnel	UNDP	0.093	Being implemented	Financed	1978-1981
CHAD	Multi-modal	Establish a transport development program as to be determined by a study.	Switzerland	10.0	Under consideration	Under consideration	1981-1984
GAMBIA	Road	Construction of the 112 km. Soma-Yoroberikunda primary road.	Kuwait	15.707	Being implemented	Financed	1977-1981
GAMBIA	Road	CILSS/UNSO 401 Program: Construction and rehabilitation of 351 km. of secondary roads.	UNSO Libya FRG	UNSO 2.82 FRG and Libya 4.10 Total 6.92	Work under UNSO financing is being implemented	Partially financed. Libya and FRG considering additional required financing ($4.1 million) on bilateral basis.	N.A.[1978-1983]

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
GAMBIA	Road	Development of a secondary road network in West Kiang to link into the Eastern IRD project financed by IDA/BADEA/UK	FED	3.0	Under consideration	Under consideration	1979-1982
GAMBIA	Road	Highway maintenance and rehabilitation program.	FRG IDA/IBRD USAID	FRG 5.4 USAID 4.6 IDA/IBRD 3.0 Total 13.0	Under consideration	Under consideration	1979-1984
GAMBIA	Road	Construction of 56km. of the major road Albreda-Kuntair.	FED	1.775	Under consideration	Under consideration	1979-1982
GAMBIA	Water	Construction of wharves in rural areas along Gambia River.	United Kingdom	0.18	Near completion	Financed	1976-1978
GAMBIA	Water	Ferry service for Banjul-Barra.	FRG	1.033	Being implemented	Financed	1977-1980
GAMBIA	Air	Expansion and modernization of Yundum International Airport.	U.A.E. Saudi Arabia OPEC Special Fund	U.A.E. 1.332 Saudi Arabia 6.610 OPEC Special Fund 1.650 Total 9.592	Being implemented	Financed	1977-1980

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
GAMBIA	Multi-modal	Preparation of a comprehensive survey of the transport sector and the identification of viable transport projects.	Kuwait	1.026	Near completion	Financed	1976-1978
MALI	Road	Road building and maintenance equipment; technical assistance.	USAID	3.25	Near completion	Financed	1977-1979
MALI	Road	CILSS/UNSO 401 Program; Construction and rehabilitation of 480 km of secondary roads.	UNSO	15.281	Being implemented	Financed	1976-1979
MALI	Road	Construction of the Koutiala-Sikasso major road.	FED	17.18	Being implemented	Financed	1978-1982
MALI	Road	Continuation of work under Second Highway Project begun in 1973: trunk road improvement; technical assistance and training for ongoing highway maintenance and feeder road betterment program.	IDA/IBRD	8.3	Being implemented	Financed	1975-1979

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
MALI	Road	Rehabilitation and maintenance of 1,200 km. of feeder roads; training	IDA/IBRD	10.0	Being implemented	Financed	1976-1979
MALI	Road	Study for the construction of a second bridge at Bamako.	FRG	0.558	Being implemented	Financed	1975-[1977]
MALI	Road	Feeder roads within Kaarta IRDP	CIDA	3.6	Being implemented	Financed	N.A.[1978-1981]
MALI	Road	Compaction trials at Gao to determine construction material for the Trans Saharian Road.	UNDP	0.133	Being implemented	Financed	1977-1981
MALI	Road	Study and design of Bamako Kayes major highway	UNDP	0.401	Being implemented	Financed	1976-1980
MALI	Road	Provision of vehicles	Japan	3.99	Being implemented	Financed	1977-[1981]
MALI	Road	Construction of the Sikasso-Dioila secondary road (250 km. plus bridge over the Bagoe River).	ADF	5.5	Under consideration	Under consideration	1979-1983
MALI	Road	Strengthening of bituminous roads	FED	5.6	Under consideration	Under consideration	1979-1981

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
MALI	Road	Fourth Highway Project: maintenance and rehabilitation, including work on Dioulasso-Bogouni trunk road.	IDA/IBRD	IDA/IBRD 10.0 required 30.0 Total 40.0	Under consideration	Under consideration. Co-financing required.	1979-1984
MALI	Road	Construction of the Kayes-Nioro secondary road linking into Kaarta CIDA IRDA area.	USAID	15.0	Under consideration	Under consideration	N.A. /1979-1987
MALI	Road	Construction of the Markala Niono secondary road (72 km.)	ADF	ADF 9.44 Required 5.56 Total cost 15.0	Under consideration	Under consideration. Co-financing required.	N.A. /1979-1987
MALI	Road	Construction and maintenance of Gao-Mopti major road; work brigade; material and experts (510 km.)	FRG	N.A. /50.1/	Under consideration	Under consideration	N.A./1980-1985/
MALI	Road	Maintenance of FED-financed major roads.	FED	N.A. /3.0/	Under consideration	Under consideration	N.A. /1980-1987
MALI	Road	Construction of Bamako-Senegal border major road (525 km.)	FRG	N.A. /46.7/	Under consideration	Under consideration	N.A./1980-1985/

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
MALI	Rail	Railroad freight cars for the Mali regional system.	FRG	1.35	Near completion	Financed	1976-1979
MALI	Rail	Material and equipment for the railroad.	FAC	2.3	Being implemented	Financed	1975-1978
MALI	Rail	Modernization and rehabilitation of railroad; training; technical assistance; rolling stock; track work; bridge repairs.	IDA/IBRD CIDA CCCE FAC	IDA/IBRD 10.50 CIDA 6.57 CCCE 5.30 FAC 1.65 24.02	Being implemented	Financed	1977-1982
MALI	Water	Supply of passenger and tanker ship.	FRG	3.068	Being implemented	Financed	1978-1981
MALI	Water	Support for the Mali Maritime company.	CIDA	2.19	Under consideration	Under consideration	N.A./[1980-1983]/
MALI	Multi-modal	Possible transport components within Senegal River Basin (OMVS) program.	Kuwait Abu Dhabi Fund	N.A. /[3.0]/	Under consideration	Under consideration	N.A./[1981-1984]/
MAURITANIA	Road	Assistance for vehicle repair center at Nouakchott.	FRG	0.199	Near completion	Financed	1976-1978
MAURITANIA	Road	Maintenance and rehabilitation of major roads; equipment; technical assistance; training.	CIDA Kuwait IDA/IBRD	CIDA 4.5 Kuwait 4.0 IDA/IBRD 3.0 Total 11.5	Being implemented	Financed	1975-1979

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
MAURITANIA	Road	Construction of Nouakchott-Kiffa major highway (582 km.)	AFESD Kuwait FED U.A.E. France FRG	AFESD 23.94 Kuwait 20.00 FED 13.00 U.A.E. 10.02 France 4.70 FRG 3.20 Total 74.86	Being implemented	Financed	1975-1981
MAURITANIA	Road	Additional funding for construction of Lake Arkiz road (previously funded for $21 million in 1974)	Saudi Arabia	36.5	Being implemented	Financed	1976-1980
MAURITANIA	Road	CILSS/UNSO 401 Program: Construction and rehabilitation of 524 km. of secondary roads.	UNSO USAID	UNSO 1.63 USAID 3.00 Required 12.60 Total 17.23	Work under UNSO financing is being implemented (110 km.)	Partially financed. USAID funding under consideration. Co-financing is required for rehabilitation of about 302 km.	N.A.[1978-1983]
MAURITANIA	Road	Rural roads - linkage to South East.	USAID	USAID 8.0 Required 12.0 Total 20.0	Under consideration	Under consideration. Co-financing required.	1981-1985
MAURITANIA	Road	Upgrading of about 300 km. of existing trails and tracks; formation of mobile brigades for construction and maintenance; training; studies..	USAID	4.5	Under consideration	Under consideration	1980-1985

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
MAURITANIA	Road	Participation in multi-donor financing of the Nouakchott-Nema road (section to link Kiffa-Atoun El Atrouss)	FED	12.92	Under consideration	Under consideration	1979-1982
MAURITANIA	Water	Nouadhibou Port expansion	Kuwait IDA/IBRD CCCE	Kuwait 8.379 IDA/IBRD 8.000 CCCE 5.700 Total 22.079	Near completion	Financed	1976-1979
MAURITANIA	Water	Study for the expansion of fishing ports.	Kuwait	0.7	Being implemented	Financed	N.A./[1979-79]
MAURITANIA	Water	Extension of ferry service and construction of a pier at Rosso.	FRG	1.469	Being implemented	Financed	1976-1981
MAURITANIA	Air	Equipment for secondary Airports.	FAC	1.038	Near completion	Financed	1977-1978
MAURITANIA	Air	Master plan for local air traffic service.	FRG	0.238	Being implemented	Financed	1976-1980
MAURITANIA	Air	Construction of a domestic airport at Nema.	FRG	6.753	Being implemented	Financed	1976-1981
MAURITANIA	Multi-modal	Possible transport components within Senegal River Basin (OMVS) program.	Kuwait Abu Dhabi Fund	N.A. [N.A.]	Under consideration	Under consideration	N.A./[1981-1984]

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
NIGER	Road	Study of the Keita-Ibohamane primary road.	FAC	0.305	Near completion	Financed	1977-1978
NIGER	Road	Road maintenance program.	USAID	2.458	Near completion	Financed	1975-1978
NIGER	Road	Maintenance and rehabilitation program: a) 4-year road maintenance program; b) reconstruction and improvement o. the Zinder-Nigerian border (113km) and Maradi-Nigerian border (49.'km) primary roads.	IDA/IBRD BADEA ADF	IDA/IBRD 15.600 BADEA 7.000 ADF 3.666 Total 26.266	Being implemented	Financed	1976-1980
NIGER	Road	Study for the strengthening of the Tsernaoua-Tahoua major road.	FAC	1.221	Being implemented	Financed	1977-1979
NIGER	Road	Bridge construction at Bailey.	FAC	0.1	Being implemented	Financed	[1978-78]
NIGER	Road	Modernization of the Niamey-Zinder major highway. (815 km)	FED	29.95	Being implemented	Financed	1976-1979
NIGER	Road	Maintenance and rehabilitation of Route de l'Unite.	CIDA	9.088	Being implemented	Financed	1978-1983
NIGER	Road	Vehicle repair service center-3rd and 4th tranches (continuation of project begun in 1974)	FRG	1.141	Being implemented	Financed	1977-1980
NIGER	Road	Provision of vehicles	Japan	3.14	Bing implemented	Financed	1977-[1980]

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
NIGER	Road	CILSS/UNSO 401 Program: Construction or rehabilitation of 393 km. of secondary roads.	UNSO	UNSO 1.019 Required 9.700 Total 10.719	Work under UNSO funding is being implemented. (70 km.)	Partially financed (70 km). Co-financing required for construction or rehabilitation of 323 km.	1977-[1981]
NIGER	Road	Niger feeder roads	USAID	USAID 6.0 Required 10.0 Total cost 16.0	Under consideration	Under consideration. Co-financing required.	1980-1983
NIGER	Road	Feeder road system development; technical assistance to Dosso Department.	IDA/IBRD	IDA/IBRD 10.0 Required 2.0 Total cost 12.0	Under consideration	Under consideration. Co-financing required.	1979-1983
NIGER	Road	Maintenance of 1,000 km. of feeder roads.	ADB	2.0	Under consideration	Under consideration	N.A./[1979-1981]/
NIGER	Road	Construction of the Zinder-Goure major road.	CIDA	30.66	Under consideration	Under consideration	N.A./[1979-1986]/
NIGER	Road	Studies for feeder roads.	ADF	0.444	Under consideration	Under consideration	N.A./[1979-1980]/
NIGER	Road	Construction of bridge over the Maggia River	FAC	0.7	Under consideration	Under consideration	N.A./[1979-1981]/
NIGER	Road	Strengthening of the Tsernaoua-Tahoua secondary road.	FAC	4.4	Under consideration	Under consideration	N.A./[1979-1983]/
NIGER	Road	Highway maintenance and rehabilitation.	IDA/IBRD	15.6	Under consideration	Under consideration	1980-1985
NIGER	Road	Construction of Niamey-Upper Volta border major road (150 km)	USAID FED	N.A./[4.7]/	Under consideration	Under consideration	N.A./[1980-1983]/

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
NIGER	Road	Goulbi bridge.	FDC	N.A. [1.5]	Under consideration	Under consideration	N.A. [1980-1981]
NIGER	Road	Feeder roads within pastoral project.	Abu Dhabi	N.A. [3.0]	Under consideration	Under consideration	N.A. [1980-1982]
NIGER	Rail	Study for the Kano-Maradi railroad.	CIDA	0.821	Under consideration	Under consideration	N.A. [1980-1981]
NIGER	Water	River navigation (Phase II)	CIDA	N.A. [6.0]	Under consideration	Under consideration	N.A. [1981-1984]
NIGER	Air	Assistance to Directorate of Civil Aviation	UNDP	0.154	Being implemented	Financed	1977-1980
NIGER	Multi-modal	Transport plan	FAC	0.4	Being implemented	Financed	N.A. [1979-79]

TABLE II A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)		ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
SENEGAL	Road	Construction of the 71 km. Cap Skirring - Ziguinchor major road in the Casamance area.	Islamic Development Bank (ISDB) ADB	ISDB ADB Total	6.25 6.00 12.25	Being implemented	Financed	1978-1982
SENEGAL	Road	Improvements and paving of the Kolda-Velingara major road (126 km.)	FED	12.55		Being implemented	Financed	1977-1981
SENEGAL	Road	Feeder roads within Casamance IRDP.	USAID	3.0		Being implemented	Financed	1978-1984
SENEGAL	Road	Project loan for construction of highway system.	Saudi Arabia	36.0		Being implemented	Financed	1978-[1993]
SENEGAL	Road	Improvement and maintenance of about 1,250 km. of feeder roads; equipment; technical assistance.	IDA/IBRD	6.6		Being implemented	Financed	1976-1980
SENEGAL	Road	Pavement strengthening of 204 km. of primary roads; equipment for highway maintenance; technical assistance.	IDA/IBRD	15.0		Being implemented	Financed	1977-1980
SENEGAL	Road	Pavement reinforcement of about 110 km. of primary roads; 4-year maintenance program (Second Highway Project).	IDA/IBRD	8.0		Being implemented	Financed	1973-1980
SENEGAL	Road	Study and engineering design work for the Tambacounda - Mali border major road.	FRG ADF	FRG ADF Total	0.666 0.278 0.944	Being implemented	Partially financed. ADF contribution is under consideration.	1975-1980

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
SENEGAL	Road	CILSS/UNSO 401 Program: Construction and rehabilitation of 426 km. of secondary roads.	UNSO	UNSO 1.2 Required 12.2 Total 13.4	Work under UNSO funding is being implemented (90 km.)	Partially financed (90 km.) Co-financing required for construction and rehabilitation of 336 km.	N.A. [1978-1981]
SENEGAL	Road	Fourth Highway Project: maintenance and rehabilitation.	IDA/IBRD	IDA/IBRD 20.0 Required 30.0 Total 50.0	Under consideration.	Under consideration. Co-financing required.	1980-1985
SENEGAL	Road	Construction of the Tambacounda - Mali border secondary road.	FRG	N.A. [5.6]	Under consideration.	Under consideration.	N.A. [1980-1983]
SENEGAL	Road	Feeder roads within Ferlo IRDP.	CIDA	3.6	Under consideration.	Under consideration.	N.A. [1979-1983]
SENEGAL	Road	Construction of Tambacounda-Kedougou secondary road.	FED	7.3	Under consideration.	Under consideration	1979-1982
SENEGAL	Road	Fifth Highway Project: maintenance and rehabilitation program.	IDA/IBRD	10.0	Under consideration.	Under consideration	1983-1988
SENEGAL	Rail	Railway rolling stock	CCCE	3.135	Near completion.	Financed	1976-1978
SENEGAL	Rail	Railway investment plan: track renewal (60 km.); track maintenance equipment; training; Dakar area improvements	IDA/IBRD	11.0	Being implemented	Financed	1978-1982
SENEGAL	Rail	Fourth Railway Porject: track renewal; technical assistance; equipment.	IDA/IBRD	10.0	Under consideration.	Under consideration	1981-1985

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
SENEGAL	Water	Dakar fishing port extension; technical assistance.	BADEA CCCE IDA/IBRD	BADEA 7.200 CCCE 6.105 IDA/IBRD 6.000 Total 19.305	Being implemented	Financed	1977-1981
SENEGAL	Water	Expansion of Dakar Port.	IDA/IBRD	10.0	Under consideration.	Under consideration.	1982-1987
SENEGAL	Air	Civil aviation technical training.	UNDP	0.085	Being implemented	Financed.	1978-1981
SENEGAL	Air	Technical assistance for the development of civil aviation.	CIDA	2.419	Being implemented	Financed.	1978-[1980]
SENEGAL	Air	Strengthening of Dakar International Airport, plus technical assistance for small airport development.	IDA/IBRD	IDA/IBRD 6.5 Required 5.5 Total 12.0	Under consideration.	Under consideration. Co-financing required.	1979-1983
SENEGAL	Multi-modal	Transport master plan for Casamance region.	USAID	1.0	Being implemented	Financed.	1978-1981.
SENEGAL	Multi-modal	Possible transport components within Kamobeu - Baila Dam perimeter.	Abu Dhabi Possibly Others	N.A.[3.0]	Under consideration	Under consideration.	N.A.[1981-1983]
SENEGAL	Multi-modal	Transport components within Senegal River Basin (OMVS)	Kuwait Abu Dhabi Fund USAID	N.A.[6.0]	Under consideration.	Under consideration.	N.A.[1981-1984]

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	CONSTRUCTION DATES
UPPER VOLTA	Road	Study for the section Fada N'Gourma on the Niamey road.	FED	1.141	Near completion	Financed	1977-1979
UPPER VOLTA	Road	Improvement and paving of the Ouagadougou-Koudougou major road (120 km)	FED	14.3	Near completion	Financed	1976-1979
UPPER VOLTA	Road	Road Transport Planning	UNDP	0.900	Being implemented	Financed	1976-1981
UPPER VOLTA	Road	Construction of the Dori-Djibo major road in the ORD du Sahel (200 km)	ADF	7.222	Being implemented	Financed	1978-81
UPPER VOLTA	Road	Improvement and maintenance of secondary roads.	CIDA	19.276	Being implemented	Financed	1977-1982
UPPER VOLTA	Road	Construction of Kongoussi-Djibo secondary road (80 km)	FAC	1.2	Being implemented	Financed	N.A. (78-79)
UPPER VOLTA	Road	Design for a bridge over the Pendjari River.	FAC	0.1	Being implemented	Financed	N.A. (78-78)
UPPER VOLTA	Road	Improvement and maintenance of 1,200 km of rural roads; maintenance of about 2,100 km of existing rural roads; technical assistance.	IDA/IBRD	7.5	Being implemented	Financed	1976-1979

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
UPPER VOLTA	Road	Reconstruction of the Banfora-Bobo-Hounde primary road (183 km); equipment; technical assistance.	IDA/IBRD OPEC Special Fund	IDA/IBRD 20.0 OPEC Special Fund 2.1 Total 22.1	Being implemented	Financed	1976-1980
UPPER VOLTA	Road	Reconstruction of the Solenzo-Koudougou primary road (70 km)	IDA/IBRD	4.15	Being implemented	Financed	1973-1978
UPPER VOLTA	Road	Rehabilitation and maintenance of rural roads in Eastern ORD	USAID	2.98	Being implemented	Financed	1977-1980
UPPER VOLTA	Road	Road maintenance equipment	FAC	0.87	Being implemented	Financed	N/A (1978-1979)
UPPER VOLTA	Road	Establishment of 3 vehicle repair service centers; experts; equipment; training	FRG	1.122	Being implemented	Financed	1976-1980
UPPER VOLTA	Road	CILSS/UNSO 410 Program: Construction and rehabilitation of 464 km of secondary roads.	UNSO USAID	UNSO 2.8 USAID 11.0 Total 13.8	Work under UNSO funding is being implemented. USAID participation is under active consideration, including possible training of work brigades for feeder road maintenance program.	Partially financed. USAID participation under consideration	1976-1985
UPPER VOLTA	Road	Upgrading of the Koupela-Fada N'Gourma-Niger border major road (230 km)	USAID	USAID 10.0 Required 50.0 Total 60.0	Under consideration	Under consideration. Co-financing required.	1980-1985

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
UPPER VOLTA	Road	Highway maintenance program	IDA/IBRD	IDA/IBRD 20.0 Required 14.0 Total cost 34.0	Under consideration	Under consideration Co-financing required	1981-1986
UPPER VOLTA	Road	Rehabilitation of Ouagadougou-Kaya primary road (100 km paved) and Kaya-Dori primary road (174 km gravel)	IDA/IBRD	IDA/IBRD 25.0 Required 21.0 Total cost 46.0	Under consideration	Under consideration Co-financing required	1983-1987
UPPER VOLTA	Road	Study of the Fada-Bogande-Taparko road-Phase I	ADF	0.222	Under consideration	Under consideration	N.A. (1979-1980)
UPPER VOLTA	Road	Roads in the Volta Valley Region	CIDA	8.212	Under consideration	Under consideration	N.A. (1980-1983)
UPPER VOLTA	Road	Reconstruction of the Ouagadougou-Kasolo link on major road to Kaya	Netherlands	2.5	Under consideration	Under consideration	N.A. (1980-1983)
UPPER VOLTA	Road	Road maintenance equipment	FAC	0.6	Under consideration	Under consideration	N.A. (1980-1980)
UPPER VOLTA	Road	Study of Dori-Sebba-Gorom Gorom road	ADF	1.0	Under consideration	Under consideration	N.A. (1979-1980)
UPPER VOLTA	Road	Maintenance of paved (primary) roads	FED	2.3	Under consideration	Under consideration	1979-1982
	Road	Development and paving of the section Sakdinee-Hounde on the main Ouagadougou-Bobo Road	ADF	6.5	Under consideration	Under consideration	N.A. (1979-1985)

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)		ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
UPPER VOLTA	Road	Construction of Hounde Sakoince primary highway (25 km)	FRG	N.A.	(2.2)	Under consideration	Under consideration	N.A. (1980-1982)
UPPER VOLTA	Road	Construction and rehabilitation of the Bilango-Taparko-Korsimoro-Boulssa all weather road (80 km)	ADF	N.A.	(2.5)	Under consideration	Under consideration	N.A.(1980-1982)
UPPER VOLTA	Road	Technical assistance for study of Ouagadougou-Tambao Railroad	FRG FAC	FRG FAC Total	0.153 0.200 0.353	Near Completion	Financed	1975-1978
UPPER VOLTA	Rail	Equipment for the Abidjan-Niger railroad system	CIDA		13.164	Near completion	Financed	1977-1979
UPPER VOLTA	Rail	Regional Railways Project-Ivory Coast/Upper Volta: track improvement; realignment; maintenance equipment; technical assistance.	IDA/IBRD		5.2	Being implemented	Financed	1978-1980
UPPER VOLTA	Rail	Construction of a railroad line to link the proposed manganese mine at Tambao with Ouagadougou	FED ADF FAC FRG	FED ADF FAC FRG Required Total cost	19.0 12.0 5.0 n.a. 54.0 90.0	Under consideration	Under consideration. Co-financing required	N.A. (1980-1986)
UPPER VOLTA	Water	Construction of bonded warehouses for Upper Volta at the port of Lome, Togo	FRG		0.69	Near completion	Financed	1975-1978
UPPER VOLTA	Multi-modal	Transport Plan	FAC		0.2	Being implemented	Financed	N.A. (1979-1979)

TABLE III A-1 (Continued)

CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL

IN THE TRANSPORT SECTOR

COUNTRY	MODE	ACTIVITY DESCRIPTION	DONORS	AMOUNT (U.S.$million)	ACTIVITY STATUS	FUNDING STATUS	BEGINNING-CONSTRUCTION DATES
REGIONAL	Road	Study for the regional road Madina-Ba-San Vicente on the Dakar-Banjul-Bissau Axis.	FED	0.078	Near completion	Financed	1978-1978
REGIONAL	Road	Two road sections in Lake Chad Basin area	USAID	1.55	Being implemented	Financed	1977-1980
REGIONAL	Road	Development of the regional road Sabongari-Gaya to link Benin and Niger	FED	5.168	Being implemented	Financed	1978-1981
REGIONAL	Road	Development of the regional road Mango-Upper Volta border (109 km) connecting Upper Volta, Niger, Mali and Togo	FED	7.988	Being implemented	Financed	1977-1980
REGIONAL	Road	Final technical studies relating to improvement of Trans-Saharian Road segment in Niger	UNDP	1.0	Being implemented	Financed	1978-1981
REGIONAL	Road	Study of Liptako-Dori-Tera-Niamey road development	ADF	0.415	Under consideration	Under consideration	N.A. (1980-1980)
REGIONAL	Road	Studies for development of road areas of influence in Gambia-Senegal	ADF	0.371	Under consideration	Under consideration	N.A. (1980-1980)
REGIONAL	Multi-Modal	Preparatory assistance to study major transit corridors and trade routes of land-locked Sahelian countries.	UNDP	0.065	Near completion	Financed	1978-1978
REGIONAL	Multi-modal	Regional Transportation Planning	USAID	5.0	Under consideration	Under consideration	1980-1984

TABLE III A-2

Club du Sahel

Current and Planned Transport Investments by Mode

Mode	No. of Projects	Investments (millions of dollars)				Percent of Total Investments
		Funding Committed	Funding Under Consideration [1]	Additional Funding Required	Total	
Road	116	517.192	480.766	313.347	1311.305	80.3
Rail	11	60.522	46.821	54.000	161.343	9.9
Water	20	49.583	38.168	0	87.751	5.4
Air	12	22.547	6.500	5.500	34.547	2.1
Multimodal	13	2.691	35.000	0	37.691	2.3
Total	172	652.535	607.255	372.847	1632.637	100.0

[1] Includes cost estimates by the DOT team for 19 officially un-costed projects

Sources: USAID, IBRD, Club du Sahel, U.S. Dept. of Transportation

TABLE III-A-3

CLUB DU SAHEL

ADDITIONAL CO-FINANCING REQUIRED FOR TRANSPORT PROJECTS

(Millions of Dollars)

Mode	Additional Co-Financing Required for:		Total
	Partially Committed Projects	Projects Under Consideration	
ROAD	41.5	271.847	313.347
RAIL	0	54.0	54.0
WATER	0	0	0
AIR	0	5.5	5.5
MULTIMODAL	0	0	0
GRAND TOTAL	41.5	331.347	372.847

Source: Club du Sahel

TABLE III A-4

CLUB DU SAHEL

CURRENT AND PLANNED ROAD INVESTMENTS

by TYPE of ROAD WORK:

CONSTRUCTION, REHABILITATION, MAINTENANCE

TYPE OF ROAD WORK	INVESTMENTS (millions of dollars)				
	FUNDING COMMITTED	FUNDING UNDER CONSIDERATION 1/	ADDITIONAL FUNDING REQUIRED	TOTAL INVESTMENTS	TOTAL PERCENT
CONSTRUCTION	294.764	338.995	206.347	840.106	64.1
REHABILITATION	184.813	94.600	83.000	362.413	27.6
MAINTENANCE	26.976	46.500	24.000	97.476	7.4
OTHER	10.639	0.671	0	11.310	0.9
TOTAL	517.192	480.766	313.347	1311.305	100.0

1/ Includes cost estimate by the DOT team for 10 officially un-costed road projects

Sources: USAID, IBRD, Club du Sahel, U.S. Dept. of Transportation

TABLE III A-5

CLUB DU SAHEL

CURRENT AND PLANNED INVESTMENTS by

TYPE OF ROAD

TYPE OF ROAD	INVESTMENTS			
	COMMITTED		UNDER CONSIDERATION 1/	
	NO. OF PROJECTS	MILLION DOLLARS	NO. OF PROJECTS	MILLION DOLLARS
PRIMARY	31	384.425	20	271.483
SECONDARY	13	78.357	14	142.528
FEEDER	8	38.380	12	63.215
OTHER ROAD PROJECTS	13	16.030	5	3.540
TOTAL	65	517.192	51	480.766

1/ Includes cost estimate by DOT team for 10 officially un-costed road projects

Sources: USAID, IBRD, Club du Sahel, U. S. Dept. of Transportation

TABLE III A-6

Timestream of Funding Committed, Under Consideration, or Required for Transport Infrastructure Projects, 1970-1990
(million dollars, 1978)

Year	Funding Committed	Under Consideration	Required	Total
1970				
1				
2				
3	1.692			1.692
4	1.692			1.692
5	18.677			18.677
6	66.199			66.199
7	102.400			102.400
8	135.282			135.282
9	130.646	44.641	41.863	217.150
1980	92.852	89.328	55.214	237.394
1	58.421	106.035	59.947	224.403
2	29.870	102.785	54.957	187.612
3	13.817	98.062	59.157	171.036
4	.709	76.911	51.890	129.510
5	.280	56.209	30.676	87.165
6		23.697	14.943	38.640
7		8.333	4.2	12.533
8		1.667		1.667
9				
1990				
Totals	652.537	607.254	372.847	1632.638

TABLE III A-7

Distribution by Recipient Country of Club du Sahel

Current and Planned Transport Investments

(in U.S. $ million)

Country	Investments: Total Value	Investments: % of Sahel Total	Modal Split		Disposition: Funding Committed	Disposition: Funding Under Consideration[1]	Disposition: Funding Required
CAPE VERDE	37.538	2.3	Road	11.391	2.82	34.718	0
			Water	21.037			
			Air	1.110			
			Multi-modal	4.000			
CHAD	200.458	12.3	Road	189.300	40.382	55.789	104.287
			Air	1.158			
			Multi-modal	10.000			
GAMBIA	52.233	3.2	Road	40.402	30.358	21.875	0
			Water	1.213			
			Air	9.592			
			Multi-modal	1.026			
MALI	279.521	17.1	Road	243.593	93.431	150.530	35.560
			Rail	27.670			
			Water	5.258			
			Multi-modal	3.000			
MAURITANIA	213.986	13.1	Road	177.709	156.966	32.420	24.600
			Water	24.248			
			Air	8.029			
			Multi-modal	4.000			

Country	Investments: Total Value	Investments: % of Sahel Total	Investments: Modal Split		Disposition: Funding Committed	Disposition: Funding Under[1] Consideration	Disposition: Funding Required
NIGER	192.767	11.8	Road	185-302	95.242	95.825	21.700
			Rail	0.821			
			Water	6.000			
			Air	0.154			
			Multi-modal	0.400			
SENEGAL	262.188	16.1	Road	184.244	132.210	82.278	47.700
			Rail	24.135			
			Water	29.305			
			Air	14.504			
			Multi-modal	10.000			
UPPER VOLTA	372.311	22.8	Road	262.704	105.277	128.034	139.000
			Rail	108.717			
			Water	0.690			
			Multi-modal	0.200			
REGIONAL	21.635	1.3	Road	16.570	15.849	5.786	0
			Multi-modal	5.065			
TOTAL	1632.637	100.0		1632.637	652.535	607.255	372.847

[1] Includes cost estimates by the DOT team for 19 officially un-costed projects

Sources: USAID, IBRD, Club du Sahel, U. S. Department of Transportation

TABLE III A-8

LOANS AND GRANTS FROM SOCIALIST COUNTRIES

CILSS MEMBER STATES

1954 - 1977

RECIPIENT	DONORS	ASSISTANCE (US $ Million)
CAPE VERDE	USSR	1/
CHAD	USSR	2.0
	China	50.0
GAMBIA	China	17.0
MALI	USSR	86.0
	Eastern Europe	23.0
	China	68.0
MAURITANIA	USSR	5.0
	China	85.0
NIGER	USSR	2.0
	China	51.0
SENEGAL	USSR	9.0
	Eastern Europe	35.0
	China	49.0
UPPER VOLTA	USSR	1.0
	China	60.0
TOTAL		543.0

1/: An economic cooperation agreement has been signed, but information on the amount of assistance extended, if any, is not available

Source: USAID, Congressional Presentation, FY, 1979, Annex A

Figure III A-1 Funding Committed, Under Consideration, and Required for Transport Infrastructure Projects Being Implemented on Pending, 1970-1990. (1978 dollars)

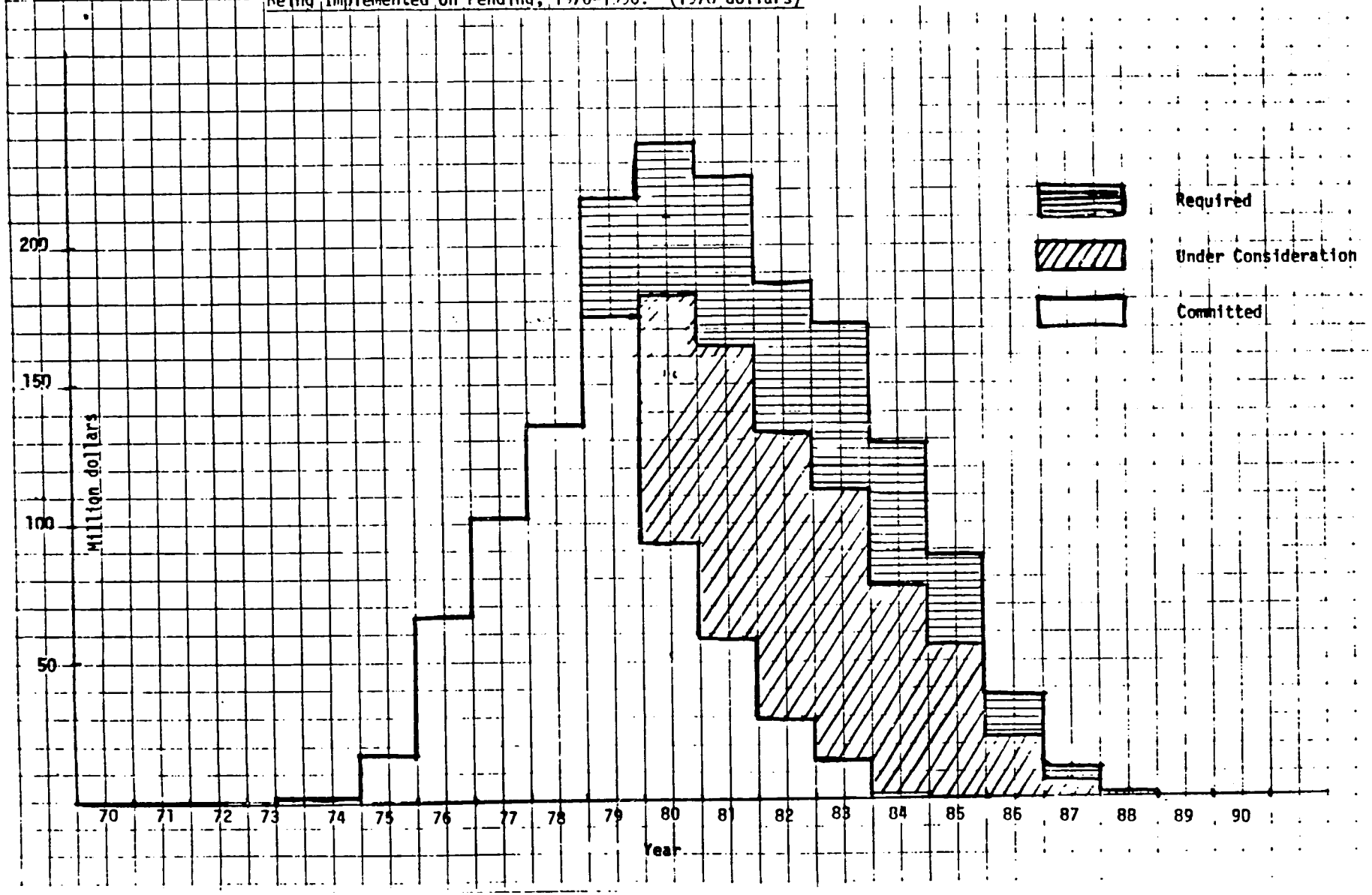


Figure III A-2 Funding Required for Transport Infrastructure Projects, 1970-1990 (1978 dollars)

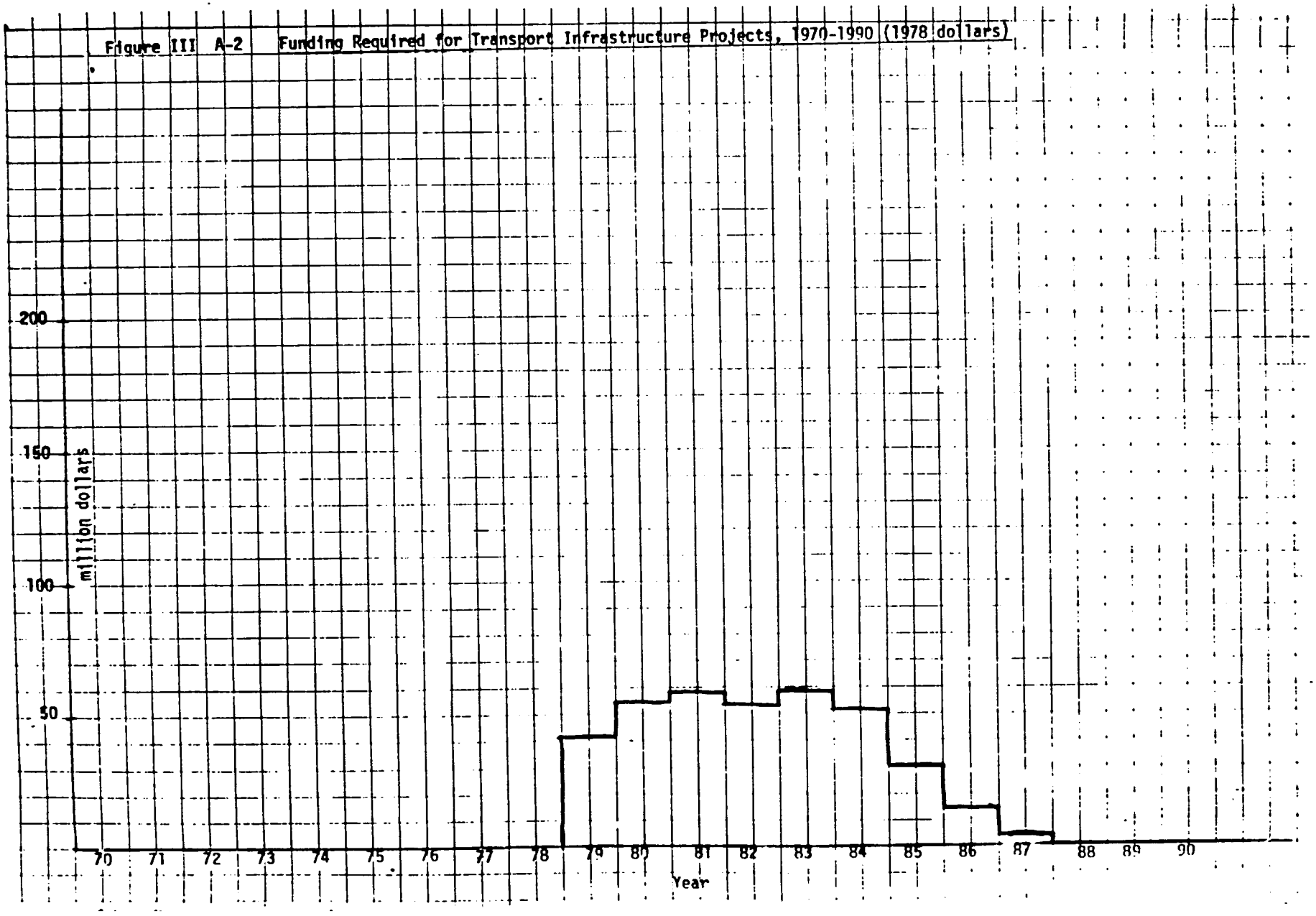


Figure III A-3 All Funding for Road Construction, Rehabilitation and Maintenance, 1973-1988 (1978 dollars)

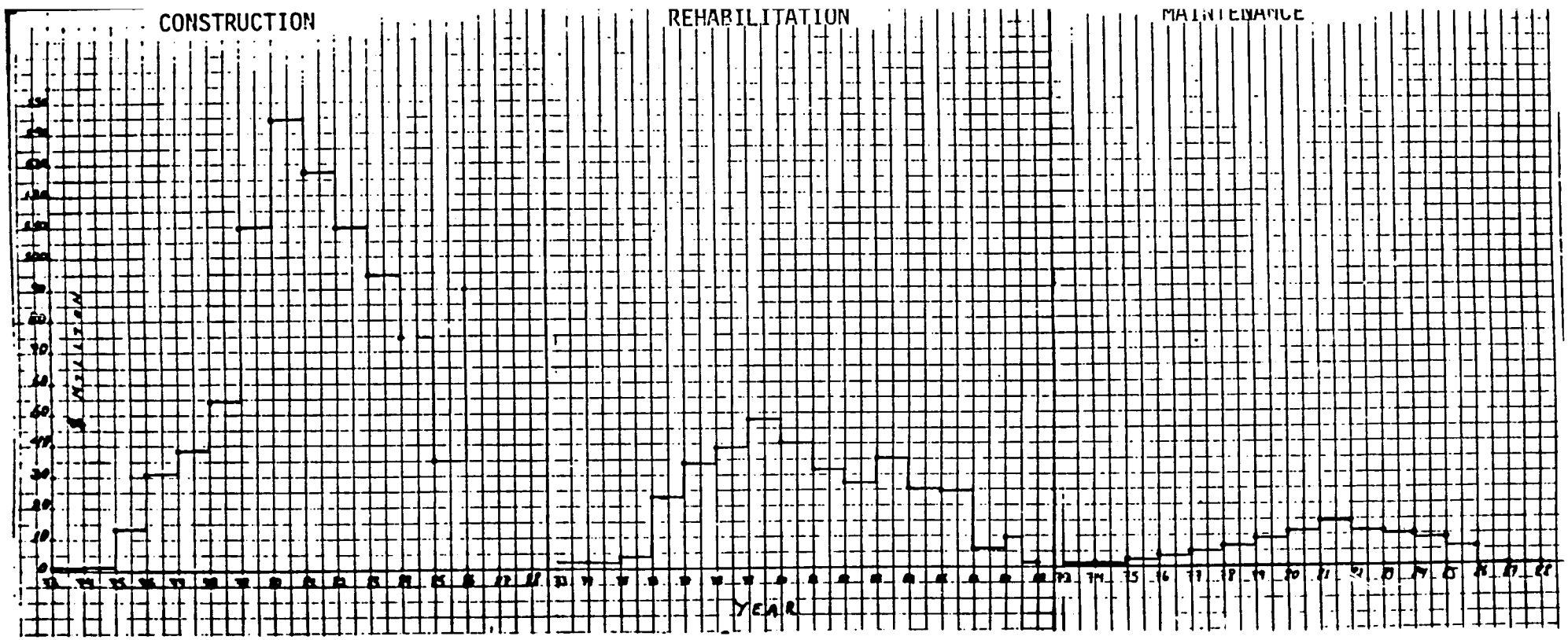


TABLE III B-1

USAID

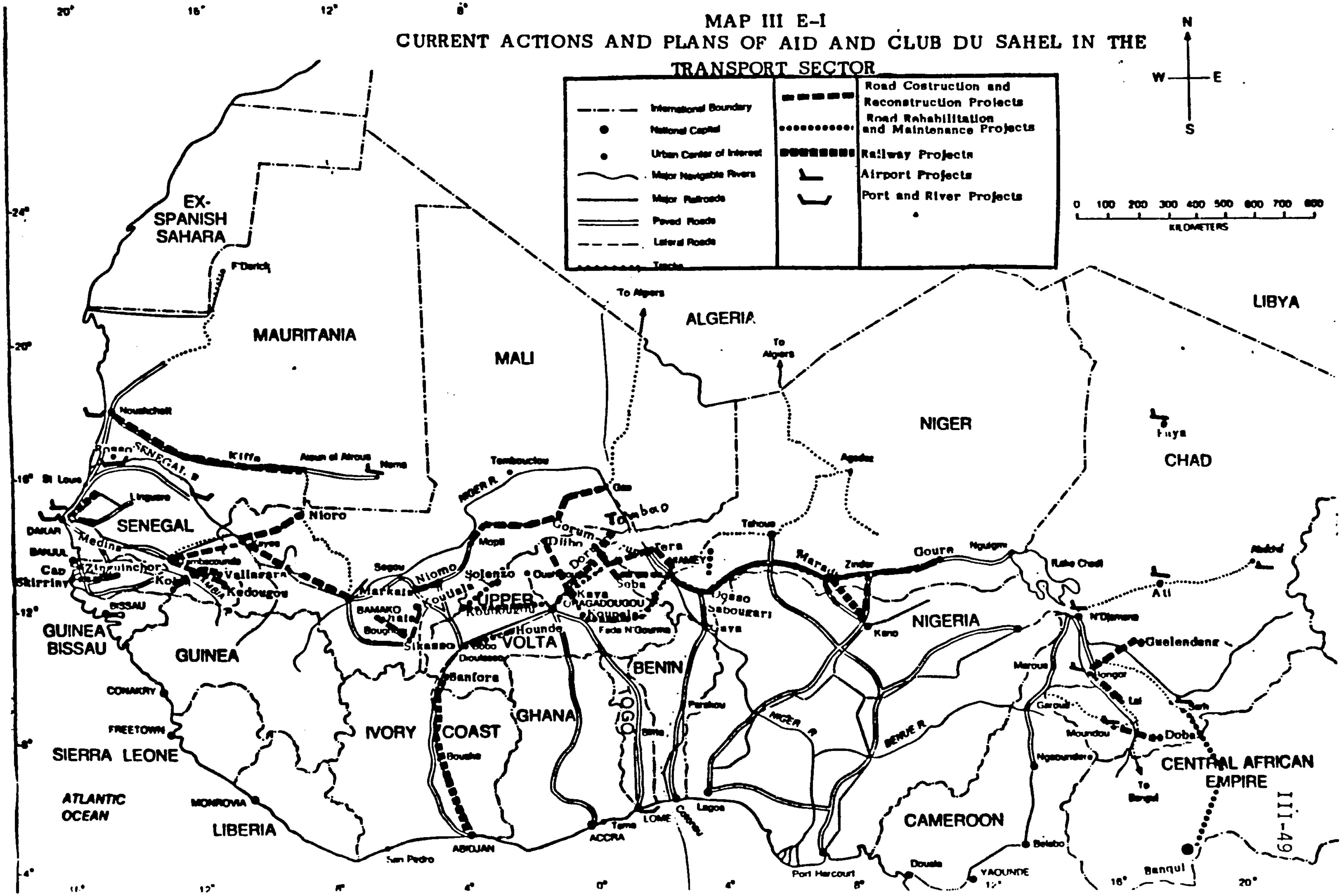
Current Actions and Plans in Sahel Transport Sector

Country	Mode	No. of Projects	Investments (in millions of dollars) Committed	Under Consideration 1/	Total Value
Cape Verde	Multimodal	1	0	1.0	1.0
Chad	Road	2	9.0	9.0	18.0
Gambia	Road	1	0	4.6	4.6
Mali	Road	2	3.25	15.0	18.25
Mauritania	Road	3	0	15.5	15.5
Niger	Road	3	2.458	13.35	15.808
Senegal	Road	1	3.0	0	6.0
	Multimodal	2	1.0	2.0	
Upper Volta	Road	3	2.98	20.0	22.98
Regional	Road	1	1.55	0	6.55
	Multimodal	1	0	5.0	
Total		20	23.238	85.450	108.688

1/Includes cost estimates by DOT team for 3 officially un-costed projects.

Souces: USAID, Club du Sahel, U.S. Department of Transportation

MAP III E-I
CURRENT ACTIONS AND PLANS OF AID AND CLUB DU SAHEL IN THE TRANSPORT SECTOR



IV. LEGISLATIVE GUIDELINES RELATING TO AID INVESTMENT IN SAHEL TRANSPORT INFRASTRUCTURE

A. General

In the Foreign Assistance Act of 1973, the Congress initiated the concept of "New Directions." This legislation mandated a shift in bilateral aid away from large-scale capital transfers to efforts focused on critical problems in functional sectors which affect the lives of the majority of the people in the less developed countries: food production, nutrition, and rural development; population planning and health; education; public administration and human resource development. Highest priority was given to undertakings which directly improve the lives of the poorest people and their capacity to participate in economic and social development.

In particular, the legislation directs that U. S. development assistance resources be allocated primarily to countries and activities which most effectively involve the poor in development by making it possible for them to better their lives through their own efforts.

Legislation enacted in 1975 provided further guidelines on "New Directions" functional goods. Policy language from the 1973-1977 legislations and from Committee hearings pinpoint the new thrust of U. S. assistance efforts.

B. Principal Elements of "New Directions" Legislation

1. The Target Group

- Development assistance furnished under this chapter shall be increasingly concentrated in countries which will make the most effective use of such assistance to help the poor toward a better life (especially such countries which are suffering from the worst and most widespread poverty and are in greatest need of outside assistance). In order to make possible consistent and informed judgements concerning U. S. bilateral development assistance that assistance should give the highest priority to undertakings submitted by the host government which directly improve the lives of the poorest of their people and their capacity to participate in the development of their countries.

- The Committee intends for this assurance to go primarily to those whose need is greatest. Particular consideration is to be given countries which demonstrate the intent and the capacity to place our assistance at the disposition of those who wish to help themselves.

2. Project Orientation

- Future U. S. bilateral support for development should focus on critical problems in those functional sectors which affect the lives of the majority of the people in the developing

countries: food production, rural development and nutrition, population planning and health; and education, public administration and human resources development.

- The priority area of concentration will be food production.

- Bilateral development aid should concentrate increasingly on critical development problems, and less on large scale capital transfers, which when made should be in association with contributions from other industralized countries working together in a multi-lateral framework.

- Provision of major transportation infrastructure is not to be ruled out as a form of U. S. assistance, despite the general policy for avoidance of major civil works in other AID activities. Emphasis is to be placed upon feeder roads (especially as part of an agricultural program) in the short-term, and upon agricultural storage needs in the immediate and medium-term future.

- Section 106 authorizes the appropriation to help solve economic and social development problems in fields such as transportation and power -- The Committee is of the opinion that AID has -- devoted too much emphasis to financing the building of large show-place projects -- dams, roads, power plants and the like -- which often do not bring direct

benefits to the common people of the developing countries. It is the Committee's intent that the funds authorized under this section be used for small local projects which will be of greatest benefit to the local people involved. Showplace projects do not belong in the new aid program.

- Assistance provided "shall be used primarily for activities which are specifically designed to increase the productivity and income of the rural poor through" improvements of marketing facilities and systems, expansion of local or small scale rural infrastructure and utilities such as farm-to-market roads, storage facilities and land tenure arrangements.

- "Growth in the gross national product is not enough. Governments of the developing nations must actively attempt to distribute income more equitably."

- "U. S. bilateral assistance henceforth should be problem-solving, people-oriented."

- "Section 106 authorizes (funds) to help solve economic and social development problems in fields such as transportation, taking into account that many LDCs still need substantial external resources to provide adequate roads, power."

- "our policies and programs must be aimed directly at the poor majority's most pervasive problems." (There) "must be a recognition that labor-intensive technologies are generally more suited to the developing world than the wide spread use of capital equipment, which eliminates jobs and uses up scarce foreign exchange. The Committee believes that policies which encourage social justice and full employment can" lead to greater economic growth then would be possible through concentration on economic growth alone.

- United States assistance should concentrate on the development of labor-intensive technologies suitable to the less developed countries.

- Assistance "should be used" to help countries solve development problems in accordance with a strategy that aims to increase substantially the participation of the poor. Accordingly, greatest emphasis should be placed on countries and activities which effectively involve the poor in development, by "increasing labor-intensive production, spreading productive investment and services out from major cities to small towns and outlying rural areas, and otherwise providing opportunities for the poor to better their lives through their own effort."

- "the President shall establish" criteria (to assess efforts to : reduce rates of unemployment and underemployment;

  - The President shall specifically take into account "countries' actions which demonstrate genuine concern and effective action for materially improving the lives of the poor and their ability to participate in development, including but not limited to efforts to"

    promote greater equity of income distribution, including measures such as more progressive taxation and more equitable returns to small farmers . . . .

3. <u>Multi-Donor Coordinated Effort</u>

   - Assistance furnished under this section shall be in accordance with a long-term, multi-donor development plan which calls for equitable burdensharing with other donors and shall be furnished, whenever appropriate, in cooperation with an international coordinating mechanism.

     "The President shall prepare an annual report on the Sahel Development Program concerning the allocation of the United States contribution to the Program, the extent of the contributions from other donor countries, the effectiveness of the integrated effort through the Club des Amis du Sahel, and the progress made in achieving the objectives of the Program."

- The plan is to call for equitable sharing of the assistance burden among donors, and whenever appropriate the U. S. assistance will be furnished in cooperation with an international coordinating mechanism.

- This is a multi-donor effort which has an established mechanism, and requires the recipient nations to coordinate and intergrate the development effort in the region.

- Rather than a fragmented approach to a given country's development needs, the Sahel program represents development in the aggregate. Each donor participates in those project areas to which it is best suited. However, the efforts of each donor are integrated into an overall development scheme.

4. Authorized Amounts.

- Two hundred million dollars was made available for this program (in addition to funds otherwise available) beginning in Fiscal Year 1978. Not over fifty million dollars was to be appropriated for 1978. The funds so appropriated are to remain available in the future until expended.

- The U. S. contribution to the overall Sahel Development Program will not normally exceed 15 percent of total contributions in any year, and will not exceed 20 percent of total contributions to the program.

5. Timing

- The President is authorized to furnish assistance, on such terms and conditions as he may determine, for the long-term development of the Sahelian region.

- It shall be in accord with a long-term multi-donor development plan.

- A long-term development plan for the Sahel is indeed a unique approach to regional development efforts. The long-term multi-donor approach to the problems of the Sahel was mandated by the Congress in reaction to the drought which brought such tragedy to this region.

- The program is to be considered in three phases: near-term (1978 thru 1981); medium term (1982 thru 1989); and long-term.

- -- A three-phase program is planned. In the near term, 1978 to 1982, activities will be designed to use existing resources and technology for crop production, protection, and storage. Integrated rural development schemes --- feeder roads (among other programs including storage) --- will be undertaken. In the medium term, 1982 to 1990, the program will continue and --- develop extensive storage facilities . . . . Over the long-term, the major resources of the region, particularly the river basins, will be tapped.

CHAPTER V - ALTERNATIVE TRANSPORT MODES AND THEIR RELATION TO THE CONGRESSIONAL MANDATE

A. GENERAL

Under legislation enacted in 1973 and 1975 the Congress directed, among other things, that the President should establish criteria to assess efforts at reducing rates of unemploymert and under-employment; and that assistance provided should be used primarily for activities specifically designed to increase the productivity and income of the rural poor through improvement of marketing facilities and systems, and expansion of local or small scale rural infrastructure and utilities such as farm-to-market roads, storage facilities and land tenure arrangements.

Further, the rural poor should participate as much as possible in the development process to ensure program effectiveness and equitable distribution of resulting benefits. AID[1] should therefore focus on programs emphasizing a strategy that includes the following broad objectives:

(a) development programs should benefit the poor primarily -- with the objective of at least narrowing the relative income gap between rich and poor;

(b) decisions about development programs should be made in cooperation with the poor to the fullest extent possible;

(c) development programs require substantial input from the poor who stand to benefit;

(d) implementing development programs becomes a learning experience for participants, yielding lasting improvements in their skills;

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(1) Implementation of "New Directions" in Development Assistance, Report to the Committee on International Relations on Implementation of Legislative Reforms in the Foreign Assistance Act of 1973, Prepared by AID, July 22, 1975.

(e) participants can improve program performance by feeding back information to program administrators directly or indirectly;

(f) participation of and benefits for women are addressed explicitly and with a view to improving their condition.

The participation emphasis of the mandate reflects the congressional view that AID expenditures should represent not consumer handouts with temporary though beneficial impact but investment in people that pays off in increased capacity to produce, the sine qua non of the developing countries' own efforts to sustain improvements in living standards.

But AID recognizes that while it is extremely important, popular participation alone will not move the poor majority above the poverty level Other inputs ranging from seeds and fertilizer to dams, farm-to-market roads, and other essential infrastructure must be available to complement labor, while health, nutrition, and training programs are needed to strengthen labor's effectiveness. Moreover, policies ensuring access for the poor to these labor-augmenting inputs and promoting their most efficient use are essential if productive capacity is to be increased. Curtailing population growth is extremely important in this process if scarce resources are to be used well.

Most transport projects and modes including those oriented toward construction, improvement, maintenance, institution building and training will satisfy to a greater or lesser degree the above criteria. This Chapter presents the best currently available information on the extent to which various types of transport projects can help meet the objectives set by the Congressional Mandate.

The focus of this chapter will be on road projects because roads, at this time, are of the greatest importance to the economic development of the Sahel, and a large amount of funds ($517 m)[1] have already been committed to this mode. In addition, as explained in Chapter VIII, expenditures on road infrastructure in the Sahel relate most closely to the requirements set forth in the Congressional mandate. Consideration is also given to rail; since this mode is owned and operated by the governments much of the impact on the rural poor that can be expected from the mode will depend on government policy with regard to service levels, fares, and tariffs. And in the Sahel, government policy is presently directed primarily toward maintaining the railroads' financial viability and charging the maximum fare that traffic will bear rather than minimizing the cost of transport to rural areas. Thus, rail expenditures are less likely to impact directly on the welfare of the rural poor and therefore do not receive as much attention in this report as do the roads.

Ports are included since the Sahel countries are vitally dependent upon ports for their imports and exports. As with rail, however, improvements in ports will probably have little direct impact on the rural poor. Airports are also considered, since expansion of airstrips in otherwise inaccessable areas may facilitate complementary regional investments. Finally, Transport Surveys and Institution Building will be briefly discussed because of the important

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(1) See Chapter III.

role they can play in improving the planning, regulation and administration of the transport system, and in enhancing rural poor participation in transport improvement benefits.

B. ROADS AND ROAD PROJECTS

Expenditures on roads fall into three broad categories:

1) Investments in construction of new roads and upgrading of old roads,
2) Expenditures on maintenance and rehabilitation of existing roads, and
3) General expenditures on studies such as transport surveys and on technical assistance aimed at improvement of the planning, administration and regulation of the road transport system.

Each of these expenditures, as will be discussed below, can have a different impact on the welfare of the rural poor. Furthermore, there are various classifications of roads and the road type that an expenditure is intended for has a bearing on the magnitude and distribution of benefits. The several road categories used in this paper are defined below.

1. Definition of Road Categories

The terminology of road types is greatly in need of standardization and considerable confusion exists on what is meant by a primary road, a secondary road and a tertiary (or feeder) road when applied to the

developing countries. Classifying the road is an essential step because, as we shall see later, not all road expenditures (new construction, rehabilitation, maintenance, upgrading) for the three road types are equally effective in increasing the welfare of the rural poor.

In this section we will attempt to define briefly the various road categories likely to be encountered in the Sahel. This categorization will be by function of the road rather than by the physical characteristics and traffic levels encountered on the road since, as we shall see, traffic levels and design standards have been observed to vary widely under the Sahel conditions. For example, in a very poor region in the Sahel a "primary" road may be nothing more than a seasonal track carrying perhaps 10 vehicles per day, whereas in a richer agricultural region a feeder road may be an all-weather gravel road with a traffic level of 80 vehicles per day.

Tertiary Roads. The tertiary road (also called by names such as feeder road, cotton road, farm-to-market road) is the most elemental type of road, whose purpose is to connect the farmer with the nearest small town and with other small villages in his neighborhood. Town is usually the center of the smallest administrative unit such as a county or municipality. It contains the local market, some basic agricultural, social, and health services, and is also the first assembly point for the farmers' cash crops.1/

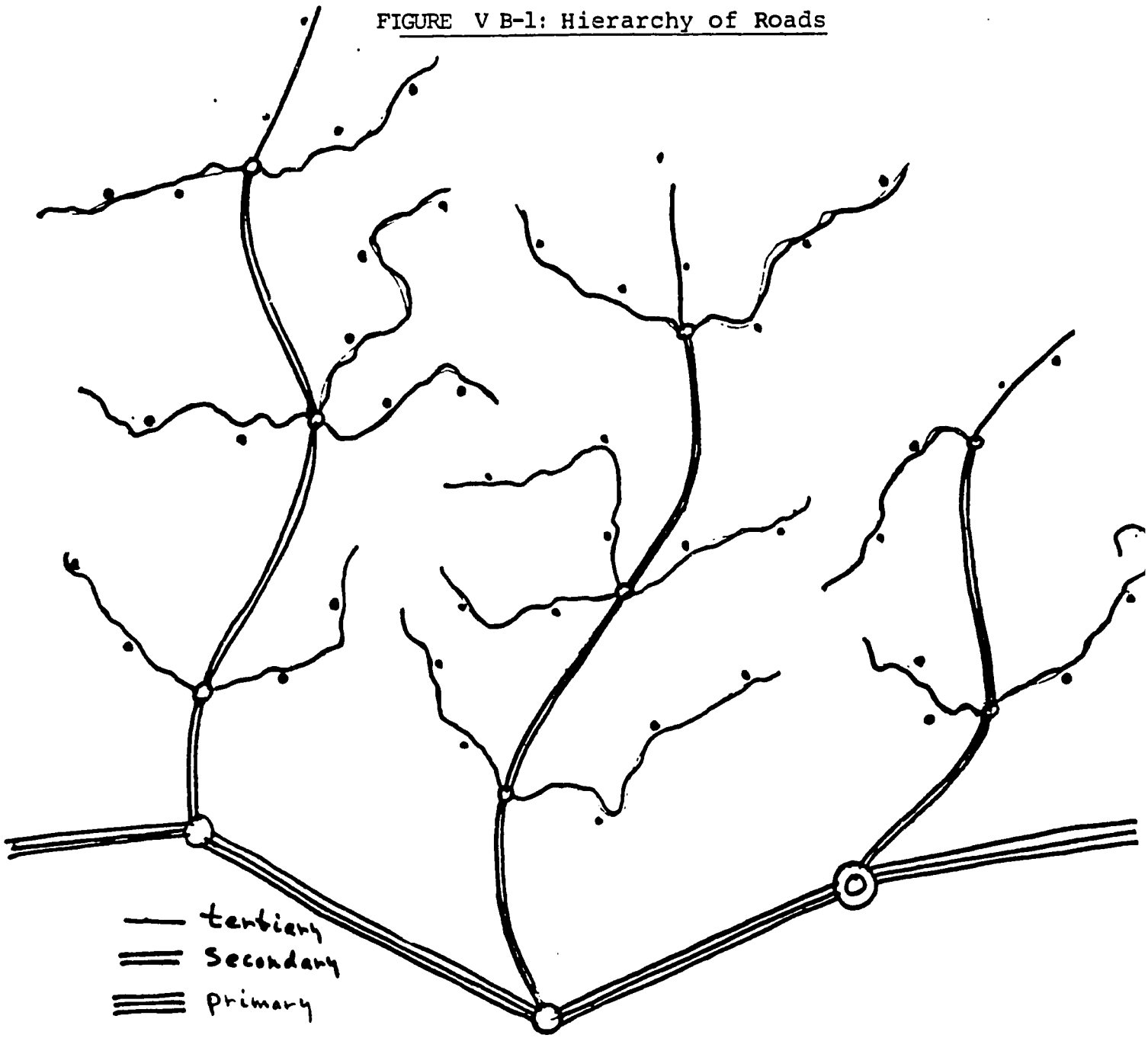
1/ (see Figure V B-1)

Villages along the feeder road typically have a population of from 200 to 2000, most of whom are directly involved in the agricultural sector. The municipality may have a population as high as 20,000, of which a small fraction may be involved in light manufacturing and services.

Feeder roads, though usually of low standards of construction and with low traffic levels may, depending on the circumstances, be excellent all-weather roads carrying quite high traffic levels. For example, a study of 37 feeder roads totalling 450 km in the Philippines showed a very skewed distribution with traffic levels ranging from a low of 9 vehicles per day to as many as 343 vehicles per day, with an average of 73 vehicles per day. It is of interest to note that a secondary road studied at the same time and located in the same area as the feeder roads had a traffic level of only 117 vehicles per day.

This large variation in traffic is due to several factors of which the most important are the population density in the zone of influence of the road, the agricultural productivity of the soil, the length and quality of the road, the bulkiness of commodity carried, and the extent of passenger traffic. The traffic composition on feeder roads consists mostly of trucks transporting unprocessed and therefore bulky agricultural products and also some passengers, and a few mini-buses transporting passengers and some cargo. Almost no private passenger vehicles will be encountered.

FIGURE V B-1: Hierarchy of Roads



- small village in a municipality with population between 200 and 2000.
- Center of municipality with a population of about 20,000
- Center of province or district or region with population exceeding 100,000
- Center of district or region with population exceeding 250,000.

In most countries, maintenance of feeder roads is the responsibility of local government.

Secondary roads. These have the function of connecting the towns with the major urban centers in the province or region such as the provincial capital. Typically, these centers are small cities with a population of about 100,000, which can provide the more sophisticated services - such as hospitals and can supply major manufactured products such as refrigerators and farm machinery. The centers also are large consumers of the farmers' products, both for direct consumption and for processing into finished agricultural products, such as groundnut oil.

Depending on the level of economic development, secondary roads can carry significant amounts of traffic with an average, perhaps, of 500 vehicles per day, and are almost always all-weather two-lane roads with a granular surface, or with a bituminous surface treatment, depending on the traffic level. In the Sahel, however, secondary roads that are nothing more than earth tracks with traffic levels of only 10 vehicles per day are observed. Even good secondary roads in the Sahel have traffic levels of only 10 to 65 vehicles per day, as observed in Chad in 1978.

Traffic encountered on secondary roads will include more passenger vehicles including a small percentage of automobiles and large buses that can carry 50 to 70 passengers. But more than half of the traffic usually consists of trucks loaded with semi-processed agricultural products such as groundnuts and raw cotton, and diverse manufactured products, including consumer goods and construction materials.

Primary roads: These roads link the main centers of economic activity in the country with each other and with the transport networks and ports of neighbors. In countries that have achieved a high level of economic development the primary roads running through rural areas are at least two-lane paved roads with traffic levels of 5,000 vehicles per day. Closer to urban centers the primary roads may be multi-lane with traffic levels approaching 30,000 vehicles per day or higher, though these levels have not and will not be observed in the Sahel for some time. The traffic composition on primary roads is usually much like that of secondary roads, but with perhaps a larger percentage of private automobiles (depending on the adequacy of passenger rail service in the country) and other passenger vehicles.

In the Sahel, the primary road traffic levels are presently very low; for example, the estimated traffic on the 157-km two-lane primary road from N'Djamena to Guelengdeng in Chad, the most

important road in the country, was only 117 vehicles per day in 1978. And the need for upgrading such a road to three lanes or higher would be far in the future. Assuming that traffic grows at a rate of 15% annually, a growth rate that would correspond to vigorous economic growth, even the need for widening that road would not arise until after the year 2000.

Truck traffic on the primary roads can account for more than 50% of the total vehicles. Trucks are loaded mostly with raw and processed agricultural products, including cotton seed, cotton fibers, peanut oil; agricultural inputs such as fertilizer, pesticides, and fuel; and manufactured products for consumption in the rural areas.

2. Benefits from Road Improvements Projects

Benefits from road improvement projects flow from: (1) reduced vehicle wear and tear stemming from higher quality road surfaces, and (2) the shorter travel times and reduced fuel consumption due to the higher speeds that are possible on the improved driving surface and from the removal of sharp curves, steep grades, or by realigning the road to shorten the driving distance. Improvements that make a road an all-weather road produce additional benefits by eliminating delays occasioned by mired vehicles or by waiting for roads to dry out and for water levels to drop at stream crossing points without fords or bridges. All these factors combine to lower, often significantly, vehicle operating costs, and enable transporters to offer lower tariffs and a higher standard of service in terms of reliability and schedule frequency. However, the vehicle operating cost reductions or "savings" may be absorbed by the truck owner, rather than being passed on to the customer as lower tariffs, depending on the degree of competition within the trucking industry and the competency and objectives of regulatory institutions.

As important to the user of transport as the possible reductions in transport tariffs, the greater reliability of transport on the improved roads, the shorter travel times, and the higher level of comfort and convenience that can be offered by the transportation service. Because of these advantages there may be reduced losses of perishable

crops, and farmers probably will be motivated to produce cash crops such as tomatoes and peppers that, without good roads, would be too risky to cultivate. In addition, the shorter travel times and improved comfort will encourage and increase the number of visits to farm villages that will be made by agricultural extension workers, health teams, administrators, and others involved in rural development. Furthermore, the increased reliability of travel will enable truck and bus operators to offer a more frequent and less variable schedule, thus eliminating the often long waiting times.

As indicated above vehicle operating cost savings may not be passed on wholly as lower tariffs to the farmers and consumers of the farmers' products. Only if transporters are competitive will the savings be passed on, enabling farmers to obtain higher prices for their products and to pay lower prices for their inputs such as fertilizers and fuel. If the industry is monopolistic, however, even though the rural population will still benefit from improved access to markets they may not participate fully in benefits from reduced vehicle operating costs brought about by the road improvement.

Chapter II analyzes the structure of the transport industry in the Sahel countries and assesses the amount of competition

that can be expected to exist in the transport industry. For countries such as Mali, where the degree of competition is not high, AID should encourage the government to institute measures to promote the competition that is required for full participation by farmers in road user savings brought by road improvement.

Even where the transport industry and tariffs are regulated by the government, the savings still may not be passed back directly to the farmer. For example, the tariff structure may not be responsive to improvements in road quality if, for example, the regulated tariff for transport on a poor road is the same as the tariff for transport on a good road. AID should be alert to these situations and should provide assistance to the government in rationalizing its tariff structure, as a condition for financial assistance in road improvements.

Other factors exist that may constrain the small farmer from realizing the full potential benefit of a road improvement project. For instance, farmers in a certain area who benefit from road improvements may be predominantly larger farmers (i.e., those who have some bargaining power vis-a-vis truckers or middlemen, or those who are able to expand production in response to lower transport costs). In such cases, the distribution of benefits may be improved by including in the project complementary investments which would enable smaller farmers to respond to the incentives created by the road improvement.

If transport savings derived from the road investment are not transmitted to producers, either because of non-competitive transport services or government controls, there may be little incentive for producers in the area to increase output. In Iran and Colombia the IBRD found that middlemen captured a large proportion of transport cost savings derived from road investments, so that the benefits to producers or consumers were minimal. Consequently, the incentive structure face by producers was not significantly altered by the road improvements and was conducive to increased productivity and output. In such cases, the only benefits to producers may be in the form of improved transport service, leading to timely receipts of inputs, efficient movements of produce, and, possibly, access to new markets. Reduced spoilage and storage requirements may result, but benefits (and developmental impact) will not be as large as would be possible if cost savings were passed on.

A similar pattern occurred in Brazil, according to an IBRD analysis of the distribution of cost savings from road improvements in three northeastern states. The analysis revealed that the lion's share of the benefits may in fact be captured by transport companies, which exert a large degree of control over the distribution system. In addition, it was observed that land tenure and agricultural credit systems may decisively influence the distribution of benefits accruing from feeder and secondary roads improvements.

For example, land-owning farmers may benefit from a road improvement while tenants may not. In all these cases, consideration should be given to policies (and complementary investments) which will optimize the impact of the road investment. Policy alternatives could relate to the modification of agricultural and transport price structures, the promotion of competition among transporters, land reform, and access to credit.

An ex-post evaluation by the IBRD of a feeder road project in Senegal found that the benefits from reduced vehicle operating costs were not directly passed on to the farmers. This occurs because the farmgate price of groundnuts, the main commodity traveling on the project feeder road is fixed by the government. There is, accordingly, no immediate link between reduction in transport cost on a specific road and ground nut production in the area of influence of the roads. On the other hand, transport cost savings which initially accrued to the agency responsible for groundnut marketing, are ultimately an element in the setting of farmgate prices. Therefore, the farmers eventually will benefit from the reduced transport cost though this may take a year or more depending upon the efficiency of the agency's administration. In this situation it is recommended that AID in the project agreement stipulate that the farmgate prices immediately reflect the reduction in transport costs brought about by the road improvement.

Section C of this chapter presents six case studies demonstrating how the improvement and construction of secondary and tertiary roads improves the incomes and quality of life of small farmers in the zone of influence of the road through higher farmgate prices by encouraging increased production through the cultivation of additional land that was marginal prior to road improvement, and by providing improved access to and from rural villages.

From experiences such as those reviewed in the six case studies, from personal observations of the determined efforts of farm communities to construct their own roads using voluntary labor, and from discussions with farmers, extension agents, and others involved in rural agriculture, most workers in rural development have no doubt that roads, especially tertiary roads, are a necessary (and up to a point also sufficient) condition for increasing productivity and incomes in an agricultural area. But in addition to the empirical evidence presented in the six case studies mentioned above, there is also theoretical evidence that improvement in transport in rural agricultural areas will increase the productivity and incomes of the farmers. A model developed by A.A. Walters[1/] deals with a rural area with an agricultural sector producing high-bulk, low value commodities that are particularly sensitive to transport prices, and is therefore particularly relevant to the Sahel. The Walters model was empirically justified by an ex-post evaluation study conducted by A. Churchill[2/] in the

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1/ Allan A. Walters "The Economics of Road User Charge, World Bank Staff Occasional Paper No. 5, 1968

2/ Anthony Churchill, "Road User Charges in Central America," World Bank Staff Occasional Paper No. 15, 1972

Western Region of Honduras, which is one of the six case studies discussed in Section C.

The relationship predicted by A. A. Walters states basically that under a number of reasonable assumptions, the incremental agricultural production along a road running through a rural agricultural area is directly proportional to the decrease in vehicle operating costsbrought about by an improvement of the road. To illustrate, if the vehicle operating cost is reduced by 10 percent, the incremental agricultural tonnage produced will be 10 percent. This rule of thumb enables us to broadly describe this impact of various types of transport infrastructure projects on farm income. This relationship was verified by Churchill, who stated;

"There can be little doubt that road improvement in the Western Region was instrumental in bringing about the increase in production. The order of magnitude of the demand elasticity for road transport (in terms of tons) encountered in the Honduran case is not far from what was predicted by the model."

Table V B-1 illustrates the reductions in vehicle operating costs that can be expected from various types of road improvements. These estimates are conservative in that only savings in vehicle operating costs and depreciation are included.

Time savings to the passengers, which can be very significant, are not counted. This table provides a broad indication of the cost savings that might result from various types of road improvement.

The table indicates, for example, that replacing a road having a gravel surface in bad condition with a good paved road would reduce the cost index from 260 to 100, amounting to a cost reduction of 61 percent. This would be reasonably representative of the cost reduction associated with primary road construction or rehabilitation. Typical feeder and secondary road construction and rehabilitation projects are such as those where an impassable (except for 4-wheel drive vehicles) gravel or earth road with a cost index of 500 is replaced by a gravel road in good condition with a cost index of 145. This could reduce vehicle operating costs by 71 percent.

Upgrading of primary roads could correspond to improving a paved road with a pavement in bad condition (204) to one with a pavement in good condition (100), with a reduction in vehicle operating costs of 51 percent. Maintenance of gravel roads would be equivalent to replacing a bad gravel surface (260) with a gravel surface in good condition (145), permitting a reduction in vehicle operating costs of 71 percent. Maintenance of earth roads by replacing an impassable surface with a good surface would give a 33 percent reduction in vehicle operating costs.

Table V D-1 - Index of Truck Operating Costs[1] on Paved and Gravel Roads in Good and Bad Condition

Pavement Type	Pavement Condition	Cost Index (units per vehicle km)	Percentage Cost Reduction From Maintenance
Paved	Good	100	51
	Fair	151	
	Bad	204	
	Very Bad	257	
	Not Passable[2]	500	
Gravel	Good	145	44
	Fair	189	
	Bad	260	
	Very Bad	334	
	Not Passable[2]	500	
Earth	Good	334	33
	Not Passable[2]	500	

For example: For primary road rehabilitation from very bad paved (257) to good paved (100) the cost reduction would be 62 percent. For secondary and feeder road improvement from impassable gravel or earth (500) to good gravel (145) the cost reduction would be 71 percent. Maintenance of paved on gravel road is assumed to restore the pavement from bad condition to good condition. Thus, the cost reduction from maintaining a gravel road would lower the cost index from 260 to 145, a reduction of 44 percent.

(1) Running costs only.

(2) Passable only to 4-wheel drive vehicles.

SOURCE: Mindanao Secondary and Feeder Roads Project, Asian Development Bank. Manila, Philippines, August 1977.

By combining the relationships developed by A. A. Walters regarding the increases in agricultural production that can be expected from reductions in vehicle operating costs and the cost reductions shown in the preceeding table, the effects of the various road transport projects on farm income in the zone of influence of the road can be estimated. For example, the largest impact on farm income (71% increase) would be generated by the secondary or feeder road improvement projects. Primary road construction would provide a 62% increase, followed by primary road maintenance (51%) and secondary or feeder road maintenance (44%). (See Table V B-2)

A change in the assumption made by A. A. Walters of perfectly elastic demand for the farmers' production and the supply of factors such as farm labor will somewhat lessen the impact of the road. For example, the Western Honduras case study indicated that the increase in production after road improvement in the zone of influence after the 50 percent decrease in transport cost was only 38% whereas ideally it could have been 50 percent. Nevertheless, this still is a substantial increase.

It is worth noting that the Walters model deals solely with the impact of transport cost reduction by road improvements and does not make any assumptions about complementary investments or services provided by the Government. Thus, the increased farm income is produced solely by the higher farmgate price and the placing into cultivation of formerly marginal land. But even though the predicted increases solely due to road improvement are substantial, the full development potential of the road improvement project can be realized only if complementary investments are provided in the area served by the road. The beneficial impact of the road could be many times multiplied, and the rural development could best be promoted through an integrated package of investments with roads constituting only one of the elements.

TABLE V B-2: POTENTIAL IMPACT OF THE VARIOUS TRANSPORT INFRASTRUCTURE PROGRAMS ON THE PARTICIPATION BY THE RURAL POOR

	AREA OF PARTICIPATION		
	Raising Income of Rural Poor.	Increasing Employment of Rural Poor through Labor Intensive Methods.	Skill Development, Local Decision Making, Woman Involvement, and other.
Roads			
Primary road construction and improvement	High	Medium	Medium
Secondary and feeder-road construction and improvement	Very High	High	High
Primary road maintenance	High	Very High	Very High
Secondary and feeder-road maintenance	High	Very High	Very High
Rail			
Rail construction and improvement	Low	Low	Low
Rail Maintenance	Medium	Low	Low
Ports			
Port improvement and construction	Low	None	None
Airports			
Airport improvement and construction	Unknown	Low	None
Technical assistance in the planning, administration and regulation of transport	Significant potential depending on conditions in the country.	High	High

3. Benefit from Labor-Intensive Road Projects.

In addition to the benefits accruing from the improved access provided by the road project, the actual construction and subsequent maintenance of the road may generate significant additional benefits if the proper labor-intensive methods are applied. In a region such as the Sahel where widespread unemployment and underemployment are a cause for increasing concern, it is generally acknowledged that productive employment opportunities must be created for large segments of the population to achieve economic development with distributional equity. The pool of unemployed and underemployed labor in the Sahel is an important resource which could contribute to real capital formation and income if the proper labor-intensive technology could be found to employ the resources productively.

The technical feasibility of the substitution of labor for machinery has been confirmed for a wide range of construction activities. (By technical feasibilitywe mean that labor intensive methods do not require both more labor and more equipment to produce the same output.) However, the economic feasibility of labor-intensive methods, which depends on the relative costs of labor and machines, has not yet been fully assessed because of the lack of adequate information on the productivity of labor under various circumstances.

Evidence collected to date indicates that great care must be taken to select appropriate labor-intensive techniques. Traditional labor-intensive methods often were not competitive with modern equipment even at extremely low wage rates because of (1) the inefficiency of the technology employed by the labor using inferior handtools; and (2) a lack of proper organization and management resulting in low incentives and unproductive

labor. Both of these faults stem from the fact that the emphasis of labor-intensive methods has been on employment creation using make-work techniques, rather than on maximizing the productive use of labor.

With superior tools, high incentives, and good management, it is now generally acknowledged that labor-intensive methods offer considerable potential to be competitive with capital-intensive methods for wages under $1.00 per day at present prices for equipment and fuel. For wages above $2.00 per day, labor-intensive methods are unlikely to be economically justifiable. For wages between $1.00 and $2.00 per day the economic viability of labor-intensive methods will depend on a number of factors.

Because of the potential for applying labor-intensive methods, the maintenance of primary, secondary, and feeder roads in Table V B-2 is rated "very high" in terms of the use of underemployed and unskilled labor. As an employer of labor, maintenance projects have an advantage over construction projects because they allow greater flexibility in scheduling. Unlike construction projects, maintenance need not occur at a steady pace throughout the year; it can be minimized during the harvest season when agricultural labor usually is in short supply, and can then be resumed at a high rate after labor again becomes under-utilized.

Secondary and feeder road construction and improvement are still rated high, while primary road construction and improvement are rated lower in their capacity to utilize unskilled labor. The lower quality design standards of low volume roads, such as tertiary and secondary roads can more effectively use unskilled labor than the flexible pavements of primary roads where capital intensive techniques are usually required to ensure adequate compaction and pavement surface of acceptable quality. While flexible pavements with low grade surfaces have been constructed under labor-intensive methods, losses from foregone savings in vehicle operating costs have been relatively high - and might be large enough to offset gains from using labor-intensive methods. Further research is required on this subject.

Rail construction and maintenance can in principle also utilize labor-intensive methods. However, rail lines are usually more distant from village sources of labor and this may present a mobilization problem, making these techniques less applicable to rail than to roads. Airport construction, even for small airstrips, does not seem to offer potential for labor intensive

techniques because of the large proportion of earth-moving, leveling, aggregate application and compaction involved. Bulldozers, dumptrucks, loaders, graders and compactors have a decided advantage in these tasks compared with manual labor. However, no recent research appears to have been published on the suitability of labor-intensive methods to airport construction. U.S. military records may be a source of information concerning wartime construction projects with labor intensive components.

Port projects do not offer great potential for labor intensive methods since they consist largely of activities such as dredging and pile driving, that are unsuitable for manual labor. Furthermore, ports are usually located close to urban centers rather than rural villages making it less feasible to mobilize rural labor resources.

Finally, it should be noted that technical assistance projects in the planning and administrating of transport can play a very useful role by ensuring that labor intensive alternatives are considered during the early stages of project preparation, rather than being included as an afterthought.

Opportunities for Other Forms of Participation by the Rural Poor. Potentially labor-intensive activities such as road maintenance also offer excellent opportunities for the rural poor to participate in the development process through: 1) learning experiences which would increase their technical and organizational skills, 2) contributing to the activities from which they benefit by assisting in project planning and implementation and 3) involving the participation and contribution of women. Labor-intensive activities involve substantial unskilled labor requiring a much greater amount of supervision than capital-intensive projects. For example, one bulldozer may be equivalent in output to 250 laborers working in groups of

25 each, but it requires more than a dozen trained workgang leaders and foremen to manage a job that, using capital intensive techniques, would take perhaps two men and a bulldozer. For a labor intensive project to succeed, it is therefore essential that large numbers of site supervisors be trained in labor supervision and management. These training programs are usually "in-service," and subsequent implementation of the project can produce experienced workgang leaders thereby increasing the human capital resources in the country. If permitted by the local culture, there is also ample opportunity for women to participate in this work.

C. ECONOMIC AND SOCIAL WELFARE BENEFITS OF ROADS: CASE STUDIES

Six case histories are provided to illustrate the impact of improved feeder and secondary road access on the lives of rural populations. The examples are from Malawi, New Guinea, Korea, the Philippines, Honduras, and Costa Rica. Findings from the case studies could generally be applicable in the Sahel, but caution is necessary. Though substantial benefits to the farmers were generated by each of the six road improvements, benefits of new access roads do not accrue automatically; provision of better roads does not necessarily result in lower freight rates to the shipper. This is because government regulations and restrictions on road transport can reduce or distort competition, and in the absence of competition savings in vehicle operating costs can be pocketed by the vehicle owners and middlemen, rather than passed on to consumers and farmers.

It is of interest to note that all six of the road improvement projects were isolated projects, and not part of a planned rural development package. Nevertheless, as is pointed out in the case study on Costa Rica, the road improvement projects by themselves stimulated additional investment in agriculture, produced substantial increases in rural income and, in addition paved the way for additional infrastructure investment such as for rural electrification and the construction of additional feeder roads. Furthermore, the improved access made possible significant upgrading of government services such as the provision of agricultural extension and credit. These services reinforced the benefits that would have followed from road improvement alone.

1. Malawi Case Study

Statistically controlled studies of the effects of feeder road access to markets on the social, financial and technologic aspects of farm life in developing nations are rare. Such a study was made in Malawi in 1965 in connection with the feasibility investigation of 300 miles of new roads into a hinterland with little access to the main road system for the small farmers.[1/] An agricultural census of the area was about to be undertaken and the road investigators were able to obtain and stratify the newly available, raw census data according to whether or not the farm had access to the road system. A total of 110 farms were sampled for this purpose, with 55 in each category. At the time, the average annual per capita income was 12 pounds, or U.S. $30, with 40 percent of that in equivalent subsistence income (food produced and consumed by the same people), so that the monetary increment effected by road access was small in absolute terms. Yet, as will be seen, the difference brought by road access to markets on the lives of the farmers was tremendous.

The Table below shows the cash income distribution in Malawi pounds of the farm operators living in the two general study areas.

Farm Operator Categories	Income in Malawi pounds, annual				
	< 1	1-10	11-25	26-50	51+
Area 1					
Lake Littoral area (isolated), %	35	40	20	5	0
Area 2					
On North-South Road (or not over 5 miles from a road to it),%	16	58	19	6	0

1/ Some large estate growers of the area produced tea for export, using a lake steamer for transport to market.

In cash income terms, the apparent effect of road access to markets was to reduce by half the proportion of small farmers with cash incomes of under one pound per year. Most of the shift was into the next bracket of one to 10 pounds. This effect may seem small, but in the lives of the farmers it was notable that at least 19 percent of the farmers left subsistence farming and entered the cash economy under conditions of better access. More striking are the statistics that 40 percent of the farmers in the Lake Littoral area reported no cash farm expenditures whatsoever, whereas only 12 percent so reported in the more accessible area. The comparison of the use of fertilizer (animal and/or commercial) was similarly striking: 2 percent versus 31 percent.

No farm operator on the Lake Littoral (poor access) reported any kind of power other than human in working the farm, and none reported owning a plow. In the more accessible area, on the other hand, 47 percent of the farm operators reported using oxen, 5 percent reported a plow, and 47 percent reported "other equipment." The tools used where there were no plows were the short-handled hoe for breaking the ground (to a depth of 7.5 to 10 cm), and the hand axe or the panga (a broad-bladed tool similar to a machete) for clearing ground or cutting stalks.

Another technological difference was in the means of obtaining water. Only 27 percent of the farmers in the lake area obtained water from bore holes, compared to 55 percent along the road area. The alternative to obtaining water from bore holes was hand-carrying or head-carrying it from available streams or the lake.

Though the amount of shillings or pounds was small, the median amount spent for farm operating needs in the accessible area was over 2 1/2 times as great as in the lake area. The expenditures were for fertilizer, insecticide spray, seeds and plants, labor, work animals, livestock, equipment, and local transport. These are the kinds of essentials that help raise the small farmer's existence up from the poverty level. An important element in all this is not just the farmer's access to markets, but also agricultural extension agents' improved access to the farms, allowing them to advise and assist small farmers in adopting improved agricultural technology. The effect on the next generation, the children of the farmers, facilitating their access to schools and health centers was perhaps the most important impact but was incalculable from the census data used in this study.

The statistics fail to show the true effects on human life of the road connection to the market economy of this southeastern African nation. Consider the fact that only human labor was employed in the area without road access; whereas in the area with access, virtually all the farmers used animals, some with plows, and the rest used equipment additional to the short-handled hoe and panga (macheté). Consider the human effort saved by the additional 28 percent of the farmers in the road area whose families no longer carried water from streams for personal and farm use. Finally, the use of insecticides and fertilizers, virtually unknown in the inaccessible area, but used by about a third of the farmers in the road-connected area, represented crop insurance and assurance of yield. These are the basics of life for the small farmer. For much of this difference, we have to credit the effec-

tive agricultural institutions of Malawi in terms of its administration, demonstration and research programs, and for its outreach in terms of field advisers, many of whom traveled to the field on bicycles. These efforts helped achieve the full potential of the road improvements.[1/]

1/ Source: Economic and Engineering Survey of the Proposed Lakeshore Road, Malawi. A report to the Government of Malawi and USAID, 1966, Contract AFR-278. H.S. Lapin, et al, Washington, D. C.

Philippines Case Study[1/]

This study strongly supports the conclusion that where agricultural potential is good but roads are poor, improved access will result in substantial increases in agricultural production. There are many reasons for this: First, the road improvement exposes traditional farmers to the attractions of higher living standards usually found in nearby towns and small cities. He is motivated to intensify agricultural production in order to earn cash to purchase more consumer goods. Secondly, the road improvement reduces risks associated with farming. Crop-spoilage in the fields or after harvest, which frequently occurs in remote areas when rain makes the roads impassable for a prolonged period, is virtually eliminated with all-weather roads. Further, provided adequate extension service is made available (a complementary investment) the risk of cultivating modern high-yielding crop varieties is reduced by the closer contact between farmers and technicians. Today many roads in rural areas of the Sahel are so bad that agricultural technicians are disinclined or unable to visit the farms. Consequently, small farmers are not exposed to improved agricultural technology, access to credit, or other necessary agricultural inputs.

1/ Villanueva, Patrocinia S. "The Value of Rural Roads" Community Development Research Council, University of the Philippines, 1968

The Villanueva study quantitatively analyzed the producers' response to road improvements. The author investigated changes in barrio (small village) productivity and living conditions after the rural roads leading to the barrios were improved. Among the benefits she attempted to measure were: (1) changes in farmgate prices (2) changes in production volume and (3) changes in transport cost. A total of 46 barrios were included in the study, and the locations were evenly distributed over the Philippines and represented both level and mountainous terrain. In general, the study supports the proposition that farmgate prices will increase measurably whenever roads to a barrio are improved. The volume of products sold also increased measurably and showed the largest increases for crops such as corn and tobacco. Table V C-1 shows the percentage increase in sales volume (by weight) for the major farm crops covered in the survey. Significant changes in transportation prices were also observed. Table V C-2 illustrates the decrease in freight rates for major crops produced by a barrio. In general, thereductions in transport price after improvement of the road were appreciable, ranging from a 33 percent reduction for bananas to a 60 percent drop for root crops. And this involved only those barrios where motorized transport was available before the road improvement. In those cases where animal transport or porters only were used (the "without" road improvement case) and where motorized transport could be used with road improvements, reductions in transport prices would be even more substantial.

The surveys in the barrios provided qualitative evidence that where roads were reliable and passable, farmers had a reasonably wide choice available between transporters, suppliers, and middlemen. There were very few

TABLE V C-1

AVERAGE PERCENTAGE INCREASES IN SALES VOLUME COMPARING ONE YEAR BEFORE AND ONE YEAR AFTER CONSTRUCTION OF THE ROAD

Crop	Number of Barrios	Unit of Measure	Percent Increase
Rice	22	cavan	24
Corn	20	cavan shelled	104
Tobacco	10	kilogram	96
Barianas	14	pieces	12
Coconut	9	thousands	30

Source: P. S. Villanueva, "The Value of Rural Roads," Univ. of the Philippines, 1968

TABLE V C-2

AVERAGE DROP IN TRANSPORTATION COST OF FARM PRODUCTS AFTER CONSTRUCTION OF THE ROAD

Product	Price Unit	Transportation Price		Percent Reduction
		Year Before (pesos)	Year After (pesos)	
Rice	Cavan/Km	.20	.10	50
Corn	Cavan/Km	.50	.30	40
Tobacco	Truckful/Km	.50	.30	40
Rootcrops	Sack/Km	.50	.20	60
Bananas	Jeepful/Km	.15	.10	33
Coconuts	Truckful/Km	10.0	5.0	50

Source: P. S. Villanueva, "The Value of Rural Roads,"

complaints concerning exploitation by transporters or middlemen that could be attributable to the road, and there were a sufficient number of independent truckers to offer a competitive environment. On the other hand, on long unimproved roads and tracks there were generally fewer transporters and middlemen to service remote barrios; both transporters and middlemen had some degree of monopoly power. But after road improvement and after the barrio became more accessible this situation tended to correct itself, and increased competition between transporters helped ensure that the savings in transport were passed on to farmers via higher farmgate prices.

3. Korea Case Study[1/]

This study of feeder roads is a comparative analysis of the impact of access on two upland villages between Kangning City and Seoul. The environment and point in time are similar in most respects, except that one has a road and the other does not. One village, Hwangeke-ri (H-ri) is on the main east-west route between the cities, the other Yonsan-ri (Y-ri) is seven km off the road. Agriculture has been very similar in the two with a growing season shorter than average in the country. In general, H-ri, on the road, is developing a commercial agricultural industry while Y-ri shows less possibility of meeting food demands from other areas.

Commercialization

Table V C-3 compares the range of crops and degree of commercialization in the two villages.

1/ Lee K. K. "Some Effects of Roads on Agricultural Production and Rural Life", M.S. Thesis, Seoul National University, Department of Agricultural Economics, Seoul, 1969

Table V C-3 [1/] : Degree of Commercialization by Location

Crop Category	H-ri (On road)		Y-ri (7 km off road)	
	(Hectares)	(%)	(Hectares)	(%)
Commercial				
Potatoes	65.21	40.0	25.05	24.5
Radishes	39.22	23.2	14.05	13.8
Cabbages	2.36	1.4	1.14	1.1
Chinese Cabbage	3.18	1.9	.93	.9
Celery	1.06	.6	0	0
Lettuce	1.63	1.0	0	0
Carrots	1.21	1.7	.09	1.0
Total	113.87	69.8	41.26	41.2
Subsistence				
Corn	20.35	12.5	29.18	28.6
Soybenas	18.76	11.5	14.95	14.7
R. Beans	1.59	1.0	3.78	3.7
Millet	.25	.3	.54	.5
Buckwheat	3.14	1.9	5.00	5.8
Rye	1.75	1.1	3.28	3.2
Others	3.28	1.9	2.38	2.3
Total	49.12	30.2	59.11	58.8

Overall, farmers in H-ri are producing seven commodities for sale, totaling 70 percent of total hectares in production. Farmers in Y-ri are selling five commodities grown on 41 percent of a smaller total acreage. The other 58.8 percent of hectares in Y-ri are in subsistence crops, mostly corn and soybeans. H-ri is concentrating on perishable commodities with higher gross value product (GVP) per tanbo.[2/]

In order of decreasing GVP:

1. Celery.
2. Lettuce.
3. Chinese Cabbage.
4. Potatoes.
5. Carrots.
6. Cabbage.
7. Rice.
8. Radishes.
9. Corn.
10. Millet.
11. Soybeans.
12. Red Beans.
13. Buckwheat.
14. Rye.

1/ Lee K. W. "Some effects of Roads on Agricultural Production and Rural Life", M.S. Thesis, Seoul National University, Department of Agricultural Economics, Seoul, 1969.

2/ 1 hectare = 10 tanbo

There is no celery or lettuce in Y-ri, and much less Chinese cabbage, potatoes and carrots. The different rates of commercialization are in part due to availability of farm-to-market transport, but roads also permit better communication of market information and new production practices essential to commercial operation. With greater emphasis on high value crops, farmers obviously can earn more return per hectare. Average GVP in H-ri is 11,900₩; in Y-ri it is 6,800₩. Table V C-4 shows road proximity in relation to farm size.

TABLE V C-4 [2/] Farm Size Related to Road Proximity

Size Farm (tanbo)[2/]	H-ri: (Households)	(%)	Y-ri: (Households)	(%)
< 5	—	—	—	—
5-10	3	6	3	6
10-20	8	16	16	32
20-30	17	34	19	38
30-40	9	18	7	14
40-50	5	10	4	8
50-60	3	6	1	2
> 60	5	10	--	--
Total	50	100	50	100

[1/] 10 tanbos = 1 hectare

In H-ri, 10 percent of the farm households have more than 60 tanbo (6 hectares), and 26 percent greater than 40 tanbo (four hectares). In Y-ri, only 10 percent are greater than four hectares, and none over six. Farmers in H-ri are renting productive uplands and raising perishable commodities.

Net Return: Prices paid to farmers are higher in H-ri than in Y-ri for the same commodity because of the lower costs of transportation for farms on the road, adding to the comparative advantage in H-ri. Transportation costs are an important consideration in Korea, in many cases

[2/] Ibid, p. 29.

amounting to over half the wholesale cost. Price comparisons appear in Table V C-5.

Table V C-5 Comparative Commodity Farmgate Prices (1967)

Crop	Unit	H-ri price (won)	Y-ri price (won)
Corn	100 Liters	1,617	1,400
White Potatoes	3.75 kg.	56	54
Soybeans	100 liters	3,540	3,460
Radishes	4 tons	16,400	14,900

Farmers in H-ri spent more on farm inputs, and acquired more production credit than did those in Y-ri, as shown in Table V C-6 suggesting more intensive cropping in the former.

Table V C-6 Expenditures for Inputs and Credit (1967)

Expenditure	H-ri (Thousand Won)	Y-ri (Thousand Won)
Fertilizer	215[illegible].7	1001.2
Insecticides	698.0	100.8
Credit	—	—
Private	131.3	36.5
Cooperatives	60.5	12.6

Value: There was more hired labor per farm in H-ri and more farm machinery. Farms are worth more in the village with good transportation facilities, because the farmer invests more and the productive capacity of the land increases, as shown in Table V C-7.

Table V C-7 Value of Farm Assets

Item	H-ri (Thousand Won)	Y-ri (Thousand Won)
Farm Buildings	161.5	29.4
Arable Land	724.0	275.0
Cattle	60.1	51.7
Total	963.6	357.6

Further, one pyong (approximately equal to 1/3000 hectare) of rice land costs 68.5 Won in H-ri and 50.3 Won per pyong in Y-ri. Uplands were 75.8 and 36.5 Won respectively and forest land 2[illegible].0 and 6.0.

Outside Employment

Other social characteristics further demonstrate the differences between the two villages. Of samples of 50 farmers in H-ri and Y-ri, 15 in H-ri had off-farm jobs and 20 in Y-ri, but off-farm income totaled 1,043,000 Won in the former and only 192,660 Won in the latter. With greater diversification of activity near the road, the range of job alternatives was greater.

Frequency of Travel to Larger Cities

Availability of transportation to both Seoul and Kangnung influenced the frequency of visits by residents of H-ri. As noted in Table V C-8 farm-related trips were much more frequent there than in Y-ri. Effective response to market conditions for inputs, retail sale, processing and other production activities requires dependable transportation.

No attempt is made to argue that the presence or absence of a road is the only factor causing the economic and social differences between the two villages. But transportation can facilitate and encourage a

whole series of institutional changes that become the substance of economic development. Without roads that permit frequent trips with large trucks year-around, agricultural development is unlikely to proceed very dramatically.

Table V C-8 Number of Trips -- Two Rural Villages, Jan. - Aug. 1968

Purpose	H-ri		Y-ri	
	To Seoul	To Kangnung	To Seoul	To Kangnung
To get credit	1	14	0	4
Buy inputs	8	68	0	36
Non-farm business	1	28	1	3
Recreation	8	8	2	13
Education	1	72	0	10
Sell Products	39	7	0	1
Public Affairs	0	5	0	0
Hospital	0	14	0	18
Mkt. Info.	1	0	2	0
Home Affairs	5	206	1	62
Other	2	0	0	0
Total	66	449	6	47

4. Honduras Western Highway

This study is one of the earliest examples of research conducted to measure increases in agricultural production that can be expected from the improvement of a highway; it is discussed in "Road User Charges in Central America", by Anthony Churchill, World Bank Occasional Papers,

No. 15, 1972. The purpose of the study was to test the validity of a model developed by Alan A. Walters, "The Economics of Road User Charges" World Bank Occassional Paper No. 5, 1968. This model describes the relationship between road improvement and increases in agricultural production within the road's zone of influence. It also describes changes that can be expected in the extent and shape of the road's zone of influence. Briefly, the Walter's model predicts, under reasonably realistic assumptions, that a decrease in transport price will induce a proportionate increase in the tonnage of agricultural production, and will increase the area of the road's zone of influence. Thus, if because of road improvement the transportation cost per kilometer is reduced by 10 percent, one can expect a 10 percent increase in the tonnage production of agricultural production.

An empirical test of this model was carried out by the ex - post evaluation of incremental agricultural output and its spatial distribution along the Honduras Western Highway improvement. Since 1955 the Western Highway has been improved in various stages from an earth road useable only in the dry season to a well aligned gravel road. Agricultural censuses covering the periods both before and after improvement in the road were available, and the census units were small enough to yield meaningful results.

For most of its length the road follows a valley of varying width and twice crosses a sizeable mountain range. The land is about equally suitable throughout the entire length of the road for cultivation of corn and beans, the two major agricultural commodities produced in the area.

Transportation from the farms to the Western Highway is mainly by donkey, and in some cases by 4-wheel drive vehicles, since only a few feeder roads existed in the area of influence of the road before road improvement. The improved portion of the road extends for about 200 kms.

Table V C-9 demonstrates that the rate of growth is consistent with the pattern of cultivation predicted by the model. Growth rates are low close to the market town of San Pedro and increase rapidly up to about 126 kms. from the market town. After that point there is a predicted "trailing off" of the growth rate until the end of the road is reached. These observations and other evidence discussed in the study tend to support the theoretical soundness of the model, and increase the confidence that can be placed in the theoretically predicted values of the producer response to road improvement.

The study indicates that one can expect a substantial reduction in truck operating costs of the Western Highway after improvement. In addition, trucking in Honduras is very competitive; there is free entry and most truck operations are the owner-operator type. Hence, one could expect that a substantial proportion of costs should be passed on in the form of lower freight rates. In the case of the Western Highway, reductions in vehicle operating costs were estimated to be quite large. In 1950 the road was not an all-weather road, while the present gravel road is of a very high standard. The improved road is also shorter than the old road, and savings in vehicle operating costs were estimated to be on the order of 50 percent.

Table V C-9

PRODUCTION OF CORN AND BEANS IN THE WESTERN REGION (HONDURAS) BY MUNICIPALITY GROUPS

Municipality Group	Average Distance in Kms from San Pedro	Production in Quintales		Percent Increase
		1950	1966	
San Pedro				
(market) 1	0-21	51,885	53,297	2.7
2	60	67,651	97,092	43.5
3	72	87,516	173,032	97.7
4	126	72,461	155,023	113.9
5	129	117,948	201,090	70.5
6	131	45,442	76,147	65.6
Santa Rosa				
(market) 7	170	90,669	123,983	36.7
8	185	61,210	63,542	3.8
		594,782	943,206	58.6

Source: Anthony Churchill, Road User Charges in Central America, World Bank Staff Occasional Paper No. 15, 1972

The proportionate increase in the production in corn and beans (from 594,782 quintales in 1950 to 943,206 quintales in 1965) amounted to 58 percent. However, it was estimated that about 20 percent of this additional agricultural production would have occurred anyway, even without the road improvement, and therefore the percentage increase in production that could be attributed to road improvement would have been on the order of 38 percent. Thus it can be seen that the percentage increase in agricultural production was approximately equivalent to the percentage decrease in vehicle operating costs of the improved road.

In summary, there can be little doubt that improvement of the Western Highway was instrumental in facilitating the increase in production. The order of magnitude of the increase in production is not far from what was predicted by the model.

5. The Canas-Upala Road in Costa Rica

The Canas Upala road is one of the longest and most expensive in the second stage rural road program in Costa Rica funded by the Inter-American Development Bank. The 60-km long earth road was difficult to negotiate in wet weather and was reconstructed to all-weather gravel standard. Reconstruction of the road was completed in 1977 and a socio-economic survey was carried out in the area of influence of the road.

The City of Upala, located at the end of the road, serves a market center and is a focal point for the distribution of government services to at least half the area of influence of the project. The survey indicated that the socioeconomic impact of the road was favorable. With construction

of the road, total production and the level of government services applied to Canas-Upala and to the surrounding area increased substantially. These services included agricultural extension services, credit, farm price support, water, health care, education and electrification. A malaria eradication program was introduced. Intensive agricultural extension courses in the production of rice, beans, and sorghum were provided. A secondary school was established.

Purchasing agents from the government price support program began to go directly to Upala from surrounding communities (this means that the classic role of the intermediary/transporter associated with the isolated rural community was largely eliminated). A rural telephone project was planned for the area, and parallel investment in 23 local agricultural feeder roads is taking place.

New agricultural crops (perishables) have been introduced which are very sensitive to transportation since they can be damaged in transit or can deteriorate quickly if a vehicle breakdown occurs. These new crops include tomatoes, sweet chili peppers, and green peppers. In total, production of these vegetables increased from 73 tons in 1975 to 154 tons in 1977.

Extraction of lumber has increased from 667,000 board feet per year in 1974 to an estimated 1,600,000 board feet in 1978. This activity is associated with the clearing of new land opened to agriculture.

The slaughter of cattle was up from 1,000 head in 1973 to an estimated 8,000 head in 1978.

The sale of fertilizers, insecticides and herbicides are indicative of changes in technology and productivity brought about in part by these improved roads. The use of insecticides and herbicides requires more complex technology than fertilizer. Prior to 1975, there were no local sales of fertilizer in Upala; fertilizer was brought from another town 60 to 70 km away from Upala. While in 1975 local sales from one representative included 7,000 sacks of fertilizer, by 1978 the estimated amount was approximately 30,000 sacks. Insecticides went from three 55-gallon drums in 1975 to approximately 30 drums in 1978. Herbicides increased from approximately 10 drums in 1975 to about 40 drums in 1978.

Agricultural seminars which indicate the acceptance by the local population of changes in technology were held in 1976 and 1977. About 60 people attended the 1976 conference, dedicated to rice and beans. In 1977, approximately 200 people attended a similar intensive course.

Between 1973 and 1977 the small farmer credit portfolio of the National Bank of Costa Rica in Upala increased its loans from $44,000 to $270,000. These loans were for rice, corn and bean production. Loans for breeder cattle during the period declined from US $29,000 to US $1,650. This seems to indicate that grazing land is being converted to the production of cash crops.

Prior to the completion of the road in 1977 no crop insurance was available; the completion of the road can be associated with the present availability of crop insurance.

In summary, the area of influence of the road has been firmly incorporated into the national economy of Costa Rica. The population has experienced a rising standard of living and enjoys access to surpervised credit, crop insurance, health services, markets and education. The area has experienced a mini-boom during the past 5 years, the effects of which appear to be widely distributed among all the socioeconomic strata of the area.

6. The New Guinea Case Study[1/]

A careful socio-economic study was conducted in New Guinea several years after the completion in 1965 of the 38-mile stretch of road from Port Moresby to Rigo. (The road continues for another 12 miles to a point called Kwikila). The 38-mile section was estimated to cost about A$17,000 per mile, and the identifiable B/C ratio (employing projected cargoes and discount rates of 6 percent for public capital and 6.5 percent for private capital) was about 4.9. This B/C ratio does not take account of social benefits or savings in travel time, both in which forms of benefit are judged to be considerable by the several Australian social scientists who conducted the detailed study.

Effects of the new road in stimulating agricultural activity by small farmers for cash-crop purposes were greater than originally anticipated. Most of the expansion in village agriculture by indigenous small farmers occurred with almost no assistance or encouragement from government

1/ The Rigo Road: A Study of the Economic Effects of New Road Construction. Marion W. Ward. New Guinea Research Bulletin No. 33. New Guinea Research Unit, The Australian National University, Canberra and P. O. Box 1238, Port Moresby, New Guinea. Jan. 1970

agencies (unlike the case in Malawi). The few European farmers remaining in the area benefited considerably, in that they began cattle and poultry raising and some established general stores. Their example provides an argument for cattle raising by New Guinea small farmers, which would further raise their potential income. (This potential is not included in the benefit/cost calculation).

A further finding was that economic effects (increased income) extended to an area "several miles" beyond vehicle access, which could be an argument for additional tributary roads to the Rigo Road.

The improved transport from the regional capital (and ocean port) of Port Moresby is believed to have encouraged trained teachers and health officers to work in the various villages and in Kwikila (the outlying market town) thereby assisting in raising levels of health and education for the small farmers and their families.

Other measures of change were in terms of road transport prices. The scant data indicated a drop in such prices, but it is difficult to generalize the proportion. More measurable was the increase in numbers of owned vehicles in the road's service area. Eventually a number of jobs will be created in terms of small service units (run by the local people) such as gasoline stations, repair garages, restaurants and perhaps some small motor lodges for travelers.

In summary it can be said that, three years after completion of the 38-mile stretch, the value of village garden produce sold in Port Moresby from the service area of the road increased manyfold, and that about

18,000 people benefited by greatly increased accessibility to the health, cultural and economic facilities of Port Moresby. The peoples' lives are being immeasurably changed, in terms of entering the money economy, and in terms of becoming a part of the world outside their villages.

The success of the Rigo Road project has opened up new possibilities for development in New Guinea, and provides a model for broader planning on a regional scale in agriculture.

Note: It was not possible to learn from the report the formation or road width of the Rigo Road, nor any aspect of its design other than average cost per mile.

D. RAIL PROJECTS

No empirical evidence nor theoretical models appear to have been developed on the impact of railline improvement on the incomes of the rural poor. In addition, the role of the railroad in the transport sector is quite different from that of roads. Where rail is available as in Mali and Senegal (Mauritania's rail system is not really representative since its sole purpose is to serve an iron mine), the railways usually provide the major means for carrying international traffic to and from the ports while at the same time accommodating significant domestic passenger and bulk freight traffic. This is a somewhat different function from that performed by roads, and it is therefore difficult to generalize from the experience gained from roads.

However, rail improvement could have a significant impact on the income of the rural poor. For example, Table V D-1 shows that agricultural products consitute more than 88 percent of the ton-km of the Mali railline export movements. And, the imports of fertilizers (10% of ton-km) and foodstuffs (20% of ton-km) and other commodities largely purchased by the poor (some of which may be urban poor) are significant. Furthermore, very substantial savings are possible in rail transport costs through proper maintenance and more efficient operation. For example, the internal rate of return measured by the IBRD for railway projects completed between 1964 and 1972 ranged from 10 percent to 23 percent with an average of 15.3 percent, and indicating that rail projects can be quite efficient in increasing national income. However, this additional income may not directly accrue to the rural poor in the form of lower fertilizer prices for example, because savings in operating costs do not necessarily lead to lower freight rates Instead, these savings are usually contributed to the Government's general fund or to

TABLE V D-1

FREIGHT TRAFFIC CARRIED ON THE MALI RAILWAY, 1976

PRODUCTS	1976 ton (000)	1976 ton-km (mil.)
NATIONAL TRAFFIC	97	34.1
Cement	45	18.9
Other carload	40	11.5
Miscellaneous	12	3.7
EXPORTS	94	45.8
Cola nuts	14	8.2
Cotton seeds	5	3.1
Cotton fibers and textile materials	6	3.5
Groundnut	22	6.8
Groundnut oil	4	2.4
Groundnut cakes	11	6.8
Karite products	1	0.6
Cereals	18	8.7
Other carload	13	5.7
IMPORTS	159	74.5
Cement	12	6.9
Machinery, vehicle, materials	12	6.1
Fertilizers	14	7.5
Foodstuff	35	14.8
Petroleum products	48	21.8
Salt	21	8.6
Other carload	16	8.3
Miscellaneous	1	0.5
TOTAL FREIGHT TRAFFIC	350	154.4

reducing the railroad's operating deficit. Technical assistance to the railway in the formulation of a pricing policy that will promote income distribution may enable the rural poor to participate more directly in rail improvements.

E. Port and Airport Improvements Projects

Even less is known concerning the impact on the incomes of the rural poor as generated by improvements in ports and airports than is known for railroads, Traditional airport improvement projects may not have much impact on the incomes of the rural poor. However, the construction and improvement of small airstrips located in livestock areas could have a significant regional income producing impact. In addition, the airstrips would facilitate access by persons involved in planning, implementing and administrating rural development, and this might increase the rate of development in formerly remote areas and consequently the rate at which the welfare of the rural poor increases.

F. Transport Surveys and Technical Assistance to Transport Institutions

The Sahel needs large amounts of further capital investments in transportation. However, in order to achieve transport efficiency in the Sahel more than capital investment is required: Transport effeciency also requires an improvement in the operation of existing facilities. Therefore, before considering additional investment projects it should be ascertained whether existing facilities are operating in an optimal fashion. This can reduce the amount of additional investment requirements and, moreover, is a condition for realizing the full potential of any new investment.

Formulating policies and measures to achieve efficient operation of transportation is an important function of the transportation institutions and operating agencies in the Sahel. Operational improvements in the maintenance of roads, railroads, or ports; or in restructuring of the management staffing or procedures for the operation of a railroad often indicate a much higher benefit/cost ratio then similar size investments in new projects. Therefore, the identification and analysis of physical infrastructure projects must be undertaken with concurrent analyses of trade-offs for operational improvements. Moreover, in several of the Sahel countries the present regulatory practices must be reformed in order that the benefits of free competition can make transport industries more productive. Unfortunately, many of the present regulatory functions have a tendency to stifle, rather than encourage competition, such as road transport tariff fixing, or restriction of entry into the road transport industry.

The enforcement of traffic regulations is also an important function. As in many of the developing countries, overloading and violation of vehicle size and weight regulation, and the lax enforcement of safety regulations in

the Sahel will work together to give undue advantage to highway transport over other modes. Practices such as overloading and operation of trucks whose size and weight are beyond the design strength and capacity of the countries' highway systems not only result in wasteful expenditures because of the need to repair the damage caused by these vehicles, but also adversely affect the operation of other transport modes due to uneconomic traffic diverson (trucks carrying cement over large distances). There is also a tendency for small truckers to neglect vehicle maintenance to realize lower operating costs with which to capture traffic, but the total public resource cost would be greater due to frequent accidents involving loss of lives and property damage.

The setting of appropriate pricing policy is also an important function of the transport institutions. Transport prices are a powerful tool for the proper allocation of the traffic among the modes and they can also assure adequate revenues for operating, maintaining and expanding transport facilities. Moreover, they can help achieve redistribution of income, and promote growth of particular regions or industries in the countries. At present, it does not appear that the potential of pricing policy tools has been adequately exploited in the Sahel. Technical assistance in the regulation of transport activities such as tariff setting, licensing, taxation and subsidation, will serve to make the operation of transport modes more efficient and complementary to each other, and will provide clear cut transport policy objectives within which well-timed priority investments can be planned and implemented and coordinated regulatory measures can be formulated.

Again, there is no empirical or theoretical evidence indicating what the impact of a more efficient transportation system might have on income of the rural poor. However, the impact could be substantial considering the reductions in transportation prices that the more efficient transportation system may make possible.

VI. TRANSPORT INFRASTRUCTURE NEEDED IN THE SAHEL AND AID OPTIONS FOR INVESTMENT

From the point of view of "economic efficiency", or the supplying of those transport services that meet the economic growth needs of the Sahel at least cost to the Sahelian economy, formulation of a coherent development policy for transport in the Sahel must take into account the following: (i) the need to minimize overland transport costs of imports and exports; (ii) the obligation to determine the priority which should be given to economically less important but nevertheless significant routes providing regional connections; (iii) the problem of allocating available resources between expansion of national route systems and maintenance of the existing infrastructure; (iv) the choice of transport modes; and (v), reflecting the new directives' mandate, any AID transport investment must have a direct and beneficial impact on the welfare of the rural poor.

A. TRANSPORT INFRASTRUCTURE CONSTRUCTION, IMPROVEMENT, MAINTENANCE

Roads

The status of economic development, the geographic concentration of economic potential in specific areas, the extent of the present primary and secondary networks, and the number of network extensions currently planned (See Chapter III)point to the desirability of limiting further new construction of primary and secondary roads. We would instead focus on maintenance to design standards of the current system and the improvement of selected tertiary roads and tracks to all-weather service.

As discussed in Chapter II, Problem Identification, the existing network of roads within the Sahel Region and of access routes to the sea is reasonably adequate for needs in relation to present population distribution and traffic levels. However, because there is insufficient capacity to maintain existing roads to their design standards, the system is in disrepair. Weakness in maintenance stems from insufficient technical and management expertise, equipment and local funds for recurrent expenditures. The IBRD and other donors have provided assistance with the first two elements, but the success of these efforts has been limited by a chronic shortfall in local budgetary support.

Most Sahelian countries do not have the technical expertise and equipment to maintain their road networks to anywhere near design standards; moreover, even when adequate technical assistance and maintenance equipment are supplied through foreign aid, provision of the recurrent local currency contributions required often places a formidable strain on the country's budgetary resources. Although the road systems in these poor countries are limited, there is already the danger of over-expansion of the infrastructure in relation to the countries' ability to maintain infrastructure to acceptable standards.

Care should be exercised in assessing justifications for extensions or improvements to the existing infrastructure to ensure, first, that the proposed expenditure, whether met from local or foreign aid sources, represents

an investment of top priority in the Government's development plan; and second, that the proposed investment will contribute to real economic growth and social equity. An investment that meets these criteria would be a project for constructing roads forming a component of an integrated rural development scheme.

In light of the above, and in recognition of the fact that every additional kilometer of road constructed increases the maintenance load, attractive economic returns can be realized from investments directed to proper maintenance of the existing system. At this stage of road development in the Sahelian countries, AID should direct the largest portion of its transport support to integrated area development and to improving maintenance organizations (including financing of recurrent local costs). Consistent with "New Directions" efforts to create employment for the unskilled rural poor, AID should continue to promote maintenance projects which incorporate substantial labor-intensive elements and require village involvement.

Road Maintenance

The recent diagnostic study prepared by a consultant firm for the Club du Sahel[1/] noted that nearly all the 80,000 kilometers of classified roads in the Sahel region are improved tracks, a great majority of which have fallen into extensive disrepair.

The classifed roads, including, all the primary and secondary roads, receive maintenance attention to the exclusion of

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1/ Louis Berger International, Inc., Road Maintenance Diagnostic Study for the Sahel, Vol. 1, Synthesis, (1977)

feeder roads in the recommendations of the study. The reason for excluding the approximately 44,000 km of unclassified feeder roads is that the consultan't study approach used the method based on transport cost effects.

> "It does not take into account other anticipated benefits from rehabilitation programs and road maintenance which can be very useful in creating new links where traffic is very low. In a diagnostic study of the present type, such roads have an unknown potential and have low traffic levels. The traffic levels are often below the threshold at which rehabilitation or even a minimal level of maintenance is economically justified. In addition, these are usually rural roads where maintenance is always difficult for existing maintenance organizations due to lack of resources. National road maintenance services cannot devote many resources to rural roads with low traffic levels while the primary road network is still deteriorating. This is the case in most of the Sahelian countries. The economic benefits to be derived from an efficient road maintenance program are larger and more commonly derived for the primary network than for rural roads. Local maintenance organizations other than the national organizations should assume some authority for the maintenance of rural roads. Such an action could possibly be connected with the implementation of labor intensive maintenance techniques".

We agree with the consultant's finding that the vast unclassified road system poses a much greater problem in the planning, implementation, and financing of maintenance than the classified system. Immediate preparation should be made to set their recommended road maintenance and rehabilitation programs in motion. Though the program does not officially recognize the unclassified road system, we note that a substantial portion of the classified road system by the consultant's own findings (See tables II C-2 to II C-9) are nothing more than unimproved seasonal dirt tracks. And, many of these probably are the equivalent of farm to market and low volume rural roads which serve the interest of the small farmers and villages. Thus, this program probably does not neglect the rural poor.

Concurrent with the above program, however, steps should be taken to identify the priorities for improvement and maintenance of the 40,000 km of unclassified roads in the Sahel. Althought these roads have low traffic levels, and improvement or maintenance of many of these roads cannot be economically justified, it is important to take into account. The low level of traffic might be because, even though the road serves an area with significant productive potential, it has deteriorated to such an extent that it is an unreliable and highly expensive access route, and has discouraged production of cash crops by farmers.

Analysis of roads in this category, with low traffic levels, must follow procedures based on the principle of "producer supplies" (See Carnemark, Biderman and Bovet, The Economic of Rural Road Projects, World Bank Staff Working Paper No. 241, IBRD, August 1976).

Road Improvement and Rehabilitation

The next road improvement level above normal maintenance constitutes works which involve the upgrading of existing route sections, either to return a road section to its original state (called rehabilitation) or to improve the surface quality, alligment, and drainage of a trail or track to all weather service

(called improvement or upgrading), where subsequent routine maintenance can suffice for traffic requirements. Often, road rehabilitation is required primarily because normal routine maintenance was not performed; in many instances planned road investment consists simply of restoring a poorly maintained road to its original design standard. In other cases, there may be a need for upgrading from track to tertiary road in support of increased or expected agricultural production, as in a rural development plan.

As a general rule, upgrading works has been beyond the capacity of the usual force account staff and equipment, and therefore required the employment of contractors. While larger works may be beyond the current capabilities of national expertise and may require foreign contracting services, there is scope for local entrepreneurs to participate as subcontractors or on smaller operations as prime contractors encouragement of such participation by national authorities and by donor countries alike will help develop a local capability and create employment. Contract terms should specify what functions are to be performed by labor intensive means.

B. MANAGEMENT OF FINANCIAL RESOURCES

Long-term policy regarding road maintenance must aim both at generating enough resources through economic development to allow adequate operations, and at improving government budgetary and accounting procedures to permit the cost-based functional control which a Road Fund theoretically provides. To this end, it is recommended that:

(i) all Sahelian countries establish "rolling" five-year projections of their road maintenance budgets;

(ii) government budgetary and accounting systems be modified to introduce cost controls; and

(iii) financial procedures be simplified.

The planning of road maintenance budgets as proposed above should present no major difficulty. Modification of a government accounting system must of course be considered a longer-term objective; however, the private sector in the Sahel countries has adopted a mandatory modern accounting system oriented towards production of economic (added value) and financial data, and there is no persuasive reason why this system could not also be adopted in government offices. Once these recommendations have been implemented, interested donors should seriously consider providing also some local currency support to the recurrent maintenance budgets of the Sahel countries.

Rate Structures

Road Sector

Many of the difficulties in the road transport sector in the Sahel

Sahel originate from inappropriate pricing. Rates are in some cases excessive because a monopoly situation has developed, and on the other hand, they are often maintained at artificially low levels. In both cases, the distortions introduced into the system lead to increased inefficiencies and economic losses, to which governments tend to react by over-regulation, establishment of state-owned companies and expanded bureaucracies. Even if rates cannot be left entirely to market forces, rates must not be fixed below operating costs, including depreciation, renewal, and adequate user charges for the use of infrastructure. This applies to all branches of the industry and to all cost components, including credit, insurance, and repairs.

Agreements on external aid in the road transport sector should be conditioned on the provision to examine and, if appropriate, consider modification of tariff road user charge policies in the host country.

The countries are faced with needs to stabilize remote communities which generate very low traffic volumes, and therefore warrant only small investments in transport services. These roads are likely to upgraded tracks constructed of local materials with a substantial element of local unskilled labor, improved to minimum all-weather standards. AID has approved plans for the design of a pilot project in Mauritania, which will develop a Mobile Brigade to improve approximately 300 km of trails and tracks to minimum all-weather service. The project will remove "bottlenecks" from what constitute secondary road links in areas of agricultural potential. The project will directly impact rural life by first providing employment in road upgrading efforts. Improved access to markets, in combination with other agricultural inputs, is expected to induce further agricultural production, sales of cash crops, and additional income to the small farmer.

Some track sections, due to their natural drainage and satisfactory surface, may require minimal improvements from the natural state. Upgrading will be largely through surfacing. As a consequence of this modest approach we expect to hold costs to a much lower level than otherwise could be anticipated.

Routine maintenance of improved links will be performed by the villages under maintenance contracts with the government.

Road Construction

Primary and Secondary Route Investments

As discussed above, principal AID emphasis should be on the maintenance of the existing primary and secondary networks and the upgrading of trails and tracks in areas of integrated development concentration. Moreover, "secondary roads" in the Sahel, contrary to an inference contained in the legislation, starkly contrast with the U.S. concept of the term. In some areas, dirt tracks constitute so called "point-to-point" routes. In regions suitable for increased agricultural production these roads will be necessary to evacuate farm produce from production areas to rural market centers and collection points. Their improvement in conjunction with agricultural development programs is essential; the method of their improvement should incorporate labor-intensive elements.

Existing primary roads should be maintained. Not only are they largely essential national integrating links but they act as principal arteries for the movement of agricultural production from rural collection points to national urban centers and to export markets. The quality of the national road system is a determinant of the competitiveness of products produced for export markets. Likewise, the cost of agricultural inputs (such as fertilizer and pesticides) to

the small farmer directly reflects national road conditions.

If the construction of a new primary road link can be economically justified on the basis of its beneficial effect on the welfare of small farmers, then AID as one of a number of donors should consider partial financing. The selection criteria prescribed in this report will provide guidance in making an appropriate.

Regional Routes

Recently, considerable emphasis has been placed on developing transport routes linking the Sahelian countries, with primary attention directed to the proposed Trans-African and Trans-West African Highways. However, since trade between the countries is negligible, these regional links are of low economic significance. Very poor rates of return have resulted from feasibility studies to upgrade lightly- travelled east-west trunk road sections such as the Niamey-Fade-N'Gourma road (300 km) in Niger, or the Sakounce-Hounde road (240 km) in Upper Volta. Simple maintenance would be much more efficient.

A major reason for the limited scope for east-west movements in the region is that climatic zonal orientation and agricultural production vary little among these agrarian countries, none of which is industrialized. While there are some surplus producing and other deficit food producing areas, surpluses as a basis for regional trade are not substantial. Demand on transport facilities for intercountry trade is also modest; while export and import flows to and from the ports are the more significant.

Special Vehicles

The Asian Utility Vehicle (AUV) is a specialized small general purpose vehicle that is extensively used over primitive roads and tracks in Asian countries. The vehicle is quite simple and therefore inexpensive to operate and maintain, and its high ground clearance enables it to operate over roads that cannot be negotiated by regular cars and trucks (non-four-wheel drive). For example, the Ford Fiera, assembled in the Philippines, a 60 hp engine, a rated payload of 885 kg and a GVW of 1600 KG. It comes in a pick-up truck and also a mini bus (10-passenger) configuration.

These vehicles are presently being assembled in Asia by several of the large manufacturers, including Ford, Toyota, General Motors, and Volkswagen, and the body design is such that the body can be manufactured in the developing countries using manual labor rather than expensive sheet metal dies and stamping machine.

It has been suggested that rather than incur high capital and maintenance costs for conventional road building in the remote areas of the Sahel, these specialized vehicles could be introduced to provide service over the primitive road systems This proposal has considerable merit provided that 1) the vehicle is cheap to operate and simple to maintain., 2) the market for these vehicles is sufficiently large to afford low acquisition costs.

These conditions are prevalent in the Asian developing countries and there does not appear any prima facie evidence that these conditions could not be met in Africa, especially for the Sahel. It is therefore suggested that AID support investigations to test the suitability of these vehicles to Sahel conditions, and on evaluating the possibility of manufacturing or assembling such vehicles for use in the Sahel. A useful test could perhaps be made by providing the AID missions in several of the Sahel countries with a few Ford Fieras for trial use in the field.

Repair Facilities

The small transport entrepreneur and the repairman can play a most important part in developing reliable transport services by introducing mechanical expertise at the village level and by training apprentices. These people use simple and well-adapted techniques, and their productivity is high; the respect which a good mechanic enjoys in his communities is clear proof of his economic importance. Means should be found to develop repair and ancillary facilities by assisting small entrepreneurs through development finance bank loans or through tax incentives. Easily maintained vehicles such as the AUV discussed above will assist in developing these facilities.

2. Rail

As a consequence of small, scattered populations in the Sahelian countries, the low level of economic activity, and the vast distances to be covered, road transport is seen to offer the cheapest and most

versatile means of transit. Chad, Niger and Cape Verde have no railways; Mali and Upper Volta have a single line connection to the ports of Dakar and Abidjan respectively; Mauritania's railway is largely an enclave operation serving the iron ore industry; only Senegal has a railway system of significant national consequence. All the existing rail systems (except Mauritania's) were conceived and developed well before modern road transport services came into their own; today, largely as a result of bad management and the impact of road competition, the railways are all in a precarious financial position.

While there is considerable interest in constructing new railways or extending lines, there is little case for such proposals. As a general rule, railway construction is considered justified only when annual traffic is forecast to reach, at the very least, about 500,000 tons per km. of line. In comparison with this figure, the total volume of principal agricultural products carried by rail in the Sahelian countries amounted to only 8 million tons in 1970, the last year before the drought condition area. The only significant export crops were groundnuts and cotton, and of the one million tons transported, one-half originated in Senegal, relatively near the port of Dakar.

Even if the total freight volume were to include import commodities (of which petroleum products are a principal item), the volume of traffic available would still be insufficient to warrant new railway construction in the foreseeable future, except in special cases where ore deposits might provide significant amounts of specialized bulk traffic.

A Comparison of Rail and Road Operating Costs based on 1970 Figures is shown in Table VI B-1.

TABLE VI B-1

Road vs. Rail Operating Costs
(in CFAF per ton-km)
(1970)

	Asphalt Road			Railway		
Annual Tonnage	Infrastructure Cost	Operations Cost	Total	Infrastructure Cost	Operating Cost	Tot.
100,000	22	6	28	20	9	39
200,000	11	6	17	15	6	21
500,000	4	6	10	6	4	10
800,000	2.5	6	8.5	4	3	7

For low density movements, road transport costs are lower than those for rail; however, where existing railways can be utilized over long distances, the marginal cost of rail transport should be lower than for road services. Railways which cater to such traffic should be maintained, while avoiding investments in new line extensions and pursuing a policy of closing unprofitable branchline services.

The CILSS investment program includes two railway developments. On the extended Abidjan-Ouagadougou railway to Tambao (340 km of line which is proposed to serve the manganese ore mine at Tambao), CILSS proposes to construct two branch lines to Ansongo (142 km), and from Dori to Niamey (245 km). Justification of the Ansongo extension is based on the manganese ore potential of the area, but this is yet unproven. The Dori-Niamey line would have little general traffic (60,000 t/year), and is not justified; further, its expected operating deficit would jeopardize operations on the main line, as shown by

the experience in Senegal where branch lines were operated at a chronic deficit. Nowhere else in the Sahel does projected traffic make a railway project a viable venture.

3. River and Lake Transport

While this mode holds promise in terms of low operating costs (ranging from 2.5¢ to 4¢ per ton-km on annual volumes of 1 million to 50,000 tons), there is limited scope in the Sahelian region for such services. Notable expections are the following:

(i) The Senegal River from Saint Louis (Senegal) or Rosso (Mauritania) to Kaedi (Mauritania). This once active service was operated by a small fleet or shallow draft craft when Dakar was the main port of entry for Mauritanian traffic. However, the port of Nouakchott around 1974 has become the entry point for this traffic, and the river transport has dwindled to service by a few old craft since road transport direct from Nouakchott is now the cheapest transport mode. It is unlikely that river service can be economically revived on any scale until the Senegal River is dammed and substantial volumes of mineral ore and agricultural produce are generated in its basin. The earlierst this could occur would be around 1985.

(ii) The Niger River from Bamako to Gao in Mali during the seven-month navigational season. This route is the principal domestic artery into northeast Mali and is estimated to provide the required transport at a cost 70% less than road service. Rapids on the river prevent service beyone Gao.

Considerable investments are required to modernize the existing fleet.

(iii) Lake Chad. A number of small private operators service points around the lake, but it is not known at this time what the actual and potential demand for this service is (though it appears minor) and what would be required to improve the service.

Considerable efforts have been expended on attempts to develop permanent long-haul river services on the Niger from its mouth north to Niamey. Trials have been completed, but commercial development of the route is not promising because of the operational difficulties and cost involved in negotiating the locks of the Kainji dam, and because of the existence of rapids in the north. It therefore appears that the scope for water transport services is very limited, and planning for further investment in the mode for the time being should be restricted to the Niger River in Mali, and on a lesser scale, to the Lake Chad area.

4. Ports

Improved results could be obtained from existing storage installations if the following lines of action were implemented by port authorities, and adopted by donor countries when dealing with port projects;

(i) the achievement of specified productivity targets, quantity of equipment, and storage facilities (including temporary covered storage and bagging equipment) should be made mandatory for port users;

(ii) port authorities should be adequately staffed with specialists in port operations whose background is in the private sector,

for example, with national shipping lines.

5. Air transport

There is some scope for the further development of domestic air services, particularly because of the long distances to remote areas in the Sahelian region, as well as the high cost of building and maintaining roads. However, the appropriate level of air service development should be the subject of detailed study in order to establish the overall as well as the specific justification for such an approach.

C. Integrated Area Development

AID should particularly support rural road improvements that are part of a larger development plan - either as an element of an integrated rural area development scheme or as a supplement to other agricultural inputs which are in place or contemplated, such as agricultural extension service, credit and price support. This requirement should be a principal criterion in the rural road screening process.

D. Technical Assistance

In the Sahel the proportion of technical assistance to economic aid likely should be higher than in other geographic regions. Management and technical capabilities are inadequate to manage development. CILSS members need technical support for a long time. In the limited period (4-5 years) of a transport improvement project implementation period we cannot expect to create the necessary capability. We can establish the organization and strive to engender progressive attitudes among host country officials, to lay foundations for permanent change.

Advisory assistance, short term in the form of particular studies of problem areas, or long-term for improvement of planning, management, and operating techniques, is a necessary component of the assistance "package". These efforts should be addressed to improving human resource capabilities which, in the final analysis, are at the root of Sahel transport problems.

1. Transport Planning

Establishment of a central Transportation Institute for the Sahel is under consideration. This could be a focal point for the exposure of national economic planners

and Ministry of Transport and Public Works planners from the Sahel countries to national transport planning, intermodal choices, national road inventories and maintenance scheduling. Initially, records keeping techniques providing data in machine readable form for road system maintenance control can be introduced, in anticipation of future computerization of the data.

2. Infrastructure Improvement and Maintenance

In-service training under the tutelage of technical advisors should be an element of every transport improvement and maintenance project. Advisors should be carefully selected and acceptable to the cognizant ministry. Advisors operating in a vacuum, without steady counterparts, and with no authority should be withdrawn until arrangements for their effective utilization can be reconfirmed.

Delivery of the "hardware" element of modernization projects should be contingent upon the firm agreement of the host country to meet its commitments and to act on proposals for change.

3. Equipment Maintenance

USAID Chad is investigating the feasibility of utilizing the training facilities at the heavy equipment school at Lomé to train Chadians. If, as reported, the calibre of training has degenerated since the termination of US aid to that facility, it might be wise to consider reestablishing lines of support. To establish another school

in the Sahel for the same purpose would be excessive, when the Lome school has a French-language curriculum and over 10 years of operating experience.

Further training in heavy equipment maintenance can be in the form of in-service training in project field work. A USAID project proposed for Mauritania trail and track improvement will feature in-service training as a major component. Starting with one mobile brigade they hope to expand as trainees become trainers, broadening the effort.

4. Labor Intensive Technology

Agricultural labor in most Sahelian countries is an underutilized resource, and with the introduction of improved agricultural techniques, more labor may be released. Where alternative employment options are limited opportunity costs will be low and economic justification will be likely, provided the labor is organized and managed efficiently. AID should continue its efforts in the direction of labor-intensive construction and maintenance, particularly with pilot efforts as elements of funded maintenance and improvement road projects.

5. Special Studies

a) General

Problem-oriented special studies should be a part of most transport project assistance. Donors should continue to obtain assurances from host governments that

findings will receive serious consideration and that government will take measures to implement acceptable recommendations.

b) Analyses of Training Requirements

Should preferably precede project authorization rather than after loan or grant authorization.

c) Management of Financial Resources

Studies of road user charges, the feasibility of establishing highway maintenance trust funds, and means for implementing such actions are under consideration in at least one Sahel country, with expectations of other similar undertakings. Findings and organizational studies leading to improvements in budgeting and financial control are recommended.

d) Rate Structure Analyses

Important, to encourage agricultural development and ensure reasonable compensation to the carriers.

e) Mobilization of Rural Labor

In view of inadequate tax bases, for a long time to come the Sahel countries will be short of resources for development and for the maintenance of in-place infrastructure. Studies of user charges and road funds are one avenue to generate funds for infrastructure maintenance. Another avenue is to determine means of mobilizing the underutilized rural workforce to maintain and improve infrastructure. Projects will be

developed in the Sahel calling for extensive involvement of the rural populations in the project planning phase and in project works programs and in subsequent system maintenance.

f) Road Regulation, axle loading limits and enforcement. To save existing roads from destruction restrictions on vehicle loading must be enforced. Appropriate load limits should be determined for existing road designs. These studies are recommended for execution at such time as there is a reasonable chance that enforcement measures can be introduced and maintained.

E. Conclusion

In response to the general view that the lack of transport facilities or the high cost of transport impedes economic development in the Sahel, the Sahel Special Office Paper on a transport strategy for the region stated:

"... it must be noted that the unfavorable climatic and hydrological factors would not be improved by having the best possible transport system. Even if a perfect system existed, much would still remain to be done in the production sectors before it could be utilized fully. Packages of services such as agricultural extension, credits, input supplies, marketing, and above all, education and training in modern agriculture and livestock management are needed to help lift the region's thin, widely-scattered population from a subsistence to a money economy. The major need in the transport sector in the region is to fully utilize and maintain the existing infrastructure, both within the Sahelian

countries and in their neighboring transit countries."

As costs of energy, food, and manufactured items rise and resources become more scarce, the logic of this conclusion should be evident to all concerned with transport improvement in the Sahel.

CHAPTER VII

FIELD GUIDELINES FOR SCREENING TERTIARY RURAL ROAD PROJECTS IN THE SAHEL

A. Introduction

The purpose of these guidelines is to provide AID field personnel with a relatively easy procedure for identifying and screening tertiary rural road projects prior to PID documentation.[1] These personnel are often faced with a bewildering number of road project proposals, many of which are poorly described and totally inconsistent with AID development ogjectives. This screening procedure is designed to cull out, using information that can be collected during a brief survey of the roads, those roads that would not meet the social and economic development objectives of AID and the host government, and those roads that would probably not be economically desirable. Thus, typical roads that would not survive the screening process would be those that serve areas where the rural poor cannot participate in the benefits of the road project due to inadequate land tenure provisions (such as roads leading through large privately owned planatations), roads that do not have a large rural poor population in a zone of influence (such as roads leading to a mining project), roads that are controlled by a monopolistic transport industry that would not share the savings in transport cost with the peasants, and roads that would be economically unviable due to poor soils in the area of influence or with inadequate market access due to deteriorated secondary or primary road links.

The general procedure consists of first reviewing the proposed tertiary road projects to assure that they are indeed high priority projects from the point of view of the host government, that the improvement will consist of an

[1]Primary and secondary roads are <u>not</u> eligible for evaluating under the methodology preposed in this chapter.

all-weather tertiary road, that the improvement falls within one of several clearly defined standard improvement categories, that the road will be maintained after improvement, and that the road will connect with an adequate secondary or primary road. The roads that pass the first screening level are then subjected to a second screening to assure that they have significant potential to contribute to AID's economic and social development objectives.

B. GENERAL DESCRIPTION OF THE SCREENING TECHNIQUE

The objectives of the guidelines printed in this chapter are quite modest, and aim only at identifying a promising collection of rural road projects for PID documentation, and that are likely to meet AID's developmental objectives. Full scale economic and social evaluation would be accomplished in the subsequent Project Paper.

In contract to the modest procedure proposed here, several other screening procedures[1] that are being seriously considered by AID and the Club du Sahel for application to transport infrastructure projects in the Sahel are more ambitious, and aim at rank-ordering a set of road projects in accordance with socioeconomic criteria with sufficient precision to obviate full-scale social and economic evaluation.

However, though it would be highly desirable to have easily applied screening techniques that can rank-order projects, it appears that these techniques will not be available for at least several years. As discussed in reference one (The Economic Analysis of Rural Road Projects, World Bank Staff Working Paper No. 241, August 1976, Curt Carnemark, et al), there are a number serious and unresolved questions regarding the development of these

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[1] "Gudelines for AID Rural Roads Project Selection in the Sahel Region", AID/ Louis Berger International Inc., November 1977 (DRAFT)

Asif Faiz, "Preliminary Screening and Selection of Rural Roads - A Framework", World Bank, August 1976.

screening devices. The most serious question is whether screening criteria and weights can be developed that correlate well with indices derived from full scale economic and social analysis. If it is possible to develop these, then the screening procedures can be reduced to application of a set of inexpensive and easily operable rules which will screen road projects for later indepth analysis, beter than random selection. These rules are not yet available, though plans are underway by the IBRD for testing alternative screening procedures to, if possible, these rules.

Until validated screening procedures are developed that will rank-order projects better than random choice, it would be a serious mistake to attempt to apply these unproven techniques to the Sahel or any other region in the world. Such procedures would permit a costly number of socially and economically unfeasiable road projects to be implemented. For example, a simple road rehabilitation project in the rural areas of the Sahel is expected to range in cost from $10,000 to $50,000 per km. with an average of perhaps $25,000 per km. Thus, each km of road erroneously identified as feasible would cause a loss of $25,000 -- an amount sufficient to do a full scale analysis of 33 km of roads.[1] It is because of the high cost associated with unproven screening procedures that this chapter carefully avoids recommendation of the rank-ordering techniques discussed earlier.

It is of interest to note that, even though validated screening procedures for rank ordering can perhaps be developed, the application of these procedures may not be cheap compared to full-scale economic analysis required by the project paper. First of all, the data required for rank-ordering is

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[1] This assumes a cost of $750 per km as the cost of a full-scale analysis using the "producer surplus" technique presented in World Bank Staff Working Paper No. 241. (See also next page)

very substantial and approximates the data required for a full-scale social and economic analysis. For example, the two screening procedures discussed above require an estimate of the additional agricultural production that can be expected from the road project, and estimates need to be made of the distribution of income in the project region in order that equity can be considered. Therefore, once these data have been collected, the additional expense of the full-scale economic and social evaluation over the rank-ordering procedure may be relatively small.

It is of interest to note that full-scale economic evaluation in the past has been very effective in identifying feasible transport projects. According to the IBRD project reviews, (Ref: Annual Review of Project Performance Audit Results, World Bank, November 1978) of the 25 transport projects representing a total project cost of almost three billion dollars, only five had a re-estimated economic return less than estimated in the original appraisal, and ~~therefore with~~ implying a precision of .80. Taking the cost of full-scale evaluation at $750 per km[1] and the precision with which that approach identifies feasible projects at 80%, the effective cost of that analysis is ($25,000 + $750) / .8 = 32,187 per kilometer of road. Compared to this we can calculate the effective cost of a screening technique as follows. We assume that the technique is 50% effective in identifying feasible projects, i.e. the technique is no better than random selection.

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1 This is the approximate cost of the full-scale feasibility study of the 850 km Mindauao Secondary and Feeder Roads Project, Asian Development Bank, November 1978. This study, in addition to preliminary engineering, included an economic analysis as outlined in World Bank Staff Working Paper No. 241, "The Economic analysis of Rural Road Projects", August 1976, and by Curt Carnemark et al.

Even at a zero cost for the screening technique, the total effective cost of road per kilometer would be $25,000/.50 = $50,000. This is almost 60% higher than the effective cost for the full-scale analysis. In order to bring down the total effective cost of the screening approach to the level of the full-scale analysis, the precision of the screening approach would have to be at least 77.7%, or practically equal to that of the full-scale analysis. And, it is doubtful that screening techniques will ever achieve that level of precision.

C. ROAD IMPROVEMENT LEVELS

Vague statements that the road project consists of "improvement" will hinder effective screening because of inability to judge the project cost and possible project impact. It should be possible to classify the improvement project into categories, such as defined below, with which approximate costs can be associated. In addition, each of these improvement levels will have associated with it a possible impact on the incremental agricultural production in the area of influence of the road. The magnitude of the impact will of course vary with the agricultural potential of the land and the level of agricultural services (credit, extension, etc.) provided. In good agricultral areas a poor road is usually such a constraint on agricultural production -- it prevents farmers from marketing their production and keeps out agricultural extension agents and social services -- that road improvement by itself can result in a substantial (20 - 35%) increase in production. In poor agricultural areas the impact of the road improvement is of course smaller.

The required improvement of the roads will vary with the condition of the road. The improvement costs presented below were appropriate for the Mindanao Secondary and Feeder Road project discussed earlier. They are presented only as indicative values of the order of magnitude of the improvement cost that might be incurred. The same holdstrue for the expected increases in agricultural production that might be attainable from the four improvement levels. For purposes of the screening, four improvement levels have been defined as follows:

1. Improvement Level 1: This improvement level will be used where there is only little improvement required of the existing road. The work will consist of shaping and compaction of the existing road and the placing and compaction of a gravel layer, together with the cleaning out and clearing of culverts and drainage channels. The improvement cost may run about $2500 per km, excluding structures. This type of improvement will usually have little impact on increasing agricultural production, though savings in vehicle operating cost can be significant.
2. Improvement Level 2: The work will include that of level 1 described above, together with the shaping and cleaning-out of road-side drainage channels, and the placing and compaction of a gravel surfacing. Generally, the thickness of the gravel surfacing will be somewhat greater than that applied under improvement level 1. Local improvements to drainage may also be required. The approximate cost of this improvement level may run about $4000 per km, excluding structures. In areas with good agricultural potential a 10 - 15% increase in agricultural production could possible be expected from this type of road improvement.

3. Improvement Level 3: This improvement applies to roads that have become impassable to standard vehicles due to lack of maintenance and other causes. Reconstruction will be required of these road sections, but the reconstruction will usually be over the existing width of the roadway. The work will consist of excavation and filling as required, the shaping, grading, compaction of the existing road, together with the construction of longitudinal drainage channels and, where necessary, the provision of adequate culverts. The placing and compaction of gravel surfaces will be as under improvement level 2 described above. The estimated cost of this work might be about $18,000 per km, excluding structures. In good agricultural areas, both improvement level 3 and 4 could possible produce a substantial improvement (20 - 35%) in agricultural production and personal mobility.

4. Improvement Level 4: This work consists of essentially new construction where there is no existing road or track, or where there is a track but with inadequate formation width. Earthworks will be kept to a minimum, however, and the existing horizontal and vertical alignments will be close followed. The maximum gradient in hilly terrain will be 8%, and the maximum gradient in rolling terrain will be 6%. The work will be detailed as described under improvement level 3. The approximate cost of this work could be about $20,000 per km, excluding structures.

Structures: At small streams concrete pipes or box culverts will be provided. Rivers crossings will be provided with fords, except where site conditions are more appropriate for bridges. Bridges will be single-lane and of re-enforced concrete construction or of the Baily type where available. The cost of structures will vary considerable with terrain conditions, but an average cost of $1500 per km might be sufficient with roads in areas where no river crossings are required. For roads that require several river crossings, the cost may reach as high as $12,000 per km.

D. SCREENING

Each candidate road must pass two screening levels. The first screening level is designed to ensure that the candidate road is endorsed by the host government and that maintenance resources for the road are in the governments development plan. In addition, a minimum amount of information must have been collected on the roads present condition and its desired improvement level. This information can be collected during a single-visit field survey. Roads that pass the first screening level can then be considered viable from the point of view of host-government support, the minimization of chances of investment loss due to lack of maintenance, and the availability of a minimum amount of information on road condition to allow rational decision making.

The second screening level aims at verifying the existence of the basic potential for economic and social feasibility of the candidate road. Roads that pass this level can then be included in the PID. Subsequent full-scale economic and social evaluation must be then applied in preparing the project for the Project Paper to confirm the socio-economic feasibility, and to prioritize the candidate road projects.

First Screening Level

1. The road improvement has the endorsement of one or more ministries other than the ministry directly involved in implementation of the construction, such as the Ministry of Public Works.
2. The road must be a candidate for construction or upgrading to the standard of an all-weather gravel-surfaced tertiary rural road according to clearly defined improvement levels such as those defined earlier (levels 1, 2, 3, or 4).
3. There must be a firm plan and available funds plus manpower to maintain the road at a satisfactory level.
4. The road must connect to an existing all-weather secondary or primary road in good condition, leading to markets for agricultural products and to local administrative and social centers. If the existing secondary/primary road is not in good condition, there must be firm plans for putting it in good condition by the opening year of the candidate road.
5. The candidate road must be at least 3 km long and must not be a parallel road within 5 kilometers.

If the candidate road meets the above criteria it can be considered for further screening in the next level.

Second Screening Level

1. The road must serve rural farm areas, and a large proportion, say 75%, of the population served must consist of farm families. Roads serving mines or urban areas not eligible for evaluating under this methodology.

2. There must be assurance that the benefits from road improvement are passed on to the small farmers by meeting the following three conditions:
   a) The road industry must be competitive;
   b) The majority of farms are small, say less than 10 hectares; and
   c) The land is owned by the farmers.
3. The population density along the road must be at least 10 persons per square kilometer.
4. The agricultural potential for increased production in the zone of influence of the road must be attractive. This may be assumed to be true if the road is part of an integrated rural development package, and complementary investments in agricultrual extension, credit, marketing, and other services are provided.

   If the road improvement project is not part of an integrated rural development package, the agricultural potential along the road may be deemed as sufficient if the following is true:

   a) A 10 to 15% increase in agricultural production would result from a level 2 improvement; or
   b) A 20 to 35% increase in agricultural production would result from a level 3 or 4 improvement.
5. The improved road must provide access to existing or planned educational facilities such as a secondary school, primary school, or vocational training institution.

6. The improved road ... must provide access to existing or planned rural health clinics.
7. Employment generation through labor intensive method must be applied where the potential exists.

VIII. A FRAMEWORK FOR EVALUATING TRANSPORT INFRASTRUCTURE PROJECTS IN DEVELOPING COUNTRIES

A. BASIC APPROACH

This chapter proposes a technique for combining both the economic impact and the quantifiable and unquantifiable social welfare aspects of transport projects in prioritizing investments. It shows first how the benefits of transport investments in terms of increased national income can be taken into account by the traditionally derived Economic Rate or Return (ERR). Then the chapter describes how the techniques suggested in recent but well-known publications by the UN 1/ and the IBRD 2/ can be employed to account for the quantifiable considerations of equity and income distribution through the derivation of a Social Rate of Return (SRR). Finally, the chapter discusses how the non-monetary elements of values implicit in non-economic factors, such as education and health benefits, can be taken into account by ranking the socio-economic merits of the projects. This is done by assigning weights (about which a great deal is still to be learned) to the non-economic factors so that they can be combined with the social rate of return into a single overall indicator for each project.

While this approach is hardly new in theory it is relatively innovative in terms of actual field application. The approach

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1/ United Nations Industrial Development Organization "Guidelines for Project Evaluation," New York, United Nations, 1972.

2/ Squire and Vander Tak, "Economic Analysis of Projects," John Hopkins University Press, 1975.

recognizes that the impact of a transport infrastructure project can be partly quantified, and that this part of the impact can be represented in the project's rate of return. Indirectly, such benefits reflect the economic value associated with the improvements in the socioeconomic living conditions as represented by reduced travel times, lower cost of travel, and increases in income various income groups. For example, the impact of improved access to health facilities should be partly reflected in the implicit higher growth rates in the region as brought about by healthier people after the road is improved and access to health facilities is provided. However, these quantifiable elements do not reflect the value of the improvements in the "quality of life" resulting from the improved accessibility brought about by the project. For example, better health will significantly improve the quality of life of the rural poor. In order to reflect these non-quantifiable elements a weighting scheme must be applied to the non-quantifiable impacts produced by a project, such as the improvement in the quality of life created by better access to health facilities.

The approach suggested in this chapter corrects a major weakness of other project evaluation techniques that prematurely include the quantifiable aspects of project impact in a subjective weighting scheme. This leads to double-counting, confusion, and lack of consistency, and that can be avoided if the quantifiable dimensions of the project such as the contribution toward income distribution,

reduction of under-employment, or better health are incorporated in the economic or social rate of return. It is only in the final step, the socio-economic ranking, that subjective weights (scientifically derived to the extent possible by, for example, using the Delphi technique or other technique developed by the social science) are applied to

B. PRINCIPAL PHASES OF PROJECT EVALUATION

In the case of tertiary rural road project analysis an initial screening process is followed in the preparation of a candidate road list for consideration. This screening stage, which precedes project evaluation described below, is outlined in Section VII.

The proposed methodology for transport project evaluation, applying to all transport modes, consists of four phases:

1. Project Identification
2. Economic Evaluation (ERR)
3. Social Evaluation (SRR)
4. Socioeconomic Ranking

C. PROJECT IDENTIFICATION, PHASE I

The screening techniques described in Chapter VII are applied to identify promising tertiary road options.

D. ECONOMIC EVALUATION (ERR), PHASE II

The economic evaluation phase determines the project's economic rate of return (ERR), the traditional indicator of the project's contribution to the economic growth of the country. It does not take into consideration equity (income distribution) and other social considerations included in the project's social rate of return (SRR) calcaulated in the next phase; nor does it take into account the "quality of life" improvements accruing to the rural poor, considered in the final phase, socio-economic ranking.

Calculation of the ERR, a well established technique, is based on comparing the time streams of project benefits and project costs. Determination of the ERR is an important step since a principal criterion of project selection should be that the project meets a predetermined standard of economic efficiency.

The project's ERR should have a minimum cut off value determined as a matter of policy. Given that the ERR is at least equal to the minimum acceptable rate of economic return, the project will have passed the Phase II analysis.

Does the requirement that only those projects be identified that have a favorable ERR place an undesirable bias against the interest of the rural poor? No, because the economic evaluation phase ensures that only economically viable projects remain to be further analyzed;

projects that are not economically viable and that do not contribute to the country's sustained economic growth cannot in the long run benefit the poor. While the remaining list may contain projects that favor the higher income groups, the list is likely also to contain projects that have substantial impact on the welfare of the rural poor. Subsequent phases of analysis "weight" the various dimensions of each project so that only those projects are selected that meet at least minimum standards for income distribution as prescribed by AID and the host government, and that also rank high in improving the quality of life of the rural poor. Projects that satisfy these criteria are responsive to the mandate of the Congress.

It may be mentioned at this point that, for certain projects sponsored by AID where the objective is one of providing emergency relief, such as a draught area or other area suffering a catastrophe, or other special projects, the minimum cut-off value for the ERR may be set quite low or ignored all together.

E. SOCIAL EVALUATION (SRR), PHASE III

During this phase the equity considerations of the projects surviving the previous phases are addressed more closely. This is accomplished by using social pricing techniques, and involves attaching scientifically derived weights to the various components of benefits from the project that accrue in different forms (such as increases in income, savings in travel time, savings in vehicle operating costs) and to different beneficiaries (rich, middle income, poor).

Implementation of the SRR phase should not present a problem to AID because theoretical foundations have been developed to a considerable degree. However, there are several technical and institutional constraints that may delay implementation and that should be recognized by AID. The methodology of social benefit/cost analysis is new to AID, and there may be considerable inertia to be overcome before the principles are accepted. In fact, it is not yet extensively applied by the other international lending institutions such as the IBRD and the UN that were so instrumental in its development, through momentum appears to be picking up. In addition,

the lack of relevant data implies that project analysis in accord with the new methodology can be undertaken only on a gradual basis after the country parameters for shadow pricing, such as the income distribution weights, have been estimated. However, a good start can be made because a considerable amount of information has been developed on the more important parameters, and sound rules of thumb have been proposed for estimating parameters on which data are lacking, with reasonable accuracy. Thus, all major considerations such as income distribution can be included in the analysis, though in a crude fashion and by the judicious application of short cuts. And this, even though the degree of accuracy is far from perfect, would be a major improvement over the traditional approach where the quantitative aspects of equity objectives are often ignored.

In general, the effect of Phase III analysis is that it produces a systematic bias in transport project decisions favoring projects that benefit the poor rather than the rich. Such an outcome represents a desirable distortion since the extent of the bias in favor of the poor reflects the concerns expressed in the Congressional Mandate. Transport infrastructure projects will be selected with due regard to their impact on income distribution, which likely will result in a pattern of investment quite different from that which would emerge if distributional considerations were ignored.

In Phase II and III almost all of the factors that can be quantified have been quantified. Where necessary to include distributional aspects the proper weights were applied, and by comparing the weighted cost and benefit time streams the "weighted" economic rate of return was calculated. This weighted rate of return is called the Social Rate of Return (SRR) in the Squire/Van de Tak reference because it is responsive to the social aspects inherent in the consideration of income distribution.

The SRR for a specific project may be higher or lower than the ERR depending on the project's impact on the target group and the extent to which the target group represents the rural poor. For example, a container berth project may have an ERR of 25 percent because of its reduction in harbor congestion costs. But since the target group receiving the direct benefits in the form of savings because of lower

harbor charges and reduced spoilage of their merchandise are the high-income middle-men and merchants with a low "income distribution weight", these savings will be considerably discounted. Consequently, since the benefits are in effect reduced in magnitude when considered from the social point of view, the SRR may be only 18 percent as compared to the 25 percent ERR.

Scientifically derived weights are also assigned to the various cost components of the project (cost of skilled and unskilled labor, the fuels and equipment used in construction), and can in practice make labor intensive projects much more attractive than they would be under the traditional ERR approach alone. For example, it was found that the social cost of unskilled labor on a project in Thailand was only 25 percent of the market price.[1/]

The weights can be derived with a reasonable degree of scientific objectivity within the context of the theory of welfare economics, and from underlying notions of the welfare function of a country. They likely will be different for each country and for regions within the country, and the principal burden of estimating the Country parameters must therefore be placed on host government planners and donor economists. For several countries, agencies such as the country's national planning office and the country desks of international lending agencies are already involved in this work. Table VIII E-1 presents an example of such weights.

1/ Social Cost-Benefit Analysis: A Guide for Country and Project Economist to the Derivation and Application of Economic and Social Accounting Prices, World Bank Staff Working Paper No. 239, August 1976.

Table VIII E-1

Values of the Income Distribution Weight (d) for Small Changes in Income.

Relative Poverty Level		Level of Equity Desired, M				
	R	M=0	M=.5	M=1	M=1.5	M=2
Very poor	.10	1	3.16	10.00	31.62	100.00
	.25	1	2.00	4.00	8.00	16.00
Poor	.50	1	1.41	2.00	2.83	4.00
	.75	1	1.15	1.33	1.53	1.77
Average	1.00	1	1.00	1.00	1.00	1.00
	1.52	1	.81	.66	.54	.44
Rich	3.00	1	.57	.33	.19	.11
	5.88	1	.47	.17	.07	.03
Very rich	10.00	1	.32	.10	.03	.01

$$R = \frac{\text{Per capita income of target group}}{\text{Average per capita income for the country}}$$

Source: Economic Analysis of Projects, Squire and Van der Tak, The John Hopkins University Press, 1975.

F. SOCIOECONOMIC RANKING - PHASE IV

The quantifiable socioeconomic impacts from the transport infrastructure projects have at this point been represented in the social rate of return. Indirectly, these benefits reflect the economic value associated with the improvements in the socioeconomic living conditions as represented by reduced travel times, lower cost of travel, and increases in income gained by various income groups. However, they do not yet reflect the value of the improvements in the "quality of life" resulting from the improved accessibility brought about by the improved transportation infrastructure project. For example, improved access to health facilities has been

reflected in the implicit higher economic growth rate in the region brought about by healthier people after the road is improved and access to health facilities is provided. The impact of the improved access provided by the road is quantified in projections of a higher rate of growth and economic activity through the reduction of human constraints caused by lack of health facilities, lack of education, credit facilities, general public services; such as post offices, police stations, and district administration; the local employment office, the educational institutions, and agricultural extension offices. However, though it is possible to quantify the socioeconomic impact partially, it is not possible to completely quantify these impacts. The main reason for this is that socioeconomic impact has two main aspects: one is the purely subjective evaluation of the importance of social, educational, health,

community contacts, etc. The other aspect which is less subjective and therefore easier to quantify can be allowed for by the higher rate of growth in economic activity generated by the reduction of the human constraints, as discussed above.

The best way to assess these impacts is first to list the socioeconomic impacts resulting from the transportation infrastructure project that appear to be of importance to a particular country and a particular region. The factors to be considered may vary from one country to another, but the following eight are typical:

Does the project provide access to:

a) Alternative markets and specialized shops (outside nearest village market).

b) General public services (post, telephone, police, district administration).

c) Social services (local office for social services administration).

d) Post primary schools.

e) Vocational training facilities.

f) Health (other than local or visiting health clinics), including some level of medical specialization, such as dental services.

g) Other public transport services to larger urban centers, such as a bus stop or train station.

h) Recreational and sport facilities (cinema, park, football fields, etc.).

The list given above is illustrative and should be adjusted to conform to local values. The best way of doing this is to use the same type of system as is practiced in regional planning and classifications of various village centers by their service levels. In a number of countries extensive work has been done in classification of regional centers and they may provide useful guidelines in establishment of criteria and factors to be used for classification purposes. It should be noted that those road projects located in an area where complimentary investment in health facilities, schools, extension offices and other facilities are taking place will obviously rate higher than roads without these advantages. It should also be noted that access to credit facilities and extension services are not included in the list, since the quality of access to these facilities should be imputed into the projections of agricultural productivity used in calculating the ERR.

Weighting coefficients must then be applied to each of these criteria: The weighting coefficients must be derived subjectively-preferably using interaction between AID, and national, regional and local officials involved in rural development. Several procedures developed by the social sciences appear applicable to ensure the systematic and consistent development of these weighting factors with the maximum involvement of all participants. One promising technique that has been applied in various forms to several projects is the Delphi technique developed by Olaf Helmer of the RAND Corporation.[1/]

1/ Olaf Helmer "Analysis of the future: the Delphi method," The RAND Corporation, Paper-3558, Santa Monica, California, 1967.

G. EXAMPLE OF SOCIOECONOMIC RANKING

Table VIII G-1 presents a hypothetical example of the socioeconomic ranking of three transportation improvement projects: a feeder road, a secondary road, and a rail line. All three projects have ERR's above the assigned cutoff value of 10 percent and are therefore acceptable for further consideration. The rail line improvement has the highest ERR (24%) and the feeder road project the lowest, 12%. Application of social pricing techniques provides the SRR for each project, with the secondary road having the highest, 20% and the rail line project dropping to the lowest, 14%. The weighting of the SRR in this example is assumed at 60% with the eight socioeconomic factors collectively weighted at 40%. Individual weights of the socioeconomic factors vary -- from a low of 4%, applied, for example, to the factor measuring degree of access provided to general public services such as the post office and police station to a high of 8% applied to the factor measuring the degree of access provided to health service. As discussed earlier, these weights should be derived jointly by AID and government officials involved in rural develpment.

Values for the socioeconomic factors cannot be quantified, and are therefore left blank in the table. However, their qualitative rating on an arbitrary scale from 0 to 100, as estimated by the project analyst, is presented. For example, the feeder road rates 0, 40, and 100 for the factors measuring the access provided to facilities providing vocational training, social services, and health services respectively.

TABLE VIII G-1 Application of Socio Economic Ranking Procedure to Three Projects (Example)

Factor	Weight (%)	Feeder Road			Secondary Road			Railline Improvement		
		Value	Rating	Weighted Rating	Value	Rating	Weighted Rating	Value	Rating	Weighted Rating
ERR	go-no go	12%	acceptable	-	18%	acceptable	-	24%	acceptable	-
SRR	60	16%	70	42	20%	80	48	14%	60	36
a) Access to alternative markets and shops	4		50	2		100	4		0	0
b) Access to General Public Services (Post Office, Police, etc.)	4		100	4		0	0		0	0
c) Access to Social Services	8		40	3.2		100	8		0	0
d) Access to Primary Schools	4		0	0		100	4		40	1.6
e) Access to Vocational Training	4		0	0		100	4		30	1.2
f) Access to Health Services	8		100	8		100	8		40	3.2
g) Access to Primary Transport (bus or rail station)	4		100	4		100	4		10	.4
h) Access to Recreation	4		100	4		100	4		10	.4
Total Rating Points	100			67.2			84			42.8
Ranking				II			I			III

Weighted rankings can then be calculated for each project and, when aggregated, indicate that the secondary road ranks highest (84), followed by the feeder road (67.2) and the rail line project (42.8). Using the results from this ranking combined with other considerations, AID would be justified in providing assistance for the secondary and feeder road project, while leaving the rail line improvement for other donors.

AFR
380.5
D772
V.2

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WASHINGTON, D.C. 20590

for International Development
NS
Washington, D.C. 20523

THE ROLE OF AID IN THE DEVELOPMENT

OF

SAHEL TRANSPORTATION INFRASTRUCTURE

A Strategy Proposed by the
Office of International Transportation Programs

VOLUME II

Department of Transportation
Washington, D.C. 20590

March 1, 1979

(Review Copy)

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CLIMATIC ZONE CHARACTERISTICS

1. General. Figure 1 illustrates the four climatic bands of the Sahel, which are individually described herein.

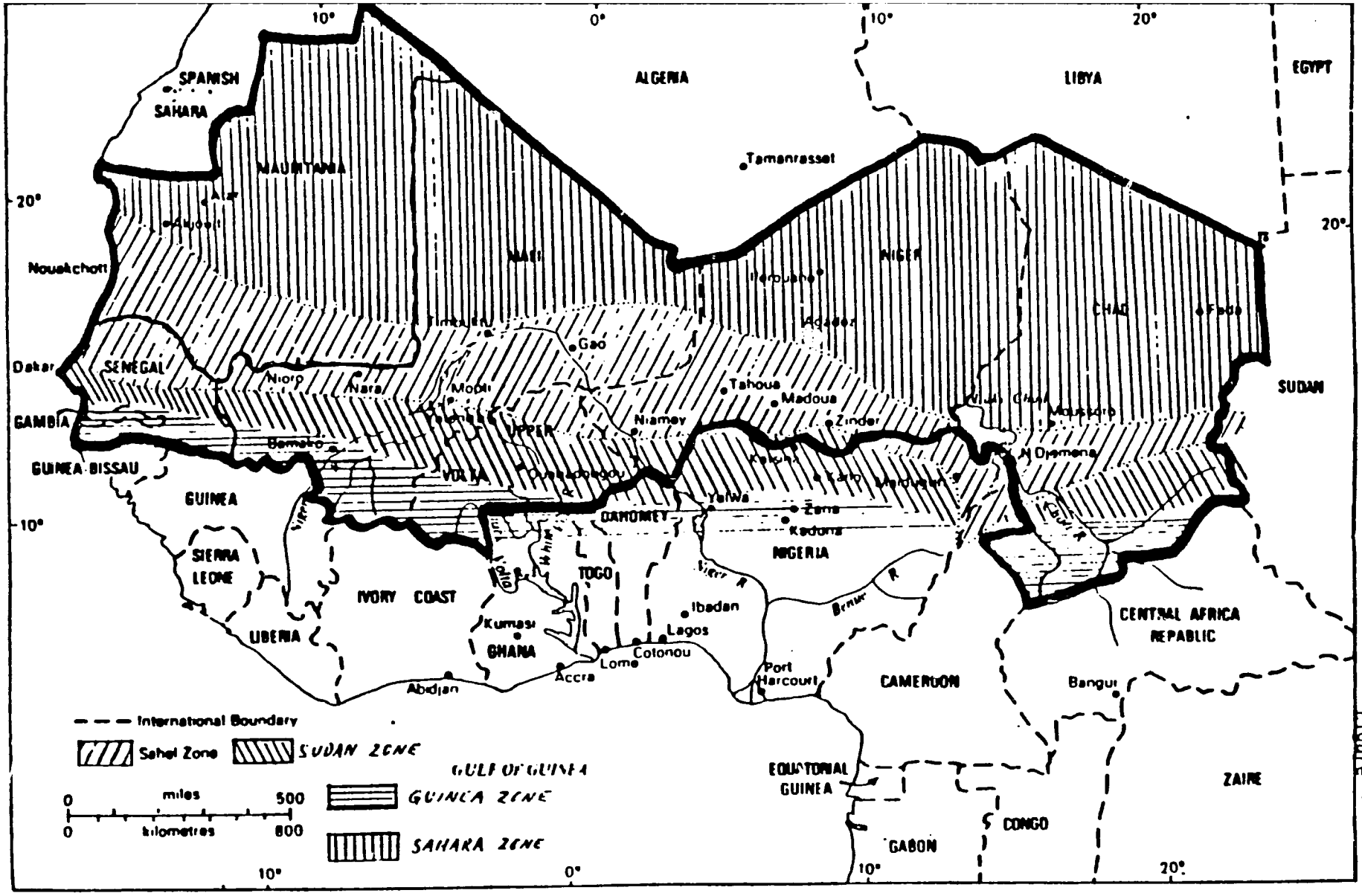
2. Sahara Zone. The Sahara Zone accounts for about 50% of the total area of the Sahel states. Hot and extremely dry, it covers substantial portions of Chad, Niger, Mali and Mauritania. Apart from its oases, this desert is of little economic importance as an agricultural resource.

   In Chad, the Sahara Zone covers most of the northern half of the country. The area receives only traces of rain during the entire year. Scattered small oases and a few small wells provide water for a few date palms or a small plot of millet or garden crops. Average daily maximum temperature is 90 degrees F. during the coolest month of the year; absolute maximums are above 115 degrees F. Strong winds from the northeast create violent sandstorms. See Figure 2

In Mauritania, the Sahara Zone comprises the northern two-thirds of the country, with the boundary generally corresponding to the isohyet (a line on the earth's surface along which the rainfall is the same) that represents annual precipitation of 300 millimeters (11.7 inches). Rain usually falls during the hivernage, or rainy season, lasting from July to September and is the result of fortuitous storms that dump large amounts of water in short periods of time. Annual variations in rainfall are also an important

factor. Temperature has extreme diurnal variations but minimal annual variations. During the winter, variations may range from an early morning low of 32 degrees F to a mid-afternoon high of 100 degrees F. During the summer, temperatures range from 60 degrees F. in the morning to more than 120 degrees F. by the afternoon. The coolest months are December and January; the warmest, May, June, and July. Throughout the year the prevailing wind is the hot, dry east wind, the harmattan, which often causes blinding sandstorms. See Figures 4 and 5 . The Sahara Zone is not represented in Cape Verde, Senegal, the Gambia or Upper Volta.

3. The Sahel Zone. South of the Sahara Zone is the Sahel Zone. It comprises about 20% of the total Sahel area. The rainy season begins earlier than in the Sahara Zone, about June, and lasts until October. Again, annual rainfall variations are of significance: Kiffa in Mauritania, had 7.2 inches in 1951, but 21.5 inches in 1936. Although temperature extremes are somewhat less severe than in the Sahara, diurnal variations do range from 60 degrees F to 70 degrees F. Maximum temperatures above 100 degrees F. occur frequently, especially during April and May. The prevailing easterly wind is hot and dry, but here in the Sahel Zone it has a slightly higher moisture content than in the Sahara and thus slows rapid evaporation of surface water. In this zone of steppes and savanna grasslands, the natural vegetation includes drought-resistant grasses, thorny shrubs, scattered acacia trees, and small areas of woods. Towards the northern edge of the zone there is a thinning out of trees and shrub until the

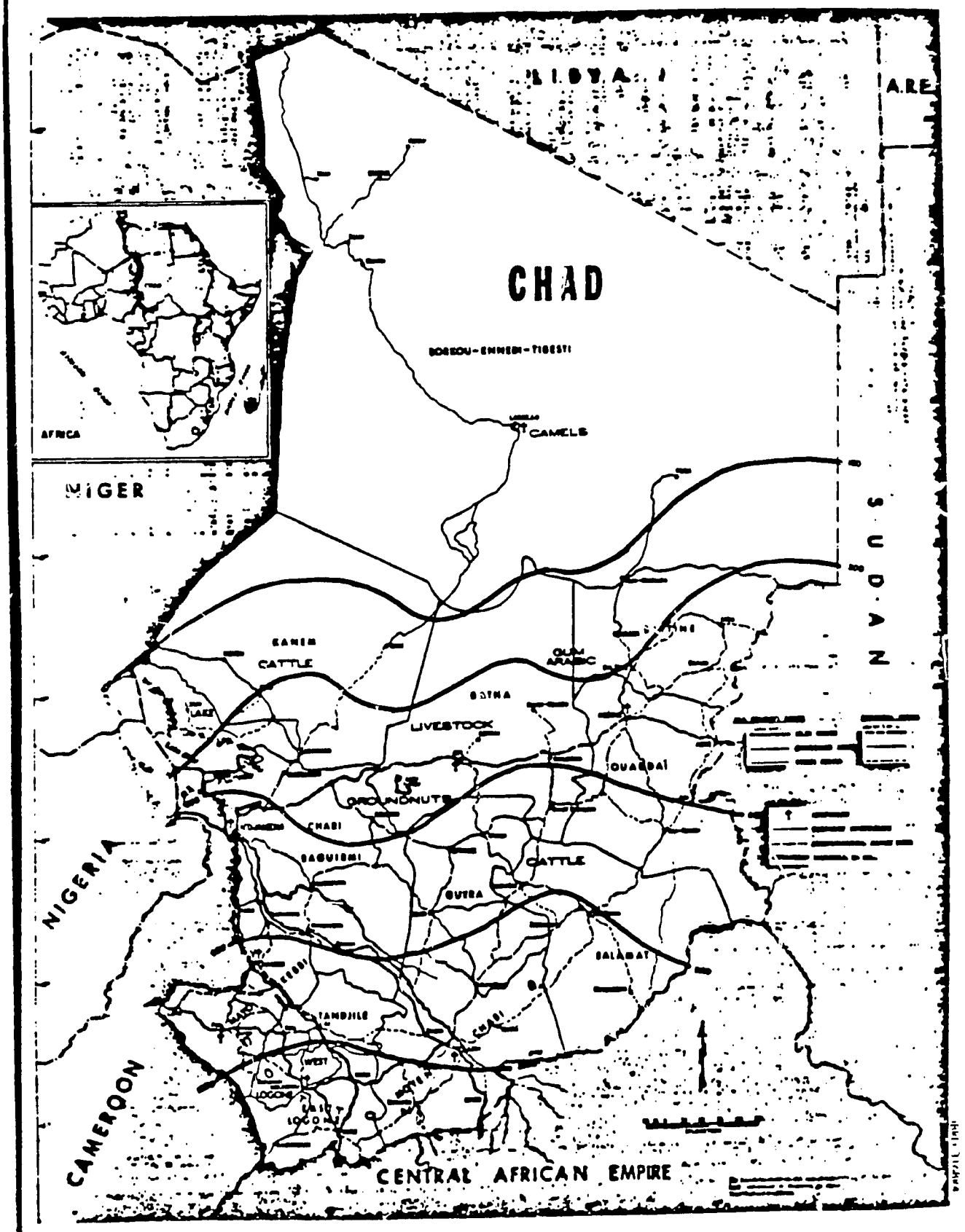


THE SAHELIAN COUNTRIES
CLIMATIC ZONES

ANNEX 1
Figure

Rainfall in CHAD

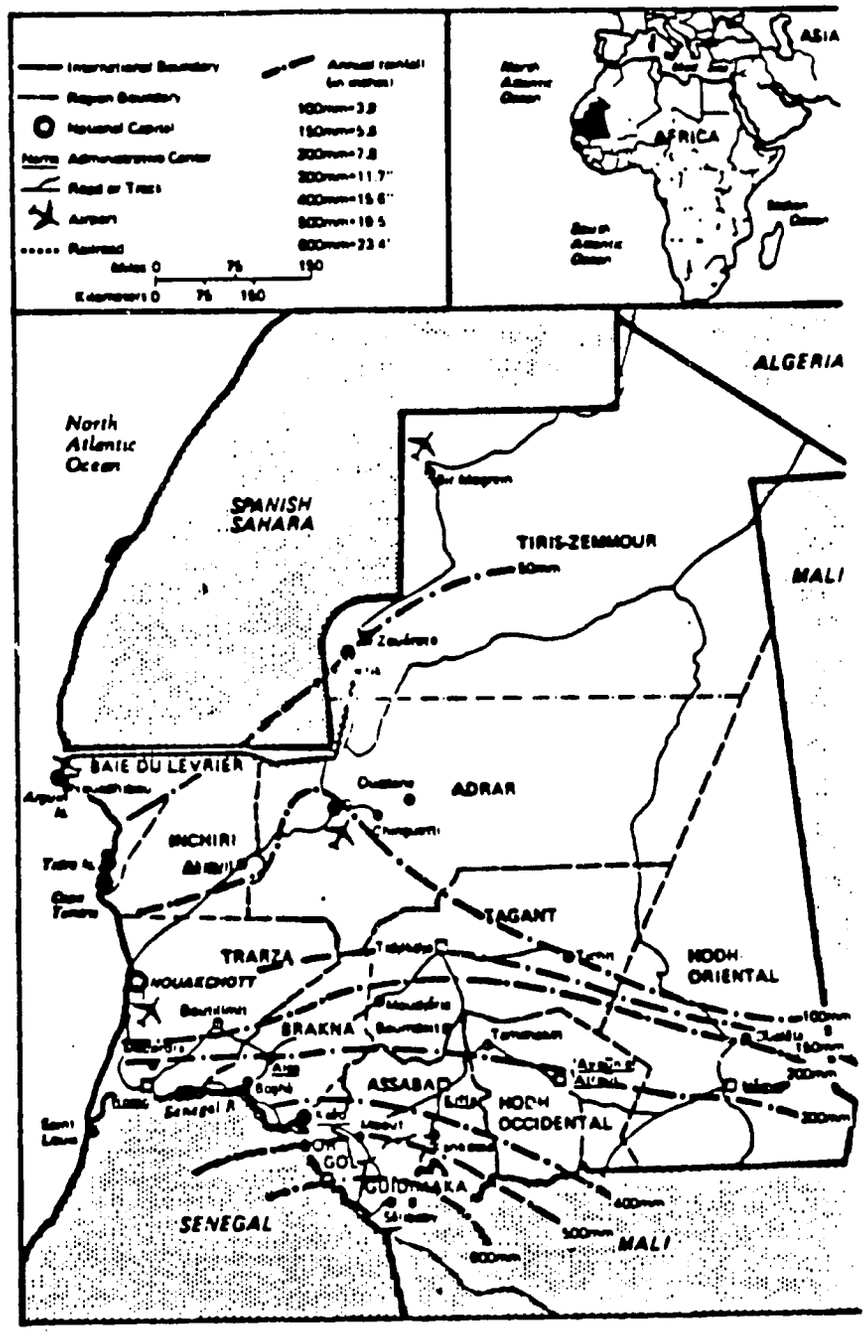
ANNEX 1
Figure 2



ANNEX 1
Figure 3

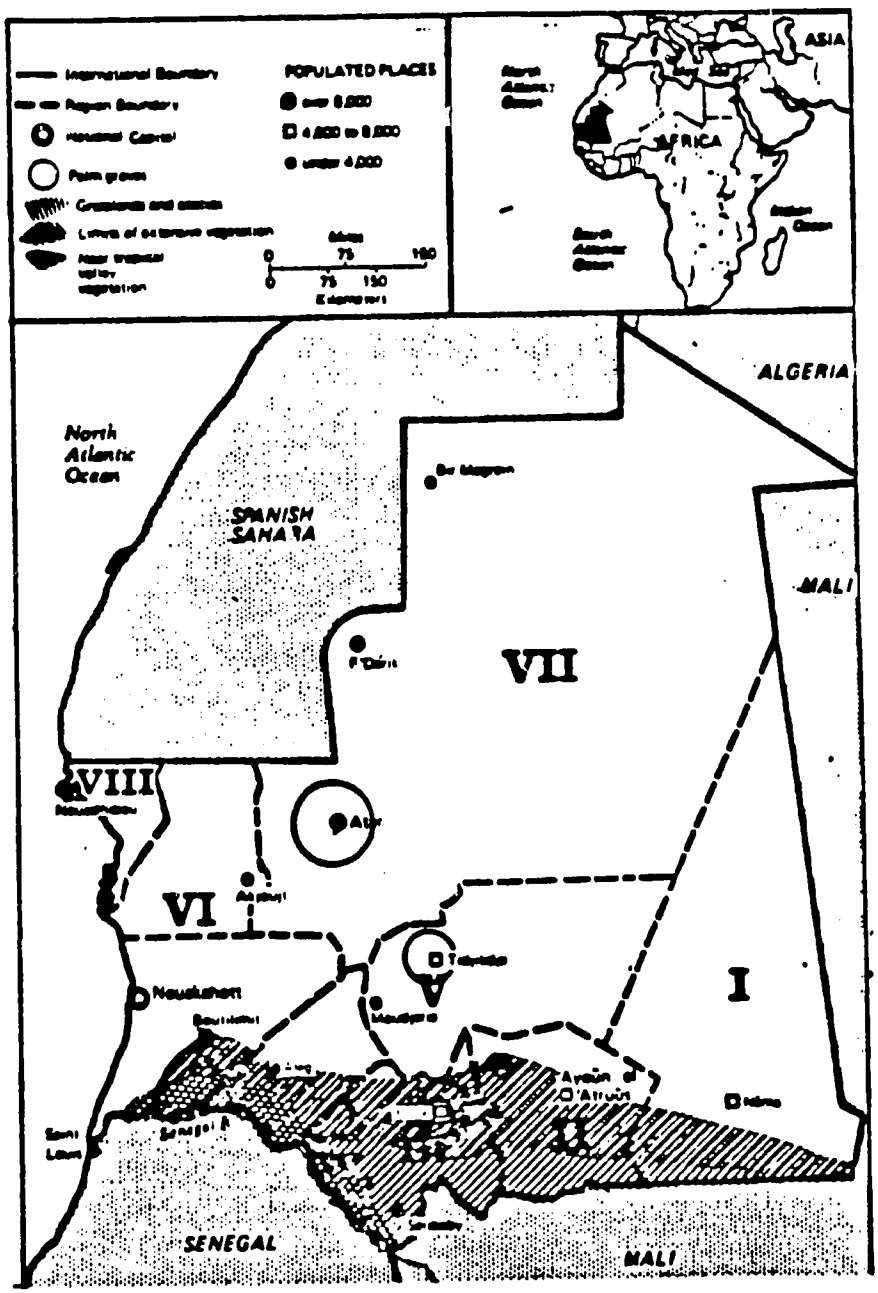
Rainfall in Niger

ANNEX 1
Figure 4



Rainfall in Mauritania

ANNEX 1
Figure 5



Vegetation Belts in Mauritania

desert fringes are reached, and here the herbaceous cover is of short-lived annuals. However, date palms, cereals, and garden crops may be grown in well-kept oasis plots. Outside these small and widely separated oases, nomads tend their flocks on the otherwise unpopulated desert during the wet season, then move southward as forage and surface water disappear early in the dry winter season. Southward, there is a gradual transition to taller grasses, with a higher proportion of perennial species, and the incidence of trees increases. Millet and groundnuts are grown here, but yields are very low. Pastoral operations are the Sahel Zone's most important economic activity. Great herds of cattle, sheep, goats and camels are moved by nomadic pastoralists across this zone from north to south following the season. For the nomadic graziers, the Sahel Zone represents a base which provides adequate forage for their herds for the four or five rainy months of the year; thereafter the herds are moved southward to graze in better watered areas during the dry season. However, a substantial number of breeding females and young stock remain in the Sahel in a normal dry season.

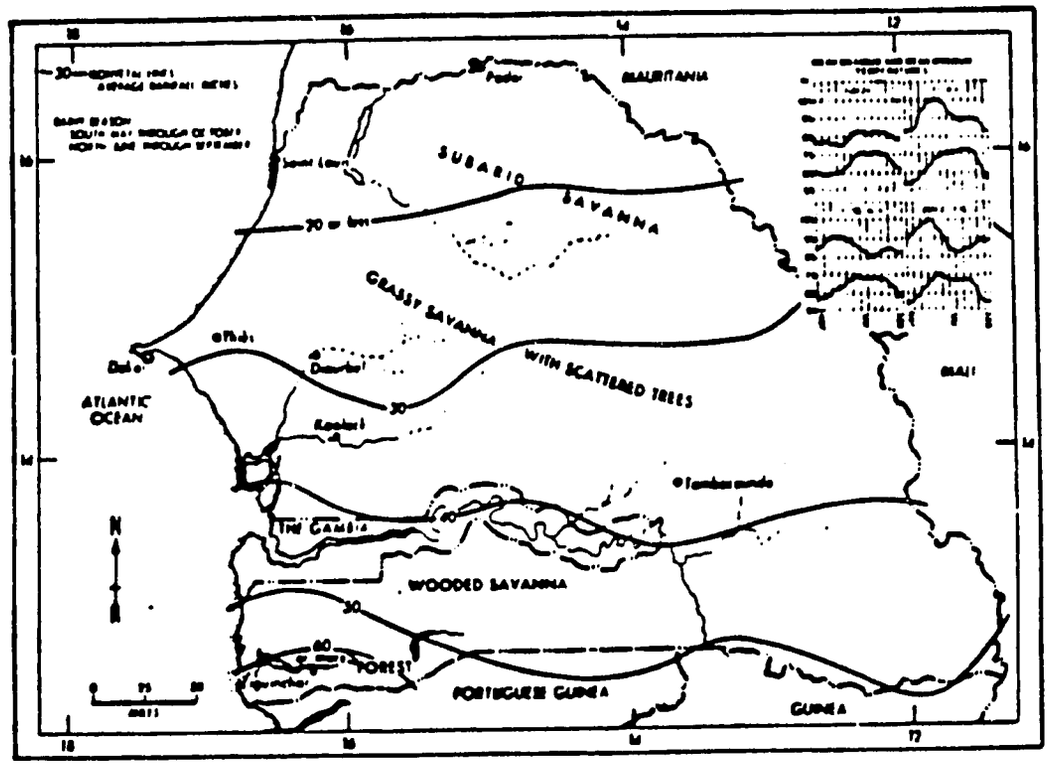
4. The Sudan Zone. The next climatic band southward is the Sudan area, characterized by an annual rainfall of between 20 to 40 inches and average temperatures of between 75 degrees and 86 degrees F. In this zone there are localized forest corridors along its southern border and in the river valleys. The rest of the area is covered with savanna-type vegetation, open grassland and scattered trees. The incidence of trees

decreases in the north as the Sudan Zone merges with the Sahel. The Sudan Zone can support relatively intensive systems of agriculture, and since health conditions are favorable in comparison with the Guinea Zone lying to its south, it supports the bulk of the population of the Sahelian countries. Over most of the zone, millet, sorghum and cowpeas are the principal food crops, and cotton and groundnuts the cash crops. There are substantial p sibilities for further diversification into crops such as maize and soybeans and, as pasture growth is better than in the Sahel, mixed farming is feasible and in some areas is being developed.

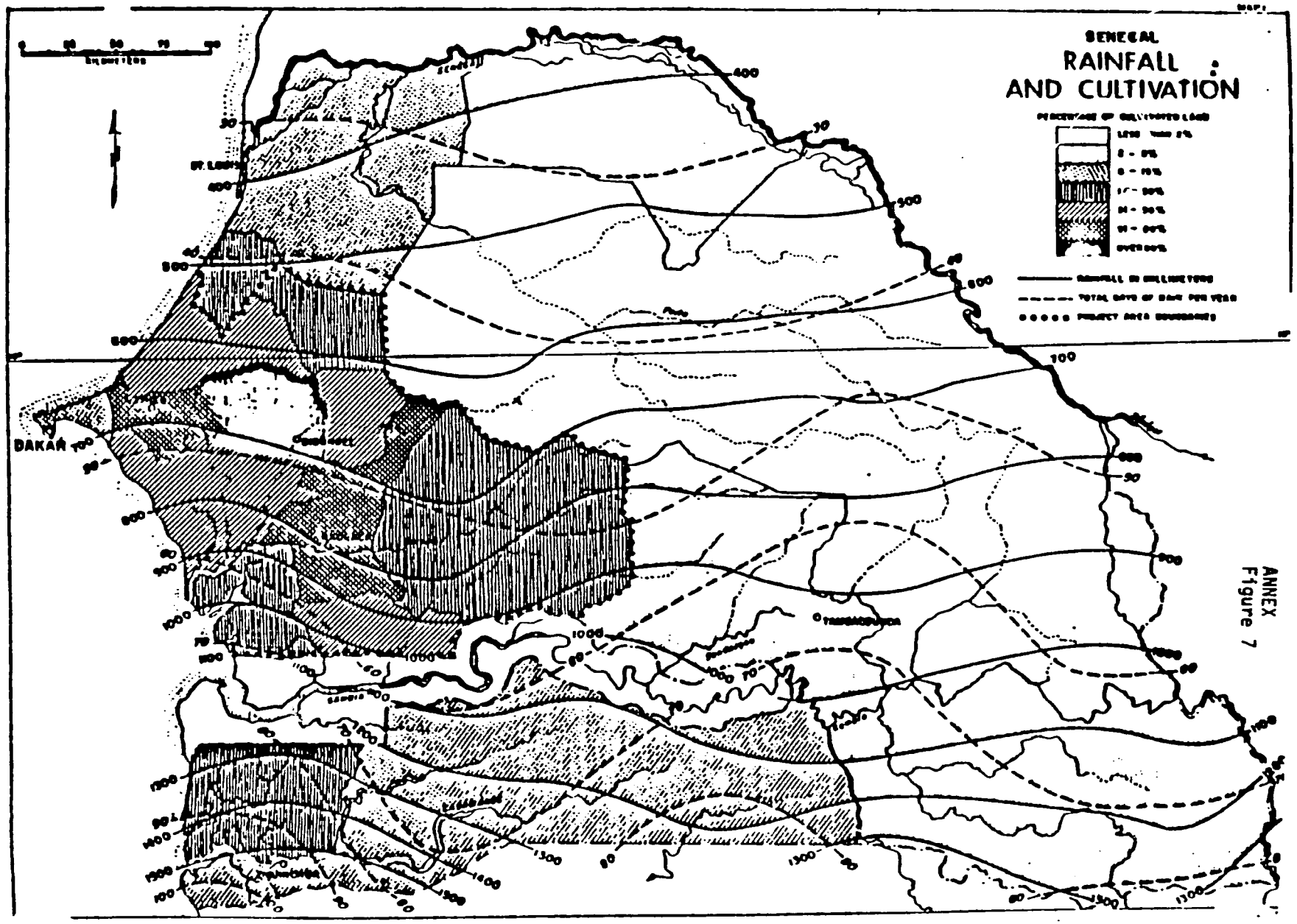
5. The Guinea Zone. Furthest south is the Guinea Zone, which is well within the northern edge of the equatorial rainbelt. The rainy season extends from April through October, bringing from 40 to 60 inches of rain. Humidity during this time is often about 80%, and temperatures are relatively high throughout the year. Daytime maximum temperatures are generally above 80 degrees F. in January - the coolest month of the dry season - and in August, when the rains have some cooling effect. Temperature maximums during the hot months of March, April, and May are frequently above 100 degrees F. and official temperatures above 113 degrees F. have been recorded in some places in the months of February, March, and April. Humidity is usually higher along the rivers and the air is often clouded by dense mists. The natural vegetation in the Guinea Zone is very diverse. It includes a mixture of tropical or subtropical grasses and woodlands, producing lush growth during the rainy season. Much of the

area, especially in Chad and Senegal, is farmland, with the natural savanna vegetation replaced by cotton, rice, peanuts, sorghum, millet and other crops. See Figures 2, 6 and 7. In areas lying in or to the south of Mali and Upper Volta, the Guinea Zone has the problem of a year-around incidence of trypanosomiasis, a high incidence of river-blindness and other diseases. See Figure 8 . Historically, disease problems have acted as a barrier to the permanent movement of people and livestock into the more fertile and better watered areas within the Guinea Zone. In Upper Volta, for example, the geographical distribution of the population does not generally correspond with the distribution of natural resources; the less productive central plateau, occupying about one-fourth of the land area, supports nearly half of the total population, while the fertile southwestern corner of the country, lying within the Guinea Zone, is relatively under-populated. This distribution has persisted, despite considerable demographic pressure for migration, due to the high incidence of diseases in the areas with more adequate rainfall and water supply in the Guinea Zone. The World Health Organization has recently launched an ambitious river-blindness eradication program in Upper Volta to open vast tracts of land to cultivation. Figure 9 illustrates the locations of the four Sahelian climatic zones. Figures 10, 11, and 12 define annual zonal precipitation characteristics, and Figure 13 shows the nature of vegetation typical of the respective zones.

ANNEX 1
Figure 6

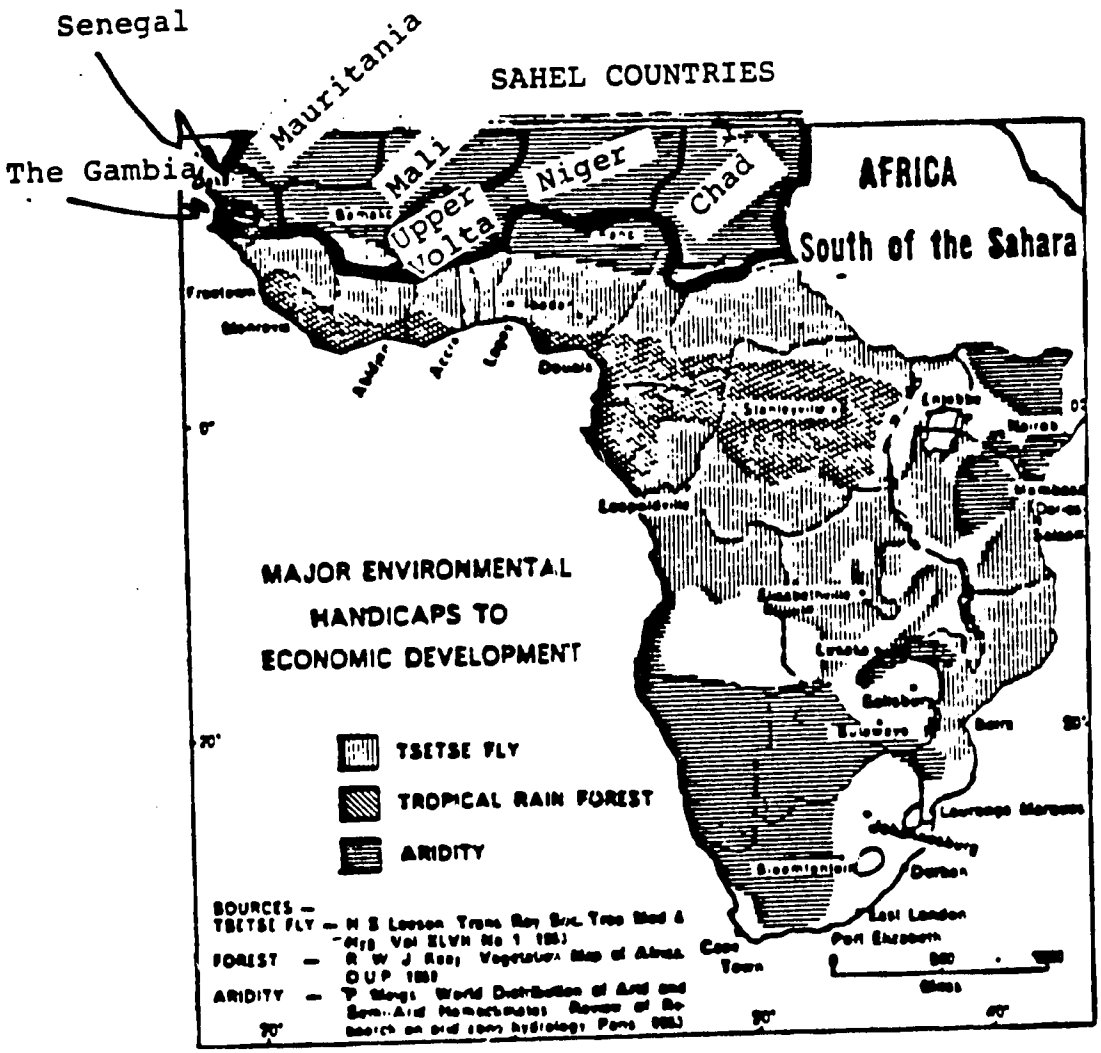


Climate in Senegal

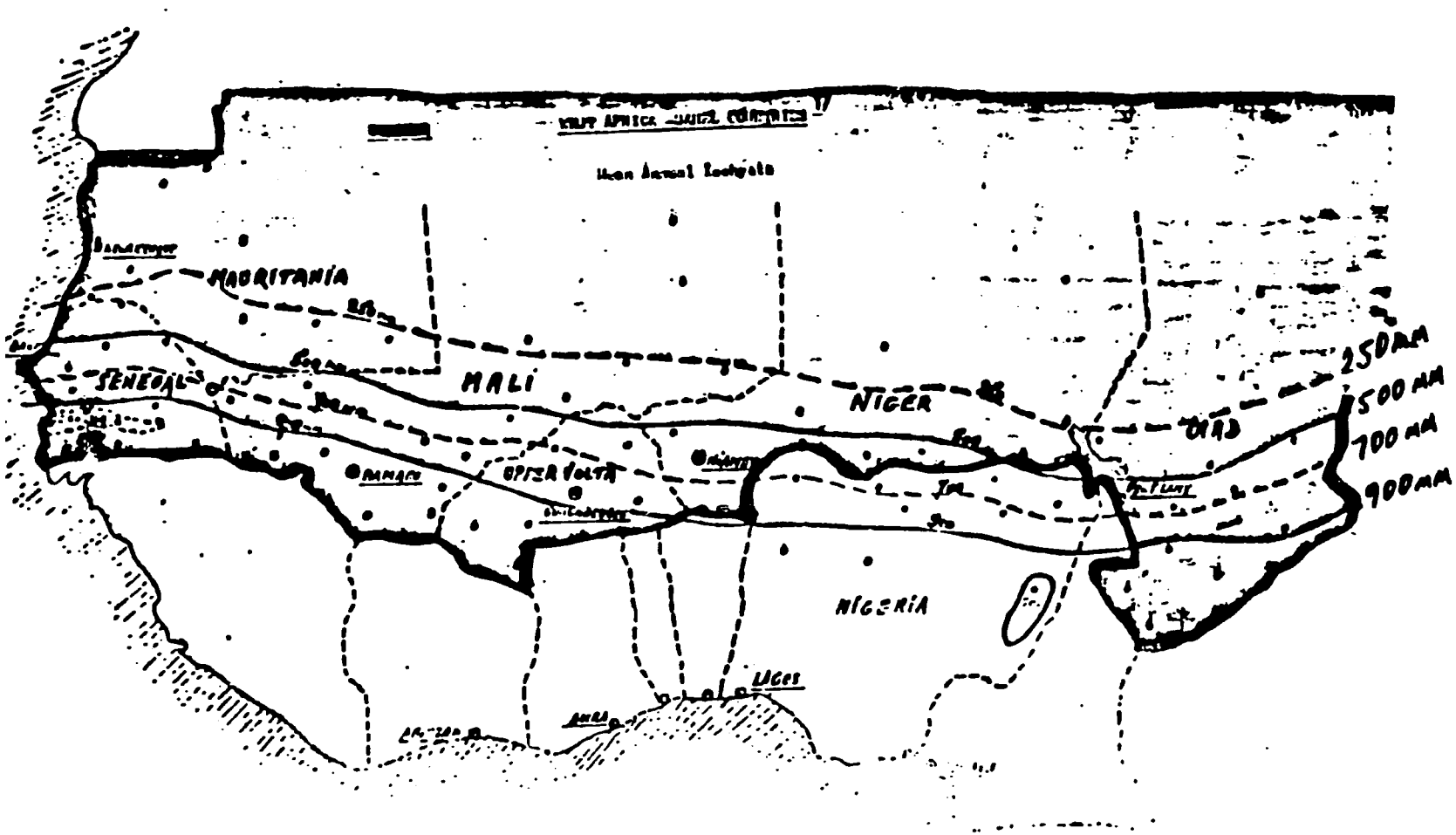


ANNEX
Figure 7

ANNEX 1
Figure 8



SAHEL
ANNUAL PRECIPITATION



CONVERSION

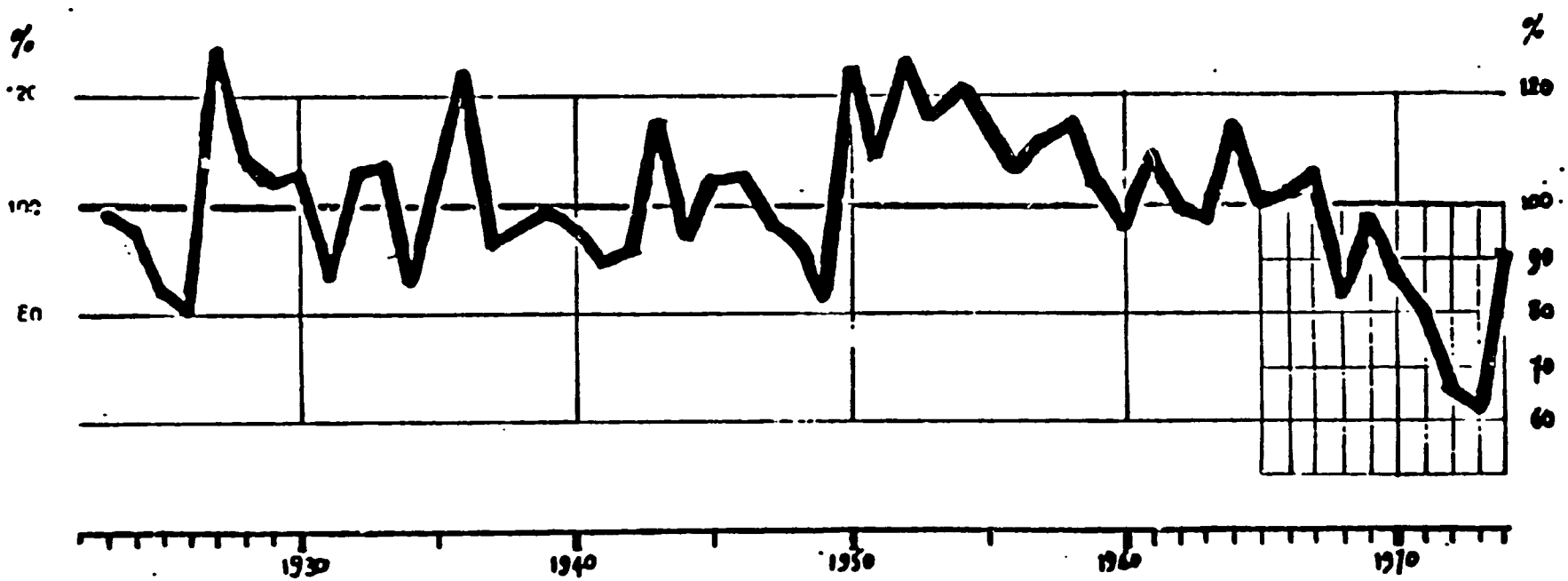
250 mm = 9.6 inches
500 mm = 19.3 inches
700 mm = 27.0 inches
900 mm = 34.8 inches

ANNEX 1
FIGURE 9

SAHEL COUNTRIES; RAINFALL (AVERAGES OF ANNUAL RAIN)*

1923 - 1974

(Average of the 3 time-periods indicated below = 100 each)



* 1923 - 1932 average 14 stations

1933 - 1940 " 26 stations

1941 - 1973 " 43 stations

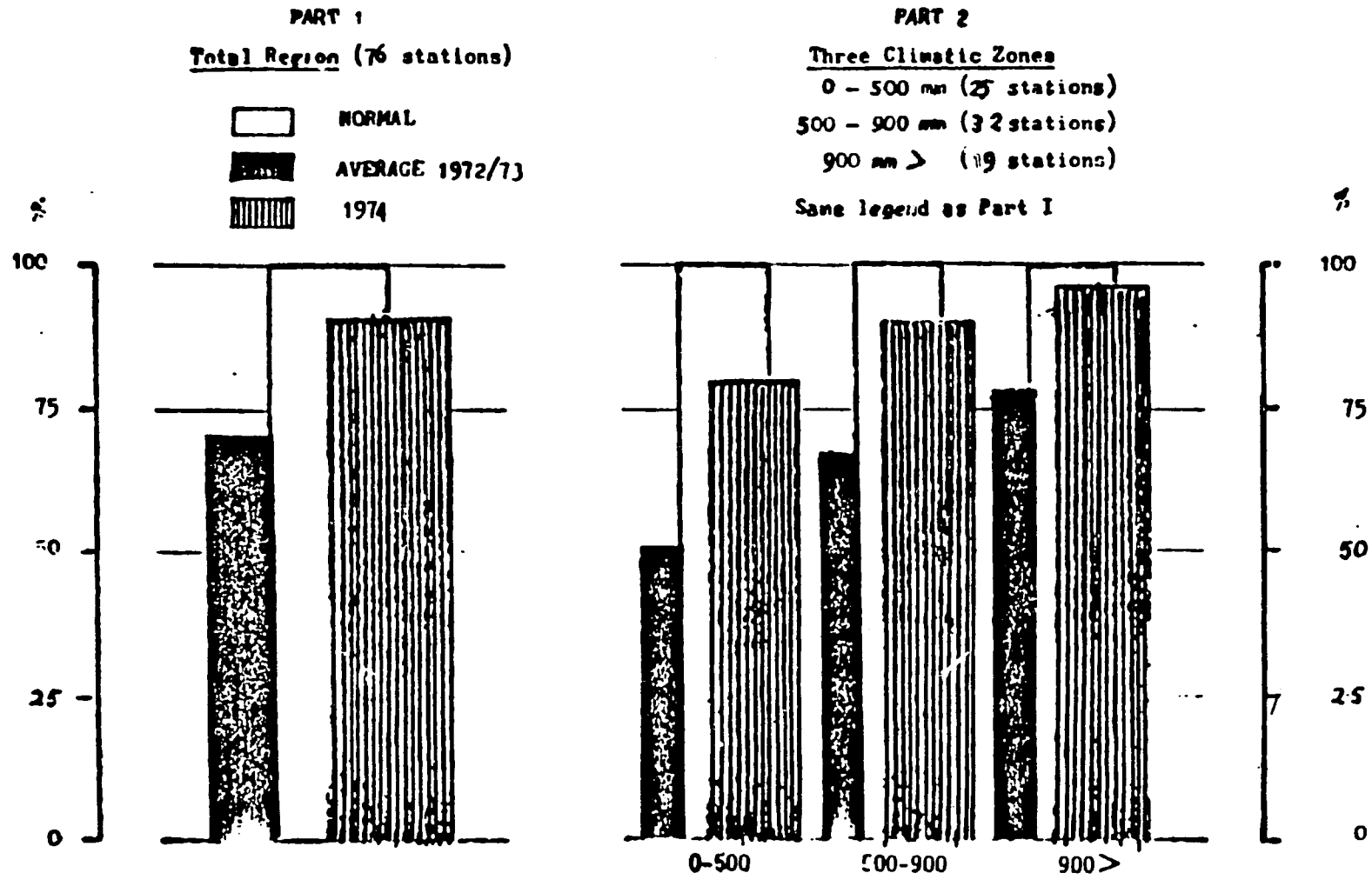
1974 estimated

*** Only stations between 100-1100 mm of normal annual rainfall were included in calculation of averages.

ANNEX 1
Figure 10

SAHEL COUNTRIES RAINFALL 1974 (June/Sept. Rains)*

Compared with normal June-Sept. Rains (=100) and the average of 1972/73

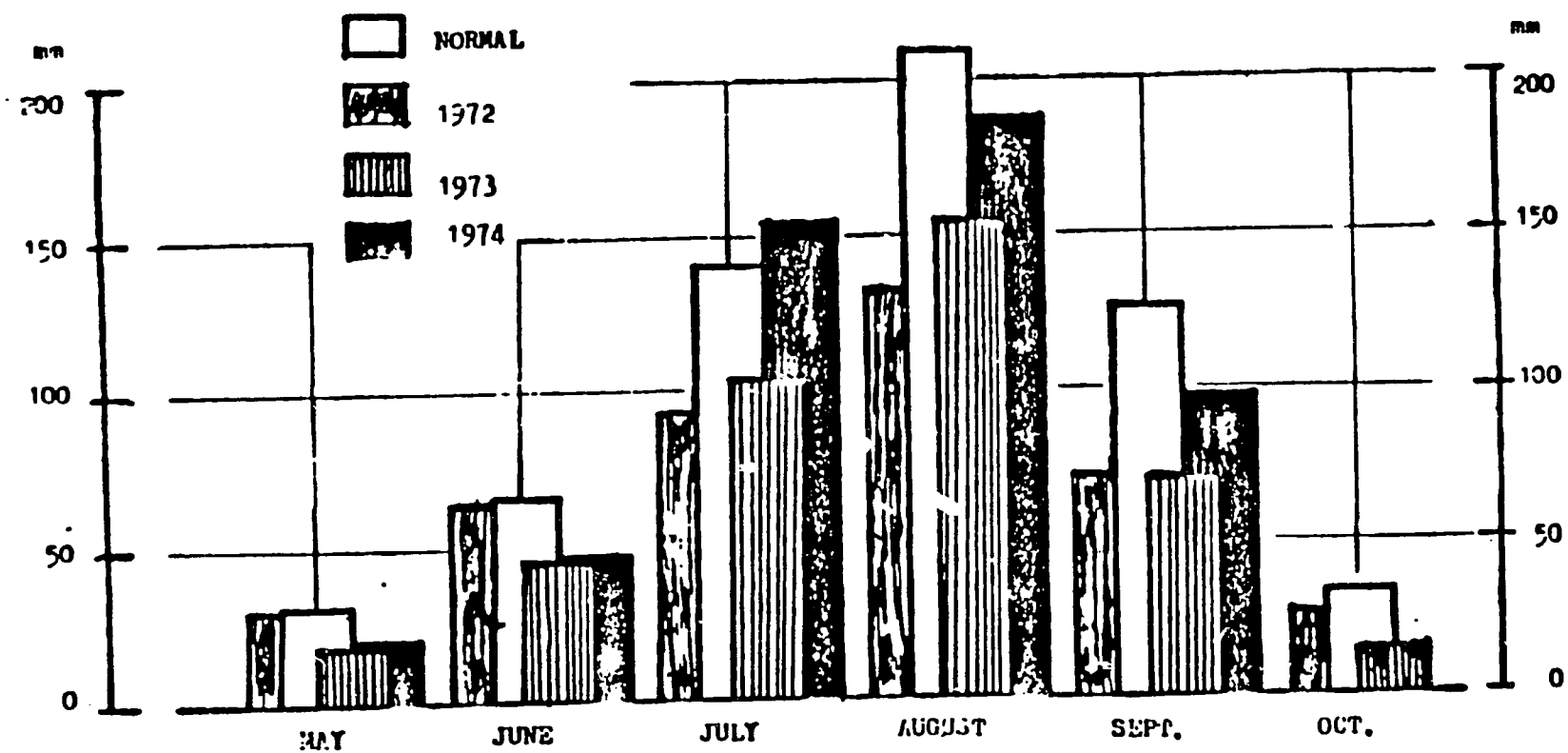


*) During June/Sept. about 85% of normal total annual rains are falling on an average of the 76 stations observed.

ANNEX 1
Figure 11

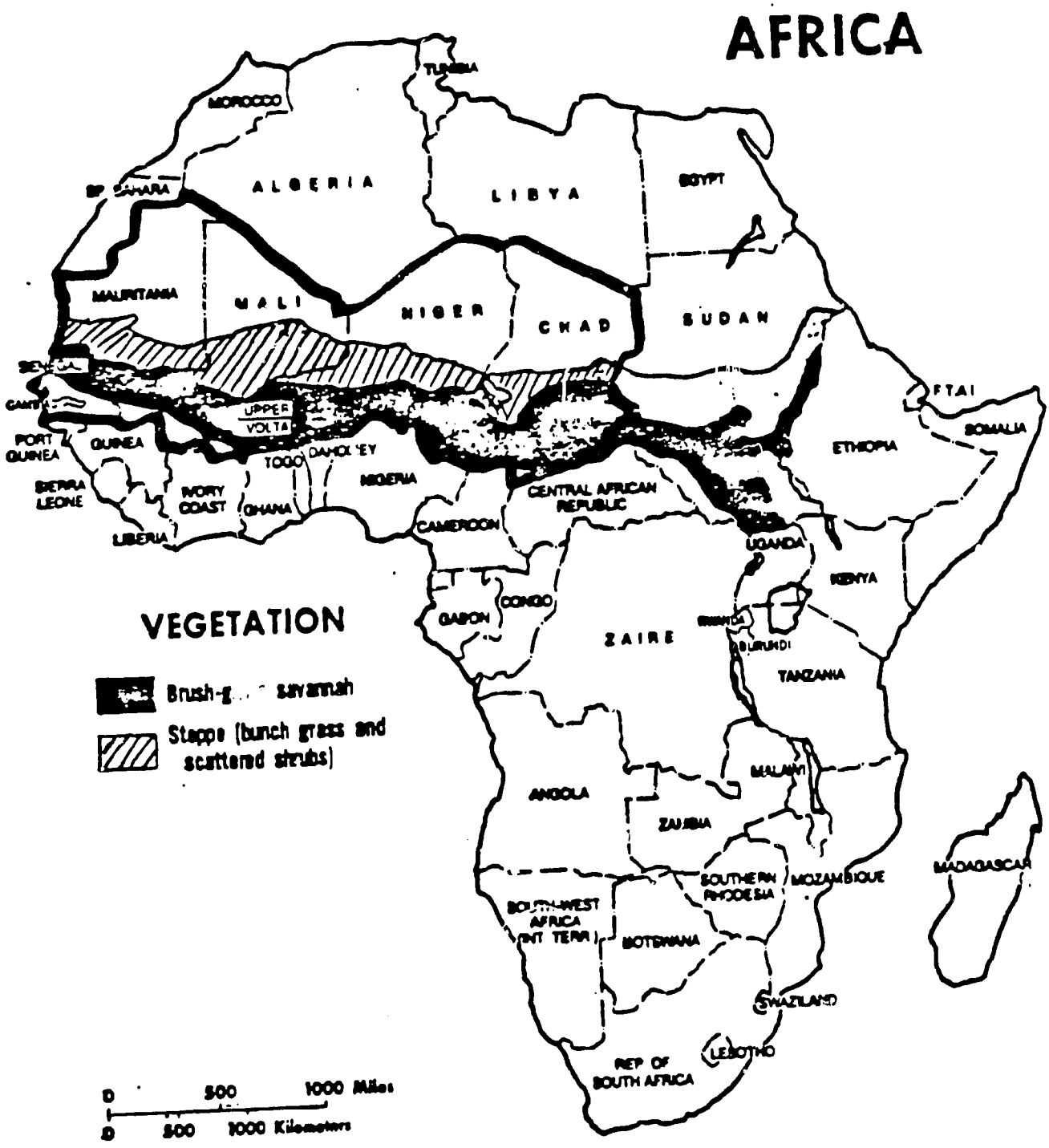
SAHEL COUNTRIES; RAINFALL

(Average of 76 Stations, by Months in Millimetres)



ANNEX 1
Figure 12

ANNEX 1
Figure 13



6. Drought and Desertification

The Sahel nations were seriously affected by drought during the late 1960s and early 1970s. Drought in the eight countries is more frequently the result of poorly distributed rainfall than of inadequate total rainfall, although in 1972 rainfall was deficient in both quantity and distribution. Thus Ziguinchor in Senegal, which lies at about 12 degrees 35' N, has a four-to-five month rainy season with 64 inches of annual rainfall; that is nearly three times the rainfall received by Dakar (14 degrees 49' N), whose rainy season is little more than three months in length. The situation worsens as one moves from south to north.

The briefer the humid period the more serious the consequences of any circumstance that shortens it. Such circumstances could be a delay in the onset of the rains or an early end to the rains. In areas with short humid periods and low total rainfall, a decline in total rainfall from the average usually means a reduction in the humid period. Variability of rainfall increases from south to north and thus with diminishing total rainfall. Consequently, the low rainfall areas of the Sahel countries have not only low total rainfalls and short rainy seasons, but also are most susceptible to the variations in rainfall that are likely to bring about drought conditions. These variations often occur at the beginning of the rainy season and typically involve rains which are adequate for land preparation, sowing and germination but which are then followed by a period of dry weather sufficient to desiccate the nearly germinated crop. In southern areas the loss of this first sowing

is not disastrous, but in northern areas - where the humid period is shorter and total rainfall lower - catastrophe occurs when the crop has insufficient time to mature before the end of the rains.

The Sahel's ecological balance is terribly fragile, and less is known about it than about gentler, more densely populated, more intensively exploited regions. This means that ecological errors are at once more likely and more costly. There is less margin for error in every sense. The effects of overgrazing on plant cover are perhaps the most commonly cited examples, but there are many others. For example, small reductions in rainfall seem to have disproportionate effects on plant growth. This derives from the rainfall-evaporative demand relationship; where the amount of rainfall is small relative to evaporative demand for water, even minor changes in rainfall tend to have magnified consequences. A similar phenomenon has recently been noted: rainfall patterns in recent years have had a kind of multiplier character in the northern parts of the Sahel; in years of good rain these regions seem to get a far larger amount than their expected "normal", and in bad years they are much drier than "normal". In this sense the ecological system is extraordinarily delicate and Sahelian society is subject to uncommon hazards, many of them weather-related, beyond the effective control of the people.

Real drought is not a single dry year but a succession of such years. Such successions do not occur randomly; there is a marked tendency of bad and good years to occur in cycles. Drought is a relative phenomenon; by the standards of most other countries the Sahel is in perpetual drought. Even

locally it is relative, for the population is likely to compare the dry years with the abnormally wet ones. Furthermore, they are likely to have adopted practices during the abnormally wet years which end in disaster during the dry years.

This was certainly the case in the recent drought, which at least temporarily came to an end with the good rains of the 1974 rainy season. The 1940s experienced average rainfall for the decade as a whole. But the 1950s were bonanza years with the Sahel Zone averaging about one-fifth more rain than average and the Sudan Zone about one-tenth more. As good years followed each other in succession, both nomadic pastoralism and sedentary farming moved north. The northward shift was facilitated by technical aid from abroad which increased dramatically the number of water points in the Sahel. So moist was it that the Fulani pastoralists of northern Nigeria and southern Niger drifted as far north as the Air plateau beyond Agadez in the Sahara Zone. Better than average rainfall extended throughout most of the 1960s.

The break came with the 1968 wet season, when rain was one-fifth below normal and one third or more below that of the 1950s. In 1969 there was a better wet season, but thereafter a massive drought developed. The rainfall deficit over the 1970-73 four-year period was approximately one-third in the Sahel Zone and one-quarter in the Sudan Zone.

In the recent drought, as in previous droughts, the proportional deficiency in rainfall has been greatest in the driest areas. The monsoon fails to penetrate as far. The monsoon advances northward at an average of 8km. per

day and finally retreats at 16km. per day, so that the length of the rainy season decreases by one day for every 5.5km. one moves northward. Normally in Niger, some rain falls as far north as 18 degrees 30' N (the Saharan slopes of the Air Plateau); in 1972, however, it failed to pass 15 degrees 40' N (just north of Taouah in southern Niger). Rainfall is extremely variable both geographically and chronologically. Places only a few miles apart may be treated very differently by the monsoon - hence the importance of nomadism in looking for pockets of good pasture resulting from fortuitous showers.

Some of the discussions about permanent weather change in the Sahel start with the assumption that the 1970 - 73 drought was the worst ever. The assumption is highly questionable, and it is not believed by most of the older people in the area. Centainly the drought was the first of its magnitude since the Second World War, following which the people of the Sahel became citizens of independent countries, with the attention of United Nations agencies. It occurred in a period of technical aid and of concern about the world's resources and received massive attention from the world's news media. While most of the area's people believe that the drought centering on 1913 was the worst in memory; in some areas the droughts of the early 1920s and early 1940s appear to have been almost as bad.

The cause of the recent cycle of dry years are unknown. At best it can be said that they are related to anomalies in the general circulation of the atmosphere. There is yet little evidence

to indicate to that there is any secular trend affecting the area's climate. Rather, rainfall records give evidence of short-term fluctuations: 1912 - 15, drier; 1916 - 24, wetter; 1925-28, drier; 1929-39, wetter; 1947-49, drier; 1950-61, wetter; 1962-67, fluctuating around normal; 1968 onward, drier. Perhaps the most one can say is that it would be unwise to assume a future Sahelian rainfall pattern very different from that which we have known in the past.

The 1970-73 drought conditions have led to a concern that the Sahara is advancing southward and that this is adversely affecting weather patterns. However, recent findings by the World Metereological Organization (WMO) indicate that:

a) a general trend in average rainfall, since the beginning of the century, either upward or downward, was not discernible despite the progress of desertic conditions; and

b) the observed progress of desertic conditions was apparently not caused by climatic conditions, but by human interference as a consequence of the increasing needs of a growing population.

The WMO study concluded that all activities influencing the delicate water balance in the transition zone between desert and cultivated land should be very carefully planned and coordinated, - especially any measures involving the additional use of groundwater, the extension of dry farming, afforestation, and increased grazing intensity.

POPULATION DISTRIBUTION BY COUNTRY

Specifics on the nature of populations, their distribution, and present migratory features are contained in the individual country studies which follow.

1. Cape Verde

The total area is 4,033 sq. km. (1,557 sq. miles) and the administrative capital if Praia, (population 21,494 in 1970) on Sao Tiago Island. The 1970 census figure was 272,071 inhabitants. While an explosive birth rate forced a significant number of islanders to emigrate to Angola, Guinea-Bissau, Sao Tome and formerly to other west African countries, most of the Cape Verdeans living in Angola and Sao Tome were repatriated in 1975. The main destination in recent years has been metropolitan Portugal where Cape Verdeans replaced Portuguese migrants to Western Europe. The main center of population is Mindelo (Sao Vincente), with 28,797 inhabitants in 1970, the foremost port and economic capital of the archipelago. Sao Tiago is the most populous of the ten islands, with 129,358 inhabitants in 1970, followed by Santo Antao (44,916), Fogo (29,592), Sao Vicente (31,462). (See Table 1)

ANNEX 2
Table 1

CAPE VERDE

Area: 4,033 sq. km, 1,557 sq. miles)
Prefectures: 272,071 (census of December 15th, 1970).
Total: (1975) 299,842.

PREFECTURE POPULATIONS

	1975 (estimates)
Boa Vista	3,943
Brava	8,659
Fogo	32,342
Maio	3,942
Patti	8,467
Porto Novo	14,257
Praia	46,049
Ribeira Grande	25,455
Sal	6,619
Santa Catarina	44,614
Santa Cruz	23,045
Sao Nicolas	17,859
Sao Vicente	36,433
Tarrafal	28,158
Total	299,842

2. Chad

The Republic of Chad, the northernmost of the four independent states which emerged from French Equitorial Africa, is the largest in terms of size (1,284,000 sq. km.). The population was 4,030,000 in 1975.

The population is markedly concentrated in the southern half of the country. Even there, however, population density is only 3-persons per sq. km. Densities and settlement patterns were determined primarily by the level of precipitation. The southernmost prefectures of Logone Occidental, Logone Oriental, Mayo-Kebbi, Moyen-Chari, and Tandjile and the adjacent areas of Chari-Baguirmi receive enought rainfall to encourage a lush savanna vegetation and a variety of agricultural crops. Approximately 1.66 million people, almost 45 percent of the population, live in this area of about 50,000 square miles (about 10 percent of the country). Population density is about thirty-three per square mile in these southern prefectures.

The Sahelian central zone of about 96,000 square miles includes Lac, nothern Chari-Baguirmi, Guera, Salamat, and Ouaddai prefectures and adjacent areas of Batha and Biltine prefectures. About 1.93 million people live in this semiarid zone, with an average density of about nineteen persons per square mile. Densities in the Sahelian zone vary widely.

The sparsely settled northern deserts and the northern part of the semiarid central zone - Borkou-Ennedi-Tibesti and Kanem prefectures and the majority of Batha and Biltine prefectures cover some 350,000 square miles. Borkou-Ennedi-Tibesti Prefecture, with nearly half of Chad's land surface, contained fewer than 100,000 persons in 1971, or less than 2.5 percent of total population. Roughly four-fifths of the population are farmers. Of these, a minority are semisedentary people - farmers who also kept livestock and were away from their home villages during part of the year on seasonal migration. About one-fifth of the population are nomadic or seminomadic herders, migrating either continually or seasonally with their livestock. As the rains advance northward during the spring and summer wet season, many of these migratory people follow along, searching for new pasturage, and then move southward as the rains recede during the autumn months. Nomads generally pay little attention to national boundaries. about 8 percent of the 1971 population was considered urban.1/ Eight population centers had populations exceeding 10,000 but many nominally urban residents still derived their living directly from the land. Only a handful of these centers had developed the political structure and services generally associated with modern cities.

The northern edge of the central area of mixed farming and grazing is near 15 degrees N. Movement of grazing animals from permanent home bases to temporary-usually seasonal - pastures is a well-established practice. The combination of crop production and herding generally necessitates several forms of seasonal movement

1/ This percentage has increased since the last great drought.

but not permanent migration. In some families both men and women tend subsistence crops in locations some distance away from the permanent home, making periodic trips to such crop areas.

In the south, typical village locations are in or near flood plains of rivers, just above the level of the average annual flood. Many are surrounded or partially surrounded by stagnant swamps during the dry months.

Two internal village arrangements are common: a loose grouping of huts on ground above the average level of floods; or a linear unit consisting of a single or double row of closely spaced huts along a road or stream. Some loosely grouped villages are built around at least three sides of a plaza or market area. In Muslim areas, some villages are constructed in a rough circle around a mosque. In other areas - for example, in Moyen-Chari Prefecture - some family compounds include several huts surrounded by a fence woven of reeds, and villages are simply clusters of such compounds. Linear v illages sometimes adjoin others end-to-end, particularly in the more densely populated southern provinces; several such units often appear to be one large village.

East of Lake Chad, in the semiarid central prefectures, villages average less than half the size of those in the south. Much of the population is primarily sedentary, the remainder either mixing

sedentary crop production with seminomadic herding or moving with their herds throughout most of the year as true nomads. Among the sedentary peoples, village locations are likely to have been determined by the existence of groundwater sources that make crops possible. Their villages are usually formless groups of huts, adapted to the terrain near a source of water; in a few cases they are laid out in squares, possibly after a move to a new location near a road. Nomadic and some seminomadic families or family members move north with the spring and summer rains, retreating southward with the rains as autumn approached; the availability of drinking water for themselves and their herds and forage for their animals determines their location

Large population centers are rare; in 1971 even the relatively productive and densely populated southern prefectures and the Lake Chad area had only seven centers containing more than 10,000 people. These centers were Fort-Lamy (150,000), Fort-Archambault (40,000), Moundou (32,000), Kelo (16,000), Doba (12,500), Pala (12,000), and Koumra (10,500). The central prefectures had developed only one sizable center, Abeche, estimated at 30,000 people. In the north, Borkou-Ennedi-Tibesti Prefecture contained only a handful of settlements numbering no more than a few hundred people.

Nomadism in the north and seasonal or seminomadic movement in the central prefectures are thus highly visible lifestyles, but most seminomadic people in the central area have a specific home village or area to which they return whenever possible.

There are more than 9,000 villages in the country, with an average of about 260 people per village. Nearly two-thirds of the population live in villages of less than 200 people, and less than one-third (30 percent) live in villages ranging from 200 to 1,000 residents. Only 4 percent of the people in the southern prefecture and less than 1 percent of those in the central prefectures live in settlements of more than 1,000 persons. The following tables and figures reflect the above data.

ANNEX 2
Table 2

CHAD

PREFECTURES

	Area (sq. km.)	Population (1972)	Density (per sq. km.)
Batha	88,800	335,000	3.8
Biltine	46,850	146,000	3.1
Borkou-Ennedi-Tibesti (B.E.T.)*	600,350	82,000	0.1
Chari-Baguirmi	82,910	490,000	5.9
Guera	58,950	181,000	3.1
Kanem	114,520	193,000	1.7
Lac	22,230	131,000	5.9
Logone Occidental	8,695	252,000	29.0
Logone Oriental	28,035	280,000	10.0
Mayo-Kebbi	30,105	555,000	18.4
Moyen-Chari	45,180	427,000	9.4
Ouadal	76,240	352,000	5.6
Salamat	63,000	95,000	1.5
Tandjile	18,045	272,000	15.1
Total	1,284,000	3,791,000	2.95

*The Borkou-Ennedi-Tibesti prefecture was abolished in September 1972 and the three constituent sous-prefectures attached to neighbouring prefectures.

CHIEF TOWNS

(Population--1972 estimate)

N'Djamena (capital)*	179,000	Kelo	16,800
Sarh*	43,700	Bongor	14,300
Moundou	39,600	Doba	13,300
Abeche	28,100	Pala	13,200
Koumra	17,000		

ANNEX 2
Table 3

COMPOSITION OF POPULATION IN CHAD (1964)

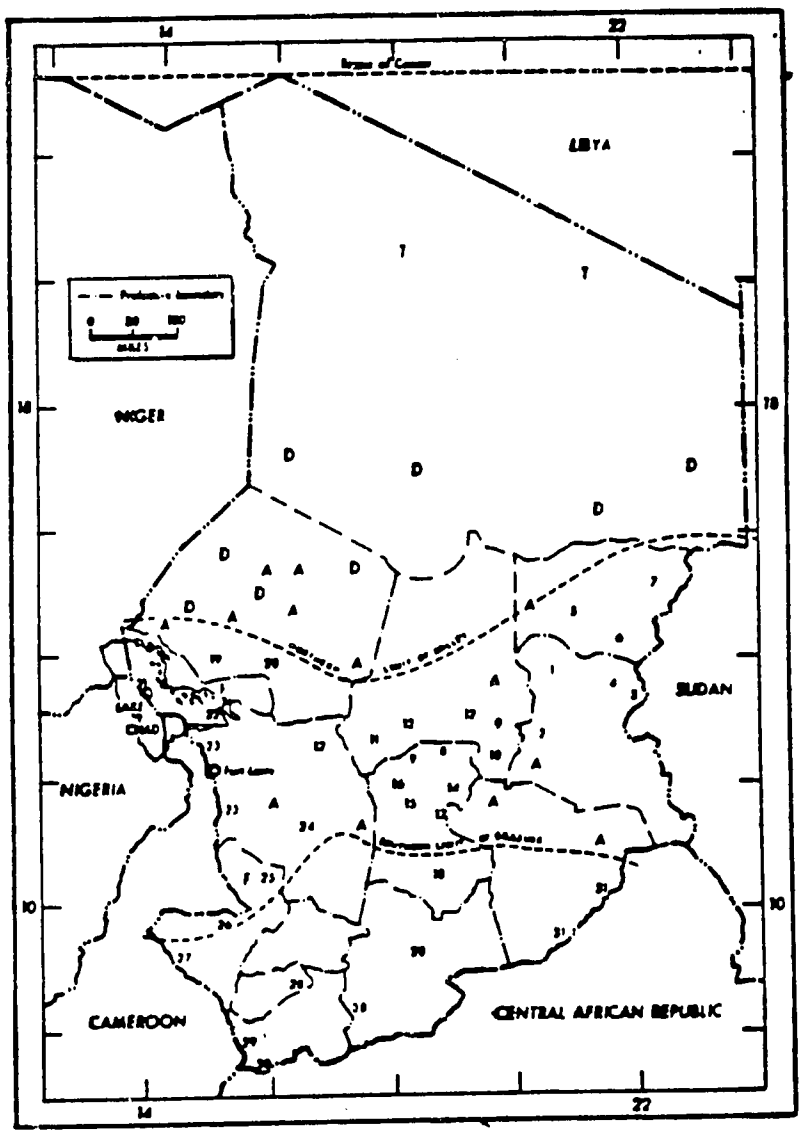
GROUP	POPULATION	PERCENTAGE OF TOTAL POPULATION
Nomads	613,650	18.6
Sedentary and Semi-Sedentary People of the Sahel	902,000	27.3
Sedentary People of the South	1,139,000	34.5
Others	645,000	19.6
TOTAL	3,300,000	100.0

POPULATION DENSITY IN THE VILLAGES OF CHAD

VILLAGE POPULATION	PERCENT OF VILLAGES
200 or less	60%
200 - 1,000	30%
1,000 or more	4% (Southern)
10,000 or more	1% (Central)

ANNEX 2
Figure 1

Selected Ethnic Distribution of Chad



Legend

T	Teda	Toubou
D	Daza	Toubou
A	Arabs	
F	Fulani	
1	Maba	
2	Dadjo	
3	Massalit	
4	Asongori	
5	Mararit and Abou Charib	
6	Tama	
7	Zaghawa and Bideyat	
8	Mimi	
9	Massalat	
10	Moubi	
11	Bilala	Lisi
12	Kouka	Lisi
13	Medogo	Lisi
14	Dionkor	Hadjarai
15	Kenga	Hadjarai
16	Dangaléat	Hadjarai
17	Bidio	Hadjarai
18	Yalna	Hadjarai
19	Kanembou	
20	Haddad	
21	Boudouma	
22	Kouri	
23	Kotoko	
24	Baguirmi	
25	Banana	
26	Toubouri	
27	Moundan	
28	Sara	
29	M'Boum	
30	Laka	
31	Kounga	

3. Gambia.

The Gambia is a narrow enclave of 10,000 km^2 inside Senegal along both sides of the Gambia River. The population of 540,000 is growing at an annual rate of 2.4%. Owing to urban migration, the capital, Banjul, is growing at 4.2% per year. The population is predominantly illiterate (90%). The annual birth rate 43.0 per 1000 and the death rate is 25.7 per 1000.

4. Mali.

Although the second largest country in Francophone West Africa, Mali has a low population density (4.3 inhabitants per square mile). The country is landlocked, and most of the land is desert or semi-desert, with the economically viable area confined to the Sahelian-Sudanese regions irrigated by the Niger. The population of 6,308,000 (1976 census) is estimated to be growing at a rate of 2.3%. The drought, affecting the Sahelian Region since 1971, new a significant part of the nomadic population to the settled areas. Of the total workforce estimated at 2.8 million in 1970, 2.5 million were engaged in agriculture.

5. Mauritania.

The Islamic Republic of Mauritania, with an area of 1,030,700 sq. km., is approximately the size of France and Spain combined. Moors, heterogeneous groups of Arab/Berber stock, make up three-quarters of the 1.3 million population.

The country's Negro population is mainly sedentary cultivators concentrated in a narrow ban in the south, especially along the Senegal River. White moors account for 54 percent of the total population; black moors 27.5 percent. The remaining 18.5 percent are black Fulbe, Toucouleur, Soninke, Wolof, and Bambara. The moors are essentially nomadic, though some 20 percent are sedentary in the oases and cities of the north or in the capital Nouakchott. The Fulbe are also predominantly nomadic, sometimes undertaking the care of livestock owned by sedentary peoples. The black minorities are mainly sedentary cultivators and are concentrated in the Senegal River valley, the cities, and the southwestern region of the country.

Nomads account for 70 to 75 percent of the country's total population - one of the highest percentages anywhere in the world. Rural sedentary inhabitants account for 17 percent; urban residents, 10 percent; 90 percent live in the southern quarter of the country, and 80 percent in the southern seventh. This yields densities varying from less than 1 per square mile throughout much of the north to upwards of 22 along the Senegal River. The overall density is approximately 2.8 per square mile, compared to 6.8 for Africa as a whole (See Tables 4, 5, and Figure 2).

Nomadism in much of Mauritania is such that, when a group begins to spend enough time in one place to harvest a millet crop it returns each year to spend several months harvesting. Depending on the season, these groups tend to be somewhat larger than

those of the pure nomands of the north, encampments numbering from 30 to 100 tents. Another stage in this gradual sedentarization process is transhumance or seasonal movement of livestock. Groups begin to move like a pendulum between only two places following the seasons. For example, the population of Tichit in the eastern Tagant near the southernmost limits of the Saharan Zone, which has 750 permanent residents, is regularly swelled by the presence of 4,500 transients who annually spend several months there during the winter season.

Perhaps the greatest impetus to sendentarization and urbanization has been direct government policy and action. The establishment of a new capital at Nouakchott as an expression of national unity expanded the urban population. The 1968 population of the district of Nouakchott was 32,000, comparising more than 30 percent of the urban population and over 2 percent of the total population. The present population of Nouakchott city is

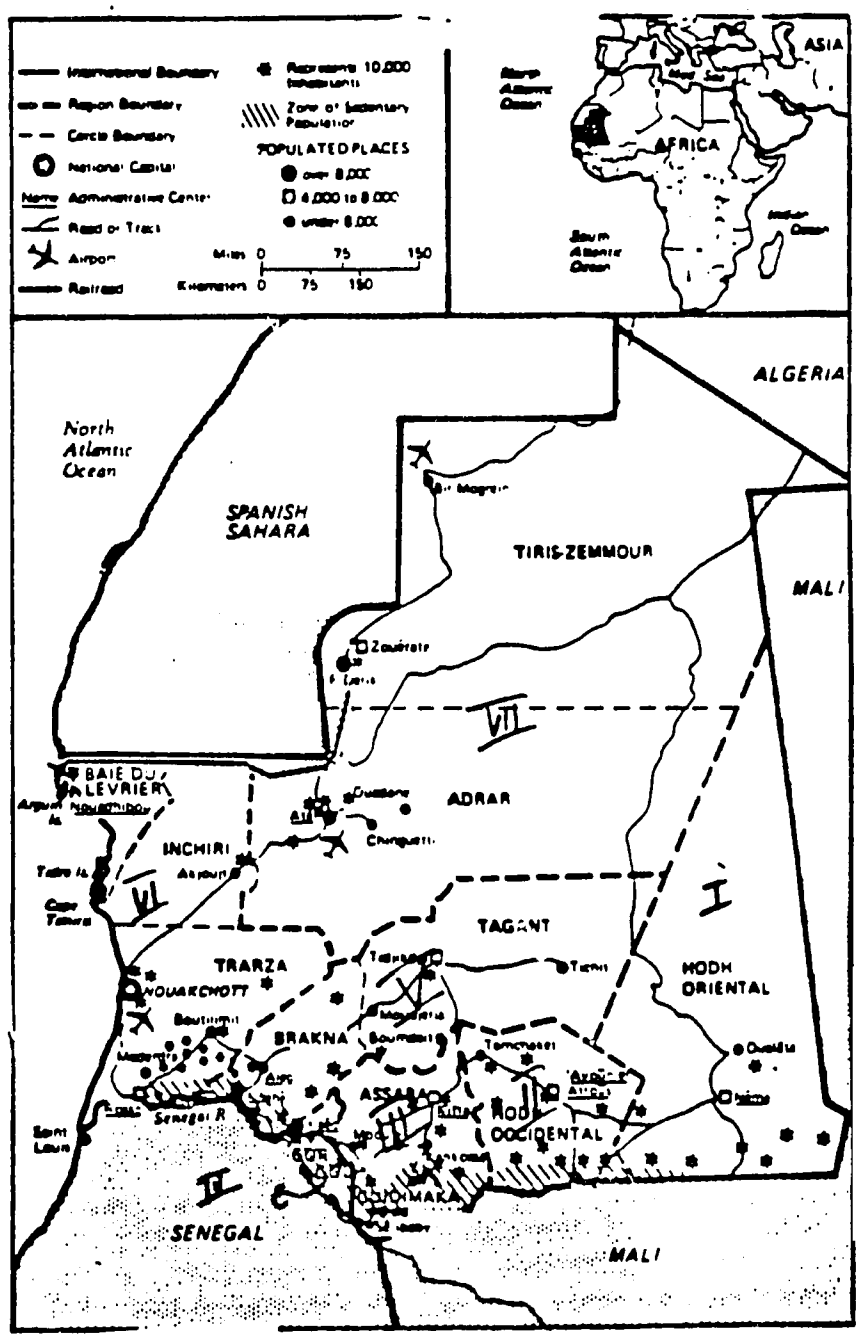
The vast iron mining complexes at F'Derik and the related transportation facilities at Nouadhibou have increased the populations of those two towns by 700 percent and 500 percent, respectively, in eight years. A similar mushrooming of population is expected at Akjoujt in the next few years. The urban population has grown from less than 5 percent in 1956 to 6.1 percent in 1967, 10 percent in 1971, and 14 percent in 1974. The trend is, however, not universal. In 1939 Tidjikdja, the central oasis in the Tagant, was the largest city in Mauritania,

with a population of 8,000; today its population is only 5,000. Such old and important towns as Chinguetti, Quadane, and Oualata are rapidly dying.

The government has encouraged rural sedentarization by building dams in the Sahelian Zone to trap rainwater and create small artificial lakes capable of supporting agriculture. In the far southeast and Hodh-Occidental, the Government is building "new world" villages in an attempt to stop seasonal and permanent shifts of population across the Malian border. Begun in 1960, the plan had produced 19 villages in Hodh-Oriental and Hodh-Occidental by 1964.

The end of the role of the warrior, the declining importance of the caravan trades, the increasing number of animals per acre of usable land, and the lure of town life have all tended to bring Moors south to the cities or to the greener pastures of the Sahel, and into consequent closer contact with the black peoples of the South.

ANNEX 2
Figure 2



Population Patterns in Mauritania

Table 4. Administrative Regions of Mauritania

Region	Former Cercle(s)	Administrative Center	Area (in square miles)
I.	Hodh-Oriental	Nema	64,076
II.	Hodh-Occidental	'Ayoun-el-Atrous	22,002
III.	Assaba and Guidimaka	Kiffa	18,065
IV.	Gorgol	Kaedi	5,443
V.	Brakna and Tagant	Aleg	50,643
VI.	Trarza and Inchiri	Rosso	43,643
VII.	Adrar, Tiris-Zemmour	Atar	
			193,849
VIII.	Baie du Levrier	Nouadhibou	
District		Nouakchott	386
	Total		397,850

Estimate of the Mauritanian Population Region, 1969

Region	Population (Jan. 1969 estimate)	Density (per square mile)
I	192,000	3.0
II	104,000	4.7
III	184,000	10.2
IV	92,000	16.9
V	207,000	4.1
VI	210,000	4.8
VII and VIII	111,000	0.6
District (Nouakchott)	32,000	---
Total	1,132,000	2.8

MAURITANIA

REGIONS
(1972)

	Chief Town	Area (sq. km.)	Population (July 1972 estimate
I	Nema	166,000	190,000
II	Alous El Alrouss	57,000	99,000
III	Kifla	46,800	190,000
IV	Kaedi	14,000	95,000
V	Aleg	131,200	210,000
VI	Rosso	112,400	220,000
VII	Atar	471,200	89,000
VIII	Nouadhibon	31,000	29,000
District	Nouskchott	1,000	48,000
	Total	1,030,700	1,180,000

*397,950 square miles.

Mid-year population (revised estimates): 1,257,000 in 1973; 1,290,000 in 1974; 1,318,000 in 1975.

PRINCIPAL TOWNS
Population (1975 estimates)

Nouskchott (capital) . . .	103,500	Kaedi . . .	20,000
Nouadhibou (Port-Etienne) .	23,000	Atar . . .	19,000
Zouerate	20,800	Rosso . . .	18,500

6. Niger

Niger's population in 1968 was estimated at 3.8 million, more than half under 19 years of age; the average density was 3.2 inhabitants per square kilometer. The annual rate of population growth is estimated at 2.5 percent. Besides Niamey, the largest towns are Zinder, Maradi, and Tahoua, each with a population of 20,000 - 31,000.

The economically active population, estimated at 1.7 million, is mainly engaged in agricultural and pastoral activities. Although the literacy rate is among the lowest in French-speaking Africa, it has improved in recent years. The primary school population doubled between 1962 and 1967, and the ratio of primary school pupils to all children of primary school age rose from 4 percent in 1957 to nearly 9 percent in 1966. Students in high schools, technical schools, and foreign institutions totaled about 3,500 in 1966.

Niger's population comprises a number of ethnic groups; the Hausa, residing mainly in south-central Niger, make up 49 percent of the total population. Other important ethnic groups are the Djerma-Songai (22 percent), living mainly along the Niger Valley, and the predominately nomadic Peuhls, Touaregs, Arabs, and Bellahs (19 percent), living mainly in the Saharan region.

Although no detailed data are available on migration, the sample survey of 1960 indicates that about 50,000 Nigeriens were living abroad, mainly as seasonal agricultural workers in Nigeria, or as workers on plantations and in industries in Ghana and Ivory Coast. African immigrants are relatively few (1,645 at the end of 1967) and consist mainly of skilled workers from Mali, Senegal and Guinea. The estimated 6,000 Europeans in Niger are employed mostly in education, trade and public administration.

7. Senegal

Senegal, the most westerly state of Africa, has an area of 75,750 sq. miles, and in 1976 had a population of 5,085,000.

The primary determinants of settlement patterns, reflected in Figure 3 and Table 6, have been the following:

1) The level of rainfall
2) Availability of drinking water

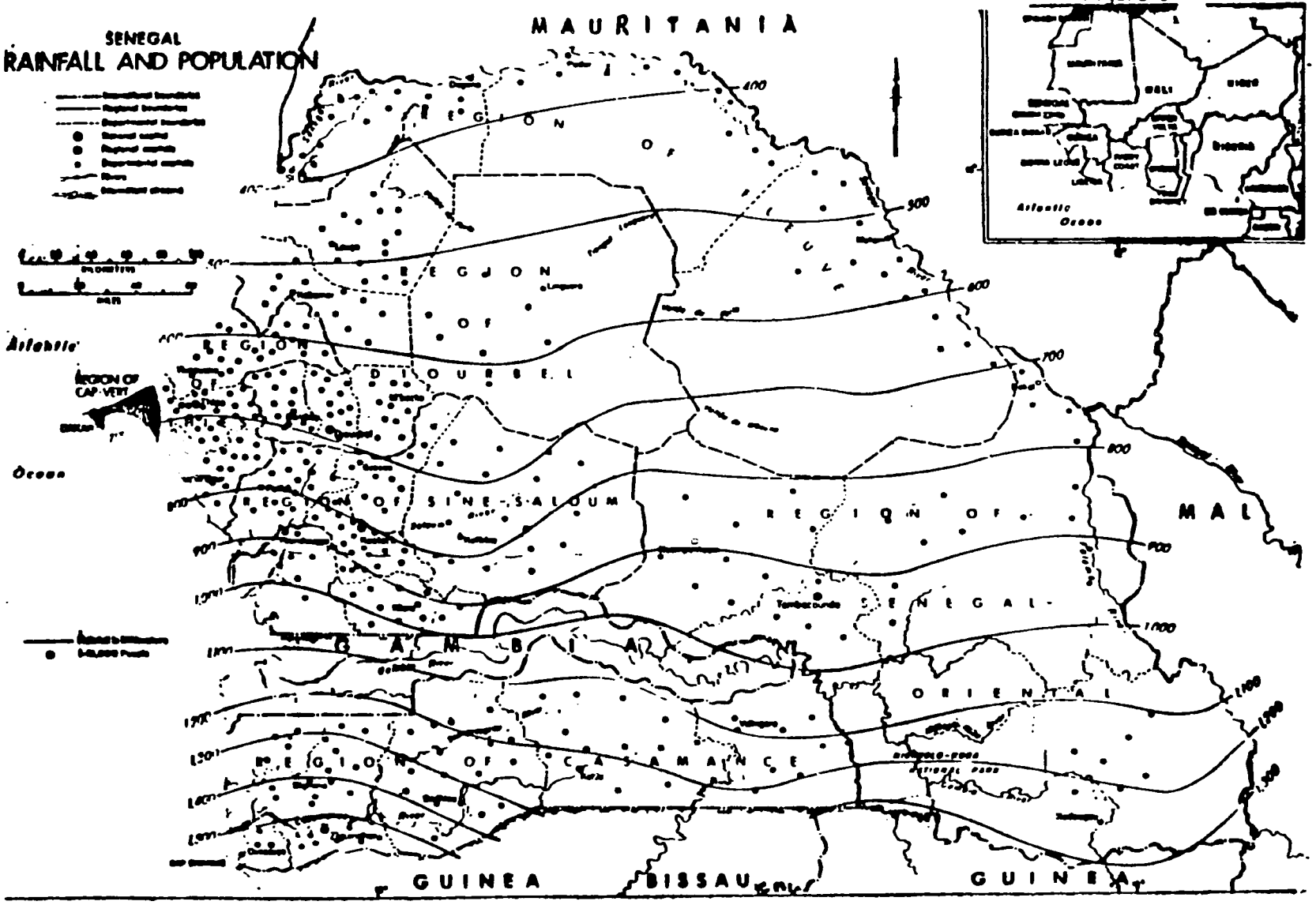
Because the lower reaches of the river basins in Western Senegal flood every year, these areas have been densely populated for centuries. Since the 14th century, cultivation has flourished in the Sine-Saloum basin, which became the area of greatest population growth. By the time of independence in 196 the more productive lands in the Sine-Saloum area were settled and exploited. The urban centers including the capital city of Dakar owe their growth to this development and exploitation of the lower reaches of the river basins.

Senegal's population is predominantly rural. Some 75% of the country's inhabitants make their living in agriculture and livestock and another 5% in fishing. Almost 75% of the total population live in villages of less than 10,000 inhabitants. The rural population still follows a traditional way of live.

Despite the rapidity of the shift to the towns most Senegalese still live in villages. Projections for the late 1970's and the early 1980's indicate that the majority of the population will continue to live in rural settings removed for the most part from whatever amenities may become available in the larger towns. Nationwide, villages average about 200 people each. They usually have fewer than 200 residents in the Sine-Saloum region and adjacent to the main groundnut production area, and they are also small in eastern Casamance Region. They range from 200 to 500 or more people in central Casamance, where soil conditions in some river bottoms are more favorable.

Still larger villages, ranging up to 1,000 or more people, exist on high ground in or near the floodplain of the Senegal River. Flood-borne silt from far upstream enriches the soil in the bottomlands every year. The subdesert areas a few miles away, beyond the reach of floods or irrigation projects, are visited by nomadic herdsmen but support only a few scattered small villages. On average, there are three dependents per active man (15 to 65 years old). While overall population pressure is not very high - 54 per square mile - and many of the best agricultural regions are still sparsely populated, population is unequally distributed: over half of Senegal's inhabitants live in the three central regions which constitute only 16 percent of the country's total area. In the last decade, population in this area has quickly approached the saturation point, based on the manpower needs of present cultivation techniques. Even excluding urban population, density in these three regions reaches almost 90 per square mile, while in the two most southern regions, despite much better agricultural potential, it barely reaches 20 per square mile.

ANNEX 2
Figure 3



SENEGAL: POPULATION BY REGION

('000 persons mid-year)

A. Regional Totals

	Population		Density /1	
	1960	1970 /2	1960	1970
Cap Vert	140	680	807	1,236
Fleuve	350	390	8	9
Diourbel	500	600	15	18
Thiès	410	520	62	79
Sine-Saloum	730	810	30	34
Senegal-Oriental	150	220	2.5	4
Casamance	530	610	19	22
Total	3,110	3,830	16	19

B. Rural and Urban Population

	1970	
Urban /3	1,140	30 percent
Semi-urban	540	14 percent
Rural	2,150	56 percent
Total	3,830	100 percent

/1 Persons per km^2.

/2 Mission estimate, based on 1970 sample survey corrected.

/3 Towns of 10,000 inhabitants and more.

ANNEX 2
Table 7

Ten Largest Urban Centers, Senegal, 1973

Town	Geographic Location	Estimated 1973 Population	Percent Annual Growth Rate	Estimated 1980 Population (000)
Dakar	West-central coast	600,000	6+	302
Kaolack	West-central	113,500	4	149
Thies	.... do	105,000	5	148
Saint-Louis.	Northern border ..	99,000	4	130
Ziguinchor .	Southern	57,000	4	76
Rufisque ...	West-central coast	54,000	4	71
Diourbel ...	West-central	43,500	4	57
Louga	Northwest	40,000	4	53
Mbour	West-central coast	30,000	4	40
Tambacounda.	Inland, southeast	24,500	4	32
				1,658

Urban concentration is high in Senegal; see Table 6. The urbanization rate mounted to 30% in 1970, compared with 18% in the rest of Africa. Urban migration mounted after World War II and accelerated after independence; only Dakar and a few other cities had populations of more than 10,000 people in 1946. This change has its roots in Dakar's former position as capital of colonial French West Africa. Nearly 80% of industrial enterprises, 66% of all salaried employees and 50% of civil servants are still concentrated in the Dakar area. By 1973 about 25% of the nation's population were urban residents. More than half of them were in Dakar and most of the remainder were in the ten largest towns. (Table 7.) Almost all towns were growing at rates of at least 4% per year; approximately half this rate was attributed to migration. Most of the large towns are located within 100 miles of the Atlantic Coast and have grown primarily on the basis of commercial agriculture and related activities. The town of Tambacoundor is an important exception as it is located some 250 miles inland along the Dakar-Mali railroad line. Near the coast, Kaolack and Diourbel are among the largest towns whose growth is based entirely on agriculture.

If urban population continues to grow at double the national growth rate it will reach 1,790,000 in 1980. This total includes an increase of nearly 200,000 in the urban labor force; employment in the urban areas, however, is not expected to increase by more than 100,000. About half of the increment in the urban population will be either unemployed or part-time workers. Moreover, the urban increase will make it particularly difficult to provide suitable housing. Consequently, every effort should be made to reduce urban migration to raise the level of rural incomes and to increase nonrural employment opportunities in villages.

8. Upper Volta

Upper Volta has an area of 274,200 sq. km. and in the 1975 census had a population of 5.9 million. Although under one-quarter the area of Mali, Upper Volta has about the same population.

Population density (19 persons per square kilometer) is high compared with that of neighboring countries (e.g., 3 in Niger and 12 in Ivory Coast). It ranges from only 4 per square kilometer in the eastern and northern regions to some 35 persons in the central plateau area, peopled mostly by the Mossi. Geographical distribution of the population does not generally correspond with the distribution of natural resources; the less productive central plateau, occupying about one-fourth of the land area, supports nearly half of the total population, and other regions - especially the fertile southwestern corner-are relatively underpopulated. This distribution has persisted, despite considerable demographic pressure for migration, mainly because of the cohesion of the Mossi group but also because of the high incidence, until recently, of epidemic diseases such as sleeping sickness in the areas with more nearly adequate rainfall and water supply.

ANNEX 2
Table 8

UPPER VOLTA

PRINCIPAL TOWNS

(1975 estimates)

Ouagadougou (capital)	168,607	Ouahigouya	25,101
Bobo-Dioulasso	112,572	Kaya	18,402
Koudougou	35,803	Banfora	12,281

A fairly large part of the population migrates to neighboring countries in search of employment. In recent years, about three-fourths of the migrants are believed to have gone to Ivory Coast and one fourth to Ghana, where most find work as plantation laborers. Some migrants go for less than six months and return for the crop season; others stay longer. A few have settled abroad permanently. Migrant's earnings returned to Upper Volta represent an important element in the country's balance of payments.

Some internal migration also occurs, mostly from the densely populated rural Mossi area to the cities or to less populated agricultural areas.

The 1973 drought has brought out more clearly than ever the basic problem facing Upper Volta's rural sector: excessive population pressure in the center, resulting from the uneven population distribution with respect to land resources. About 61 percent of the population, or 3.5 million people, live on the Mossi plateau which has only 32 percent of the total area. Although the average population density on the plateau is 36 per square km.-- a high level by African standards --, many of the 13 districts, ("cercles") with a population of 1.6 million have a density of 40 or more. This is generally considered by agronomists to be the maximum that the land on the plateau can support at subsistence food levels, with existing cultivation techniques, without over-exploitation of soils and decreasing yields.

In addition the Mossi plateau offers very mediocre natural conditions. First, average rainfall of 600-800 mm concentrates over a short period -- three months from May to August -- which limits the choice of crops to the growing and drought resistant ones. Secondly, rainfall is more irregular than

in areas where the average is higher; for example, whereas, normally, population living in the area of 600 mm rainfall or less is about 270,000, in the recent drought years the number increased to 1.5 million, because the 600 mm isohyet moved southward. Third, with already cultivated land covering about 1.3 million hectares or 61 percent of the country's cultivated area and 15 percent of the plateau's total area, finding additional land of suitable quality appears extremely difficult under the traditional system of extensive cultivation. As a result of these factors, average productivity of land on the Mossi plateau is only about one-fourth that of the western and southwestern regions. These conditions explain the mediocre results of massive efforts, technical and financial, devoted to the agricultural development of the Mossi plateau in the past. It also explains that the bulk of the migrants, now probably exceeding half a million people permanently abroad, comes from this region. Since those who leave are the younger elements of the population, emigration, while alleviating population pressure, also results in a loss of productivity and dynamism among those left behind.

CURRENT AND PROJECTED ECONOMIC ACTIVITY

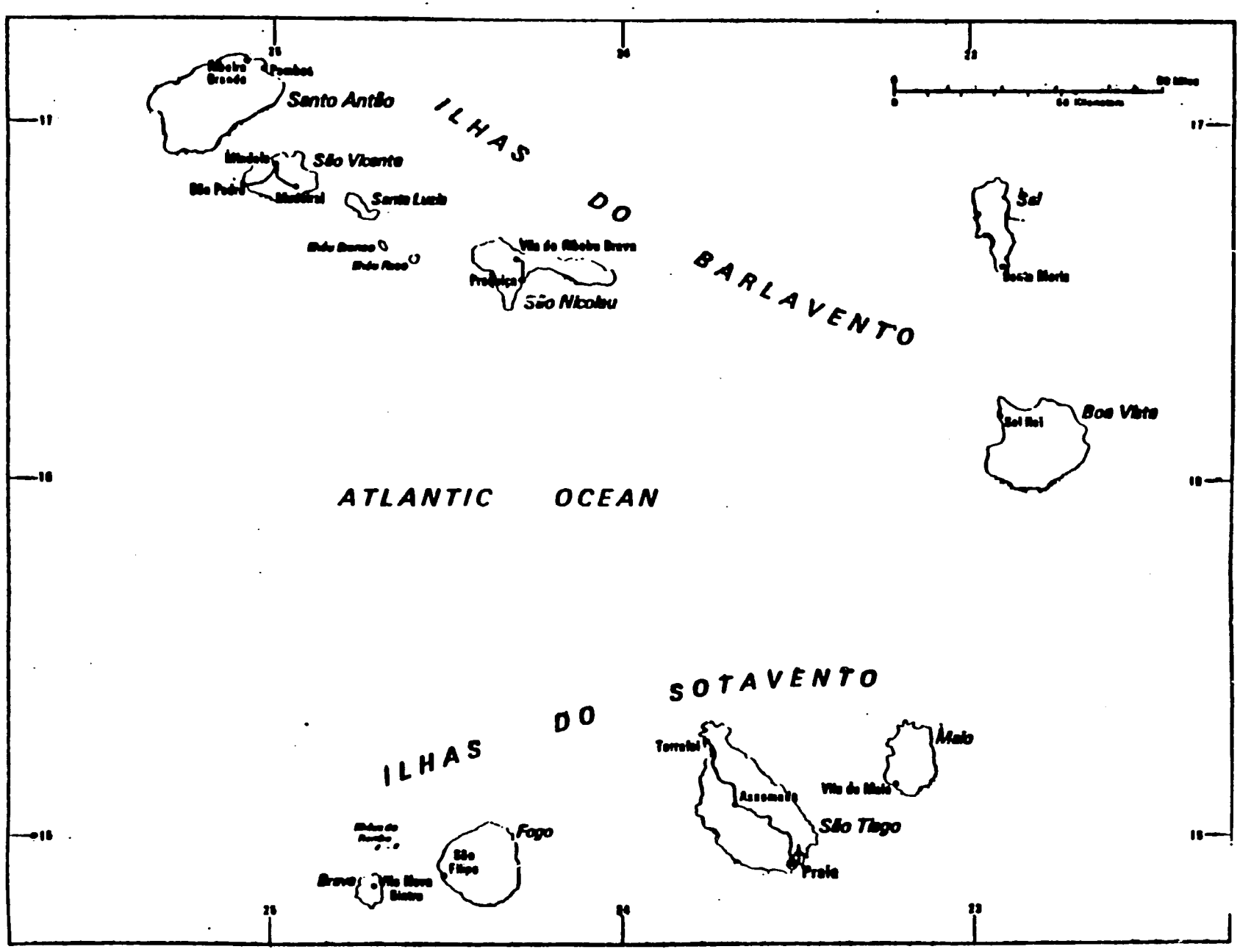
A. CAPE VERDE

1. General

Poverty is prevalent in this subsistence economy, which hinges on the vagaries of the rainfall and is threatened by local overpopulation in the wetter islands. The flat islands (Sal, Maio, Boavista), where the wind blows almost all the year, have little farming, livestock-breeding being the people's main occupation. The other seven islands suffer from poor agricultural technology, a lack of incentives, erosion, and, above all, sparse rainfall. About 100,000 people depend on agriculture for their living, but only 5% of food consumption is met by local resources. Food crops are maize, beans, cassava, sweet potatoes, supplemented wherever soils, terrain and rainfall permit, with bananas, vegetables sugar-cane, and fruits. The main staples are beans and maize. Sao Tiago is the main agricultural producer, followed by Santo Nicolau. Cash crops, such as bananas (7,000 tons in 1975), sugarcane (9,000 tons), arabic coffee, peanuts, castor beans and pineapples are grown, but poor inter-island communications, general ignorance and conservatism, a paucity of government funds, and the lack of suitable land militate against the development of more prosperous agriculture. In 1972 Cape Verde exported bananas, coffee, castor beans and tomatoes, but quantities are minimal owing to the prevailing climate.

The tourist business is in its infancy. A tourist complex was planned on Boavista with Belgian capital; it included three hotels with accommodations for 1,200 people. German capital was also interested in tourism on Sao Tiago, but uncertainties as to the political future are not conducive to large-scale development in this sector.

In 1975, according to FAO estimates, about 19,000 cattle, 7,000 asses, 24,000 goats, 3,000 sheep, and 19,000 pigs were raised for food and milk. About 15,000 horses, donkeys and mules are the main form of transport in rural areas. Within two years, livestock numbers were reduced to a quarter or a tenth of their pre-drought levels, but they are slowly recovering. Fishing could be important, and is being slowly developed with modern gear and boats. The catch in 1975 was about 3,900 tons, with a value in 1972 of 32,143,000 escudos (more than the total value of agricultural exports). About 2,600 local fishermen take part in this activity, which has ample opportunity for growth (mainly tuna fish and lobsters). Mining is of little significance, pozzolana clay (684 tons in 1975) and salt (20,941 tons) being the main products, albeit decreasing. In 1972, the main port of the islands, Mindelo on Sao Vicente, which still plays a transatlantic role, received 189 Portuguese ships (913,747 d.w.t.) and 755 other foreign ships (8,794,000 d.w.t.). Traffic declined dramatically in 1975 when 491 vessels entered all harbours and when cargo loaded (170,469 tons) was less than half the earlier figures.



ANNEX 3
Figure 1

B. CHAD

1. General

Chad is one of the least developed of the Sahel countries and its geographic isolation, climate and meager physical resources have resulted in an economy of very narrow breadth. Crop farming (sorghum, millet and groundnuts, cotton, gum arabic), nomadic cattle grazing and fishing occupy most of the population and account for most of the domestic product. In 1968 these activities were reported to be the chief or sole livelihood of some 95% of the population. Most of those in trading, transport or industry are engaged in the further processing or handling of crops and livestock products and are thus indirectly dependent on the primary sector.

The country is landlocked and its major economic centers are situated at distances varying between 1,449 and 2,898 km from the sea. Its immense problems of economic development have been rendered still more acute by the differences between north and south and by severe droughts. Traditional cultivation methods still prevail in most areas despite the growing number of modernization projects; these methods permit small holders to cultivate barely enough for their own family's subsistence during the year. About 75% of the value of Chad's annual crop production is accounted for by subsistence farming.

The country probably has the resources for self-sufficiency in basic foodstuff, as well as for exports of an eventual crop surplus and increased exports of livestock products; the prevalent low level of development,

however, results in periodic food shortages, usually of brief duration, and a generally poor level of nutrition.

2. Sectoral Analyses

a) Agriculture: Data on agricultural production are presented in Table 1. Cultivation areas are shown in Figures 2 and 3 The most important crops are the following:

1. Millet and Sorghum: These two crops are the foremost staples; they constitute the cereal diet of both cultivators and nomads. Grown principally for subsistence use, millet and sorghum in 1970 occupied an estimited 15% to 20% of all cultivated agricultural land and contributed 12% of GDP. Millet is grown everywhere outside the desert zone, which has been encroaching south of 16° N lat., and is cultivated in the oases within the northern desert zone. Fine pennisetum millet is cultivated north of 12° N., wherever there are light sandy soils and an annual rainfall between eleven and thirteen inches it is the principal crop of the Sahelian Zone. It is also grown in the south, wherever soils are too light for good sorghum yields.

2. Cotton

Chad's principal commercial crop and its only significant export crop is cotton. In good years it accounts for 20% of the total area under cultivation. More than 95% of cotton output is grown in the area of maximum production, embracing the five southernmost prefectures of the country. Commercial production has also begun somewhat farther north, in the southern districts of the Central Region. Cotton output statistics from the period 1935-1975 are presented in Table 2.

CHAD

AGRICULTURAL PRODUCTION

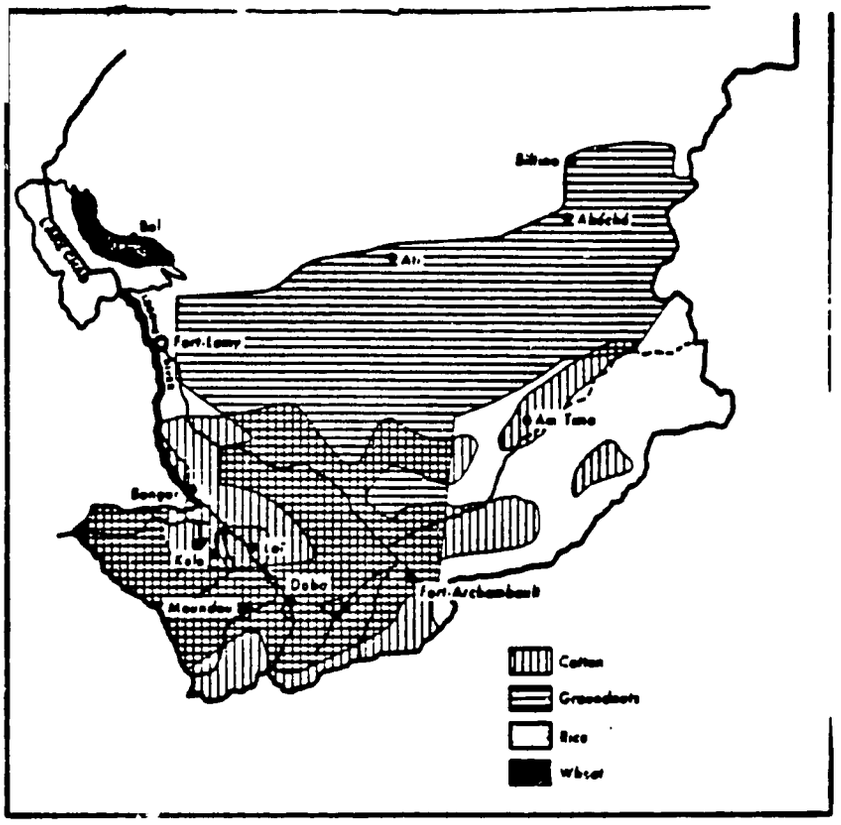
	AREA ('000 hactares)			PRODUCTION ('000 metric tons)			YIELD (kg. per hectare)		
	1973	1974	1975	1973	1974	1975	1973	1974	1975
Wheat	4	5	5*	3	3	4*	650	700	720*
Rice (paddy)	55	50	53*	33	35	37*	600	700	696*
Maize	9	9	9*	7	8	8*	800	900	900*
Millet and sorghum	832	851	900*	464	359	450*	558	657	500*
Sweet potatoes and yams	14*	14*	15*	45*	46*	46*	3,214*	3,250*	3,143*
Casava (Manioc)	18*	18*	19*	50*	52*	53*	2,778*	2,889*	2,824*
Pulses	185*	190*	204*	70*	70*	71*	378*	368*	346*
Groundnuts (in shell)	60	53	56*	48	45	45*	800	850	810*
Sesame seed	30	28	28*	10.5	9.8	9.8*	350	350	350*
Cottonseed	269	272	299	68*	88*	101*	253*	324*	338*
Cotton (lint)				43	53	65	160	195	217
Dates	n.a.	n.a.	n.a.	25	25	25.9*	n.a.	n.a.	n.a.

* Estimated

ANNEX 3
Figure 2

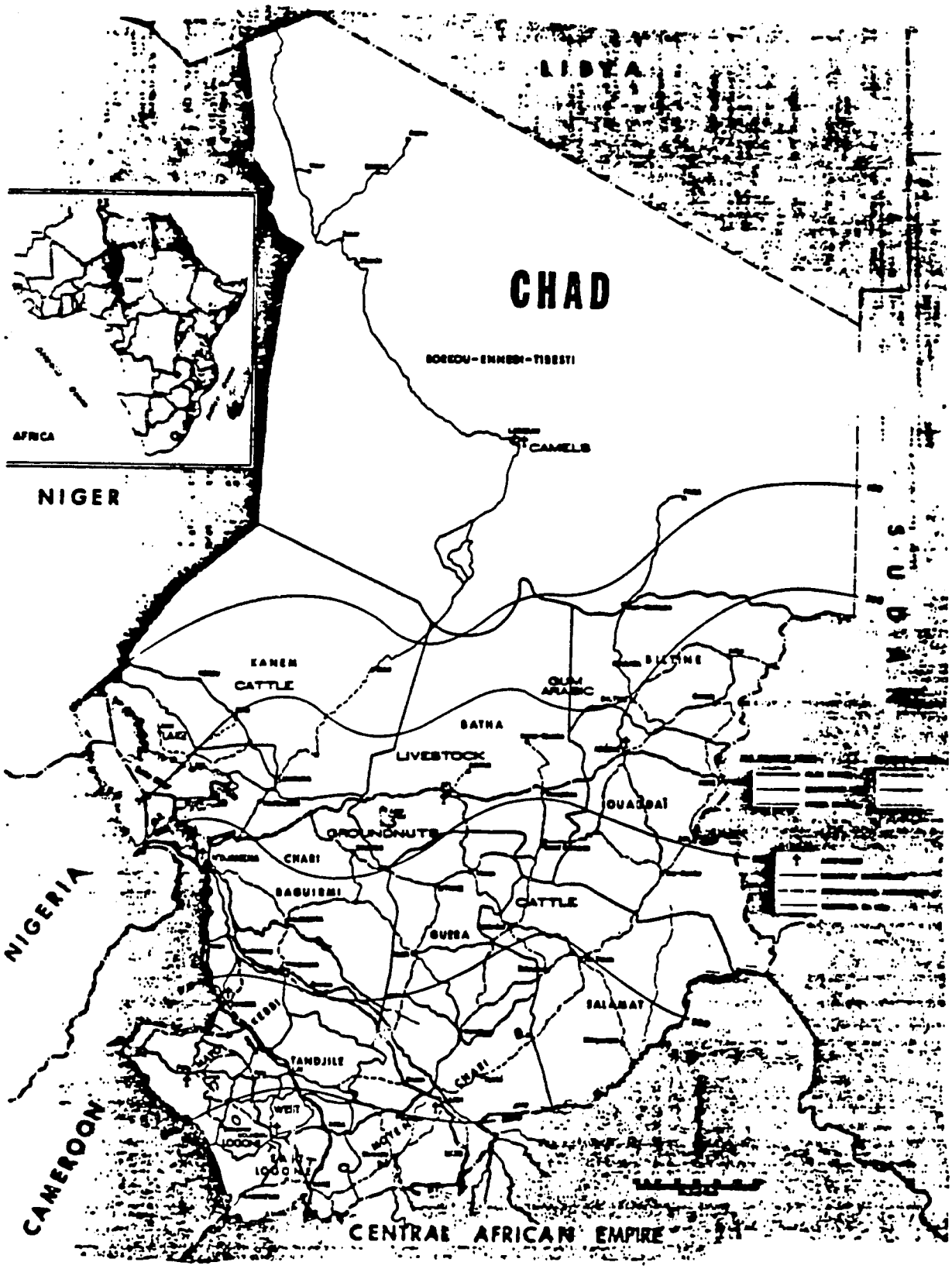
CHAD

Areas of Maximum Production,
Selected Crops of Chad



ANNEX 3

Figure 3



CHAD

Cotton Production
(1000) metric tons

PERIOD	AMOUNT
1928	34
1940	24
1950	41
1962 - 66	86
1966 - 70	122
1970 - 71	104
1972 - 73*	105
1974	53
1975	26

* The target was 157 but due to poor rainfall the target was not met.

3. Groundnuts

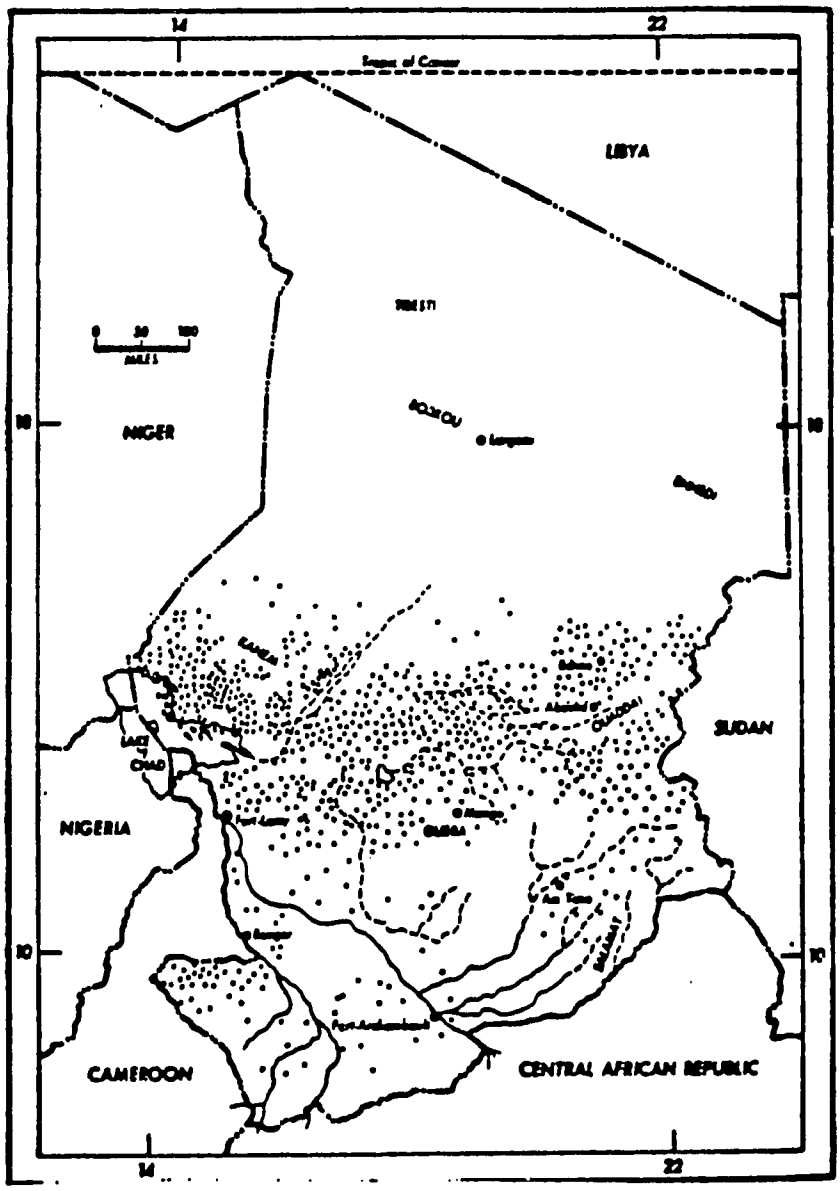
Despite official efforts to promote the cultivation of groundnuts as an export and industrial crop in the mid-1960's, some 97% of the annual crop was still absorbed by subsistence consumption and to a lesser extent, by localized barter or cash trade. Production tends to follow the pattern of population density, with the largest quantities grown in the prefectures of Mayo-Kebbi, Chari-Baguizme, Moyen - Chari and Logone Oriental. South of 10 degrees N. groundnuts are generally grown for family consumption in association with sorghum or millet and pulses in the third year of cultivation.

4. Livestock

The five prefectures of the south, which have 50% of the population, accounted for only 8% of the country's cattle herds; 21% of the sheep, goats and horses; 8% of the donkeys; and 61% of the pigs. Beef consumption in the area is low. The raising of cattle for eventual slaughter, rather than for draft purposes in the cotton-growing zone totaled 50,000 head in 1970, and is increasing by about 25% a year. Figure 4 shows where livestock raising takes place in Chad. Table 3 indicates livestock production for 1973-1975.

ANNEX 3
Figure 4

Schematic Representation of Maximum
Cattle Raising in Chad.
1970



ANNEX 3
Table 3

CHAD

LIVESTOCK
('000 head, year ending September)

	1973	1974*	1975*
Cattler . .	2,970	2,800	3,200
Goats . .	2,450*	2,000	2,100
Sheep . .	2,450*	2,000	2,100
Horses . .	160	140	140
Asses . .	350	300	307
Camels . .	330*	300	303
Chickens . .	2,700*	2,767	2,833

*Estimated

b) Industry

Chad has the least developed industrial sector of any of the Sahel countries. Its principal industry is cotton ginning, undertaken in 20 mills, which accounts for nearly half of the output in the industrial sector.

In the late 1960's, about 32,000 people of a total population of 4.03 million were employed in industrial activity. Industrialization is still largely in the planning stage. A number of factories have been established, mainly with foreign aid funds, under government ownership.

The potential for industrialization appears quite limited for the following reasons:

1. Commercially exploitable mineral deposits and economic sources of fuel or power are lacking.
2. The great distance from seaports and the climate, with its seasonal floods, and dry periods, inhibit road building and water transport and make shipment of goods both time-consuming and costly, with the danger of spoilage of perishables, pilferage, and inadequate storage.
3. A sparse and scattered population, with minimal purchasing power, does not offer a substantial market for the products of mass production.
4. Subsistence demand and traditional trading channels have absorbed the entire domestic production of most agricultural, livestock and fishery products and ambitious industrial

development projects promoted by government investment and foreign aid have been obliged to rely in whole or in part on imported materials.

The existing industrial establishments are all confined to the southern half of the country and, because of transport and population factors, the government does not now plan any industry in the remainder of the territory. A number of industries established during the 1970's were automated and use little labor The agricultural processing facilities in operation during 1970's are summarized in Table 4. The competitive stature of the new industries relies heavily on low raw material costs, since the cost of transport, power, and other inputs other than labor are high in relation to those of other producers. Despite the fact that most of these industries depend on imported inputs, they were able to generate some savings in foreign exchange, and by the end of the next Five-Year Plan the government expects to obtain an adequate supply of domestically growth groundnuts, wheat, sugarcane, and tobacco. Similarly, it is planned to organize cattle raising in the area of Fort-Archambault to adequately supply the existing slaughterhouse, cannery, tannery and shoe factory there.

The relatively few industrial establishments that are not involved in agricultural product or fish processing include a transistor radio assembly plant; a bicycle and motorcycle assembly plant; two brickyards; a plastic footwear factory; a tire retreading plant; a woodworking establishment; and several construction establishments.

ANNEX 3
Table 4

CHAD's AGRICULTURAL PROCESSING FACILITIES AND THEIR LOCATIONS (1970's)

AREA	INDUSTRIES
Southern Part	1. 25 - Cotton gins
	2. 2 - Large oilseed mills
	3. 1 - Soap factory
	4. 2 - Smaller Oil Mills
Fort Lamy	1. Sugar refinery
	2. 2- Slaughter houses with refrigeration facilities
	3. Oil mill
Fort Archambault	1. 2 - Slaughter houses with refrigeration facilities
	2. Meat cannery, tannery
	3. Shoe Factory
	4. Cotton textile mill
Moundou	1. Soft-drink plant
	2. Cigarette factory

Current industrial activity is shown in Table 5

c) Exports

Cotton is the most important export crop and small ammounts of gum arabic are also exported. In 1970 exports still consisted almost entirely of agricultural products-principally cotton, meat, livestock, and fried or smoked fish. Apart from ginned cotton and a few assembled transitor radios, there were scarcely any manufactured or processed exports.

d) Development Planning

The thrust of efforts in Chad's first Five-Year Development Plan (1966 to 1970) has been on selective development. Industrial and educational development are to be concentrated in N'Djamena (Fort Lamy), Sarh (Archambault) and Mondou. Similarly, in agriculture, efforts will be focused on a limited number of areas and crops. The agricultural programs have suffered over the years from:

a) Too wide a dispersal of efforts;
b) Deficiencies in personnel and in bureaucratic organization;
c) National setbacks such as droughts;
d) Inadequate knowledge of local customs and social values, on the part of foreign assistance entities;
e) An inadequate infrastructure system.

Water resources remain one of the principal limiting factors, but increased amounts of government investment and foreign aid have been devoted to water exploration and well drilling projects such as the Lake Chad Irrigated

CHAD

INDUSTRIAL PRODUCTION

		1970	1971	1972
Flour . .	metric tons	686	937	874
Groundnut Oil . .	hectolitres	10,700	2,970	n.a.
Cottonseed Oil . .	"	6,000	5,010	n.a.
Oil Cake . .	metric tons	1,491	1,367	1,380
Beer . .	hectolitres	70,920	87,470	89,620
Soft Drinks . .	"	13,820	13,000	14,400
Sugar . .	metric tons	13,065	15,400	15,760
Cigaretes . .	'000 packets	1,660	11,850	12,606
Printed Textiles . .	'000 metres	13,350	15,120	14,790
Plastic Shoes . .	pairs	175,900	102,930	129,770
Bicycles . .	number	5,770	7,390	5,700

Agriculture Project, which aims to increase food production in Chad. Project activities are underway and include crop and irrigation research, the repair of old polders, and the construction of new ones.

Approximately 8,000 farming families will be helped directly. Production of basic cereals will be increased by about 17,000 tons annually by 1985. The Regional Food Crop Protection project includes Chad. This project supports a comprehensive research and development program for integrated pest management in the Sahel.

Two projects have been undertaken by AID for the improvement of livestock production:

a) A Chad Range and Livestock project, which provides technical assistance in range management at the national level.

b) The Regional LCBC Livestock and Mixed Farming project designed to develop and test resource management techniques in the Lake Chad area for cultural, political and economic acceptability to the area's population.

C. GAMBIA

1. General

The economy consists mostly of traditional smallholder rural activities; agriculture, livestock and fisheries account for 60% of the country's total GDP and employ about 85% of the active population.

2. Sectoral Analyses

a. Agriculture

Agriculture is mainly rainfed, characterized by a short production period - six months - during the rainy season and is dominated by groundnut production which is the only cash crop in the Gambia. Groundnuts are the main source of foreign exchange and constitute the basis for the country's major industrial activity. Groundnut exports have risen from an average of about 70,000 long tons /yr in the 1960's to 120,000/yr. in 1975-76.

b. Industry

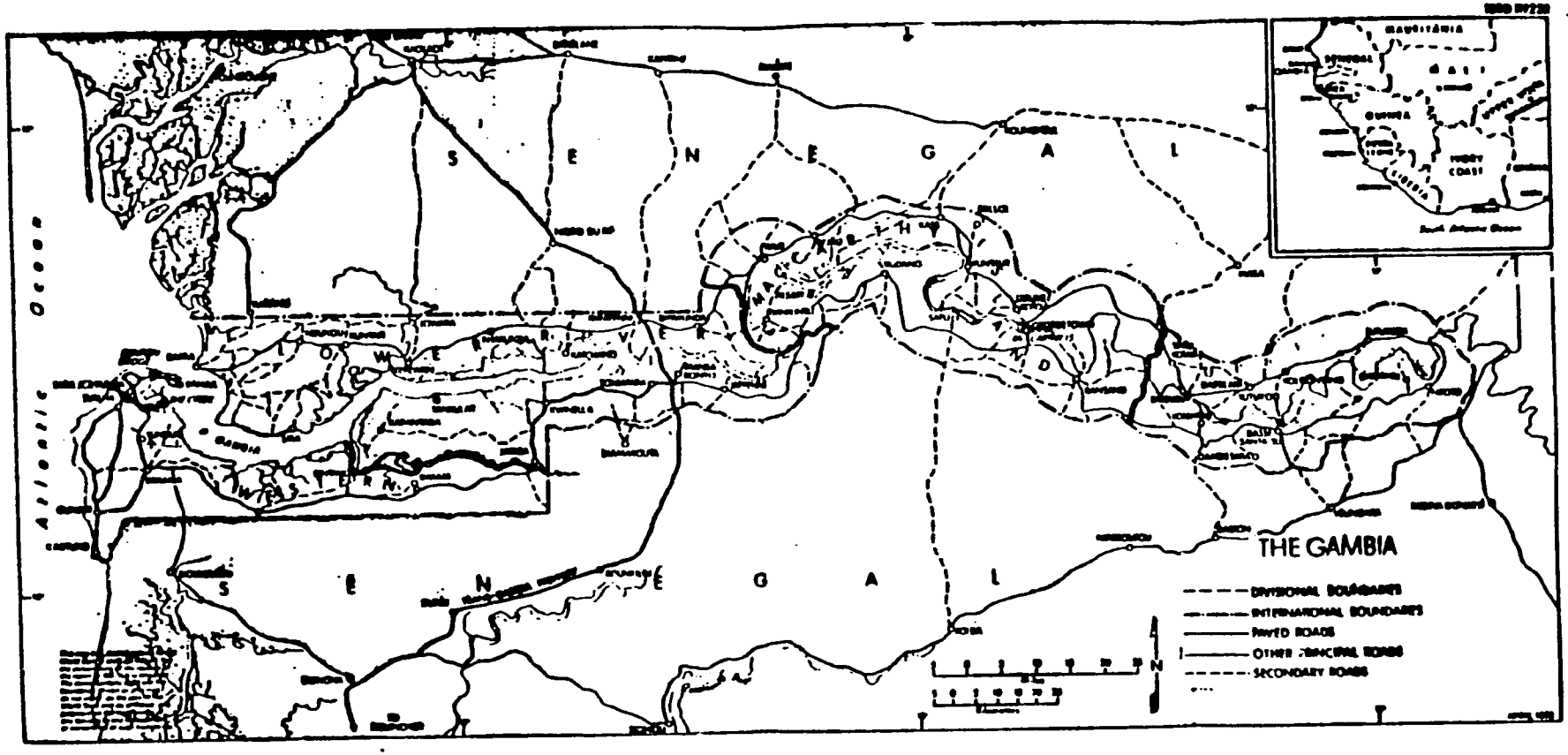
Modern industries are concentrated in the Banjul area although other urban centers (Farafenni and Basse) are growing in commercial importance. Tourism is one of the fastest growing activities in Gambia. The number of tourists rose from 500 in 1967 to 25,000 in 1977. Most tourists come from the Scandinavian countries, particularly Sweden.

c. Development Planning

Development programs have been concentrated on transport and communications and on increasing the yields of groundnuts and rice. A cotton development project is financed by the African Development

Fund; and operation of a ginnery was expected by 1977. A target of 10,000 acres under cultivation has been set for 1979.

An Agricultural Development project financed by the World Bank will develop over 1,900 acres of irrigated rice production along the Gambia River.



ANNEX 3
FIGURE 5

D. MALI

1. General

The Republic of Mali is landlocked; Dakar in Senegal and Abidjan in the Ivory Coast are its principal outlets for both road and rail to the sea. The northern part of Mali is almost uninhabited. The areas under cultivation include the Niger River Valley and the southernmost region.

The country suffers from several development constraints:

a. Distance from the sea; the closest seaports (Dakar and Abidjan) are 1,200 km. from Bamako.

b. Lack of mineral and other natural resources.

c. Shortage of skilled manpower.

d. Problems of communication due to the large size of the country, and its inadequate road and telecommunications systems.

2. Sectoral Analyses

a. Agriculture and Livestock

Agricultural production, which rose 1.5% a year in the first five years of independence, has been badly affected since the late 1960's by the drought. After declines from late 1960 levels, the production of millet, sorghum, maize, and rice showed recovery in 1974-75 and 1975-76. Millet, sorghum, and maize reached about one million tons and rice 300,000 tons. (See Table 6).

MALI

AGRICULTURE

LAND USE, 1974
('000 hectares)

Arable and Under Permanent Crops	11,700
Permanent Meadows and Pastures	30,000
Forest	4,457
Other Land	75,843
Inland Water	8,000
TOTAL	124,000

PRINCIPAL CROPS
('000 metric tons)

	1973	1974	1975
Millet, Sorghum and Fonio	525	600	700*
Rice (Paddy)	100	90	90*
Maize	80	87	60
Sugar Cane†	80*	80*	80*
Sweet Potatoes and Yams	60*	60*	60*
Cassava (Manioc)	120*	121*	121*
Pulses	18*	19*	19*
Groundnuts (in shell)	100	120	120*
Cottonseed	31	33	37*
Cotton (Lint)	19	23	24

* Estimated.

ANNEX 3
Table 7

MALI

LIVESTOCK (000's)	1973	1974	1975
Cattle . . .	4,500	3,700	3,886
Sheep . . .	3,900	4,100	4,000
Goats . . .	3,800	4,000	3,800
Pigs . . .	20	21	23
Horses . . .	120	121	123
Asses . . .	320	340	340
Camels . . .	150	158	160
Poultry . .	9,000	9,400	9,667

LIVESTOCK PRODUCTS (metric tons)	1973	1974	1975
Cows' Milk . . .	52,000	52,000	52,000
Sheep's Milk . .	20,000	20,000	20,000
Goats' Milk . . .	38,000	38,000	38,000
Butter . . .	1,062	991	920
Beef and Veal . .	24,000	24,000	24,000
Mutton and Lamb .	11,000	11,000	11,000
Hen Eggs . . .	4,860	5,076	5,220
Cattle Hides . .	6,000	6,000	6,354
Sheep Skins . . .	3,480	3,625	3,919
Goat Skins . . .	1,800	1,900	1,936

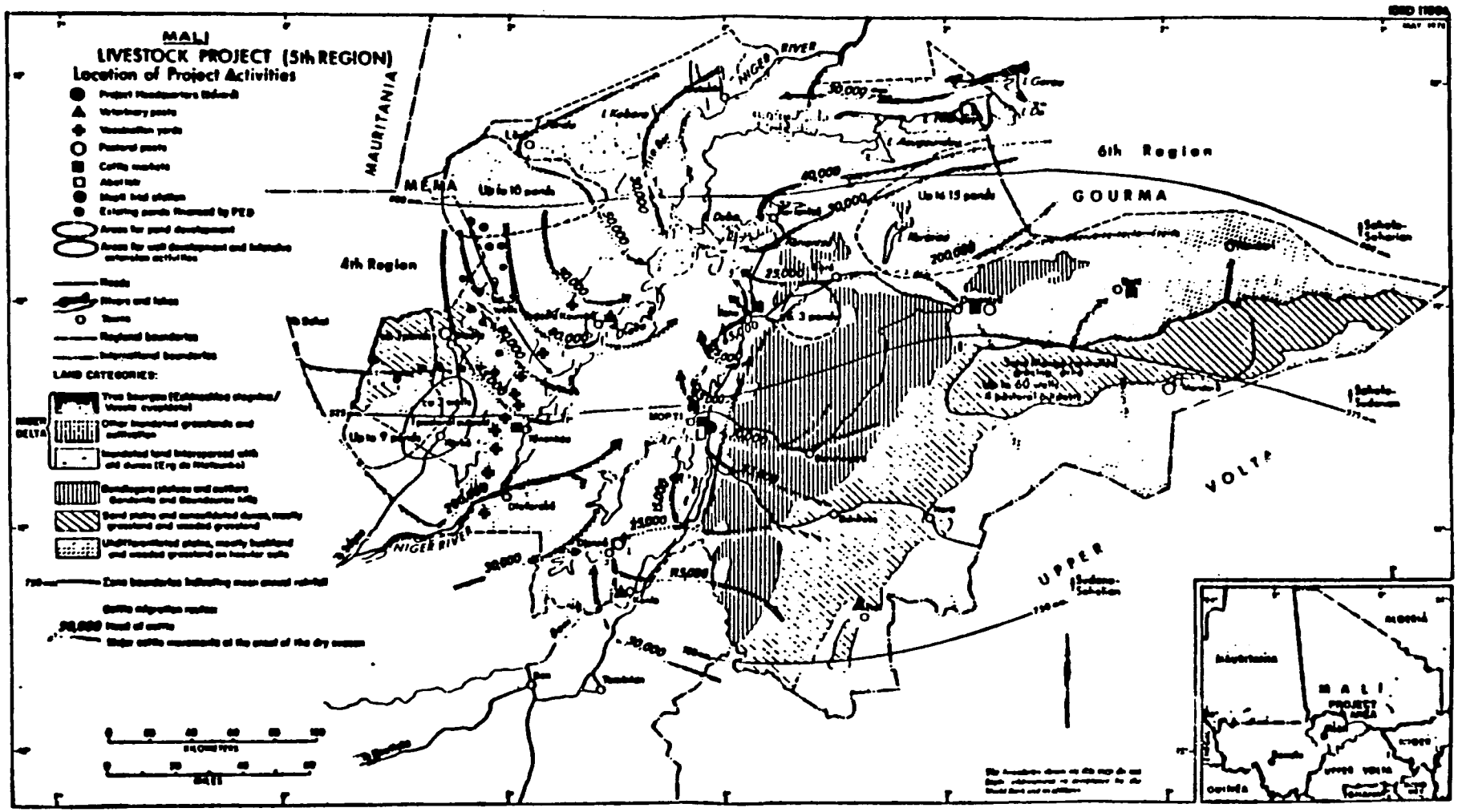
MALI

INDUSTRIAL PRODUCTION

		1971	1972	1973
Raw Sugar . . .	Metric tons	6,000	8,000	10,000
Sugar Confectionery .	" "	1,000	1,305	1,450
Beer	hectolitres	2,000	2,000	n.a.
Soft Drinks . . .	" "	20,000	22,000	n.a.
Cement	metric tons	35,000	42,000	47,000
Soap	" "	4,917	4,589	n.a.
Electric Energy . .	million kWh.	45	52	61

ANNEX 3
FIGURE 6

MALI



Cash crops have been doing well. Cotton and groundnut production has increased. In 1973-74 cotton production was 55,000 tons, and Mali now is the second largest producer in Francophone Africa; the production in 1975-76 reached 113,000 tons. In 1975 the groundnut crop reached 120,000 tons, compared with 95,000 tons in 1968. Sales to neighboring countries, mainly Mauritania, range between 10,000 and 30,000 tons a year.

Sugarcane is another commercial crop under development, with an annual output reaching 80,000 tons in recent years.

The drought has also affected livestock; numbers of cattle were down to 3.7 million in 1974 and sheep 4.1 million from 5,350,000 and 5,750,000 respectively in 1969-70. These were easily the largest herds in Francophone West Africa. (See Table 7).

Until the drought started to cause major losses in 1972, livestock numbers had increased substantially. Between 1960 and 1972, livestock exports more than doubled, reaching a yearly level of 220,000 cattle and 210,000 sheep and goats, or about 30% of annual livestock production and 40% of all exports. The main customers are the Ivory Coast and Ghana, though exports to the latter have decreased considerably due to import and currency restrictions. Carcass meat exports have been insignificant, - 500 to 1,000 tons per year - and are mainly air freighted to Liberia and Libya.

b. Industry

Manufacturing activity, largely directed to meet local demand, is on a small scale, mainly in the form of agricultural product processing and the manufacture of consumer goods. In addition there are cement plants, an industrial gas plant, and metal working installations (See Table 8). Under the 1974-78 Development Plan, the government hopes to reach 12% annual growth with manor expansions in textiles, cement, metal manufacturing, sugar, cotton and groudnut processing.

c. Mining

No significant mineral resources have been located, despite exploration. The only important operations at present are for marble, at Bafoulabe and limestone quarrying at Diamou. A project for joint iron ore exploration with Senegal, if developed, would yield an estimated 65,000 tons.

E. MAURITANIA

1. General

Mauritania has few natural resources other than minerals, but their development since the early 1960's has supported this country's rapid economic growth. The 1973 GDP was 13,043 million ouguiya (US $290 million) representing some 10,300 ouguiya ($228) per head and a per capita growth rate of 5% a year since 1960. Subsequently, growth eased, owing to drought and a fall in world demand for minerals since 1975.

The economy is sharply divided into the traditional sector of agriculture and animal husbandry and a modern sector based on mineral and fish resources. Agriculture, labor-intensive, employs age-old methods of crop cultivation and livestock husbandry. Roughly 90% of the population is engaged in traditional economic pursuits and production is at a subsistence level.

2. Sectoral Analyses

a. Agriculture

Agriculture is largely concentrated along the Senegal River, although there are some small-scale agricultural activities scattered throughout the country wherever there is sufficient water to support crops. The availability of water also influences raising livestock; sufficient pastureland is found principally south of the 17th parallel. Camels are the predominate herd animals in the northern pasture areas; camels and sheep are raised in the middle areas, and cattle are found in the more moist southern region.

Most agricultural settlements are located in a relatively narrow fertile strip along the northern bank of the Senegal. This area includes about 350,000 hectares of viable land of which 260,000 hectares are under millet. Although the region along the Mali River has ample rainfall - up to 20 inches a year - production is limited because the region is isolated from potential markets by inadequate roads. The central and northern parts of the country are dotted with a few oases, where dates and some vegetables are grown. (See Figure 7). Agricultural growth has been limited in Mauritania because of:

a) Physical limitations

b) Poor marketing and distribution facilities

c) Rudimentary modes of cultivation

d) Lack of adequate roads connecting the main agricultural production areas with existing markets.

Production of major crops has changed little during recent years except for fluctuations brought about by droughts. (See Table 9).

1. Millet and Sorghum

They are the most important crops and an estimated 111,000 metric tons are produced annually. Roughly 75% of these two crops is grown in the flood plain where growth depends upon moisture remaining in the soil after the annual flood has receded. The Brakna-Gorgol area accounts for some 40% of the flood plain production and the Guidimalaa region, for about 15%. (See Figure 7). Although the yields in the flood plain are the highest in the country, the estimated average of about 357 pounds per acre is quite low. Despite the need to import millet, a considerable portion of the

MAURITANIA

MAJOR CROPS

(FAO estimates, '000 metric tons)

	1973	1974	1975
Millet and sorghum	30	30	40
Maize.....	3	3	3
Potatoes.....	2	2	2
Sweet potatoes and yams.....	4	4	4
Cow peas.....	8	8	8
Dates.....	13	13	13
Groundnuts.....	1	1	1

flood plain crop is exported to nearby markets in Senegal, where prices are generally higher than those prevailing in local markets. It is not transported to the more distant markets in central and northern Mauritania.

2. Rice

Since the mid-1960's, considerable attention has been given to the cultivation of rice, but rice imports have averaged around 12,000 tons annually. Because domestic production has amounted to only 700 tons annually, the Government has undertaken several experimental rice growing projects, which are discussed in a separate part of this report.

3. Livestock

Traditionally the most important occupation of the rural population, the raising of livestock, is still the main source of rural wealth. Nearly all the Moors and the nomadic Fulbs are stockraisers, and sedentary people also raise animals. Cattle, sheep, goats, and camels are important animals from the commercial standpoint. (See Table 10))

In terms of the domestic market for livestock products, in non-monetary rural trade milk is more important than meat; while in commercialized trade, meat is the more important. The Government has been trying to improve conditions in the stockraising segment of the economy by attacking the problems that severely hamper production; the lack of water, and diseases. Under the first Four-Year Plan, some CFAF 600 million was invested in activities related

ANNEX 3
Table 10

MAURITANIA

LIVESTOCK
(FAO estimates; '000)

	1973	1974	1975
Cattle	1,900	2,800	2,900
Sheep	3,000	2,800	2,800
Goats	2,200	1,900	2,000
Asses	230	251	271
Horses	24	26	28
Camels	700	711	722
Poultry . . .	2,700	2,800	2,900

LIVESTOCK PRODUCTS
(FAO estimates; metric tons)

	1973	1974	1975
Cows'milk	60,000	60,000	62,000
Sheep's Milk	30,000	30,000	31,000
Goats' Milk	54,000	54,000	55,000
Hen Eggs	2,295	2,380	2,465
Mutton and Lamb	3,000	3,000	3,000
Cattle Hides	1,620	1,620	1,681

to livestock -- mainly the digging of wells and the provision of a well maintenance team. In January, 1968 an abattoir and cold-storage facilities were opened in Kaedi. This processing facility has the capacity for an annual production of 2,500 tons of meat. It is expected that 75% of the output will be exported and that the remainder will supply domestic urban consumption. At present there are no major roads connecting the abattoir at Kaedi with the major urban centers, nor with the capital from which the exports will be transported to their destination. The Senegal River can be used also, as a transport route which will connect Kaedi with the urban centers.

b. Industry

Industrial development in Mauritania has been limited entirely to activities related to mining and to fish processing at Nouadhibou (See Table 11). Most of the existing power facilities and a considerable proportion of the transportation system are connected with the mining operations and the few urban centers which have been created by the mining developments. Other industries, of secondary importance, are as follows:

1) A flour mill in Nouakchott
2) A sugar refinery, a match factory and a cement works
3) An oxyacetylene plant in Nouadhibou. The annual capacity of the plant is 1,200 cubic meters of gas -- enough to meet all the country's requirements.

Construction was begun on the country's second largest capital investment, a $65 million oil refinery at Nouakchott. It is entirely financed by the Government and came on stream in mid-1977 with one million tons capacity.

Reflecting needs for iron and copper smelting, electric power generation was expanded rapidly in the late 1960's, from 38.4 million kwh in 1967 to 95 million kwh in 1974.

c. Mining

Mining is the most important element of the modern sector of the economy; iron and copper resources have provided the main thrust to the country's recent development. Production of these two mineral resources is shown in Table 12 . The iron ore mines at F'Derik began operating in 1963, and the copper development at Akjoujt opened in 1970. Mining operations account for a relatively large percentage of the modern sector employment. The iron ore company employs 20% of the modern sector labor force, but on the national level the mining industry employs only 3% of the total labor force. The importance of mining to the development of the country is essentially indirect; the construction activities connected with their initial development provides many more jobs for Mauritanians.

The main mining sites of Mauritania are the following:

		MT Annually (millions)
1) Tazadit deposits		1.5
2) Original F'Derik deposits		
3) Rouessa deposits		
4) The new F'Derik deposits (See Figure 9)		1.5

The production of the new F'Derik mine has reached 1.5 million tons annually. The port of Nouadhibou was expanded to meet the existing needs due to the increase of tonnages from this mine. Other mining sites of less importance

ANNEX 3
Table 11

MAURITANIA

INDUSTRY
SELECTED PRODUCTS

		1972	1973	1974
Frozen fish	Metric tons	3,252	2,303	15,650
Salted, dried or smoked fish	" "	4,336	3,476	1,713
Electricity	million kWh.	79	94	95

ANNEX 3
Table 12

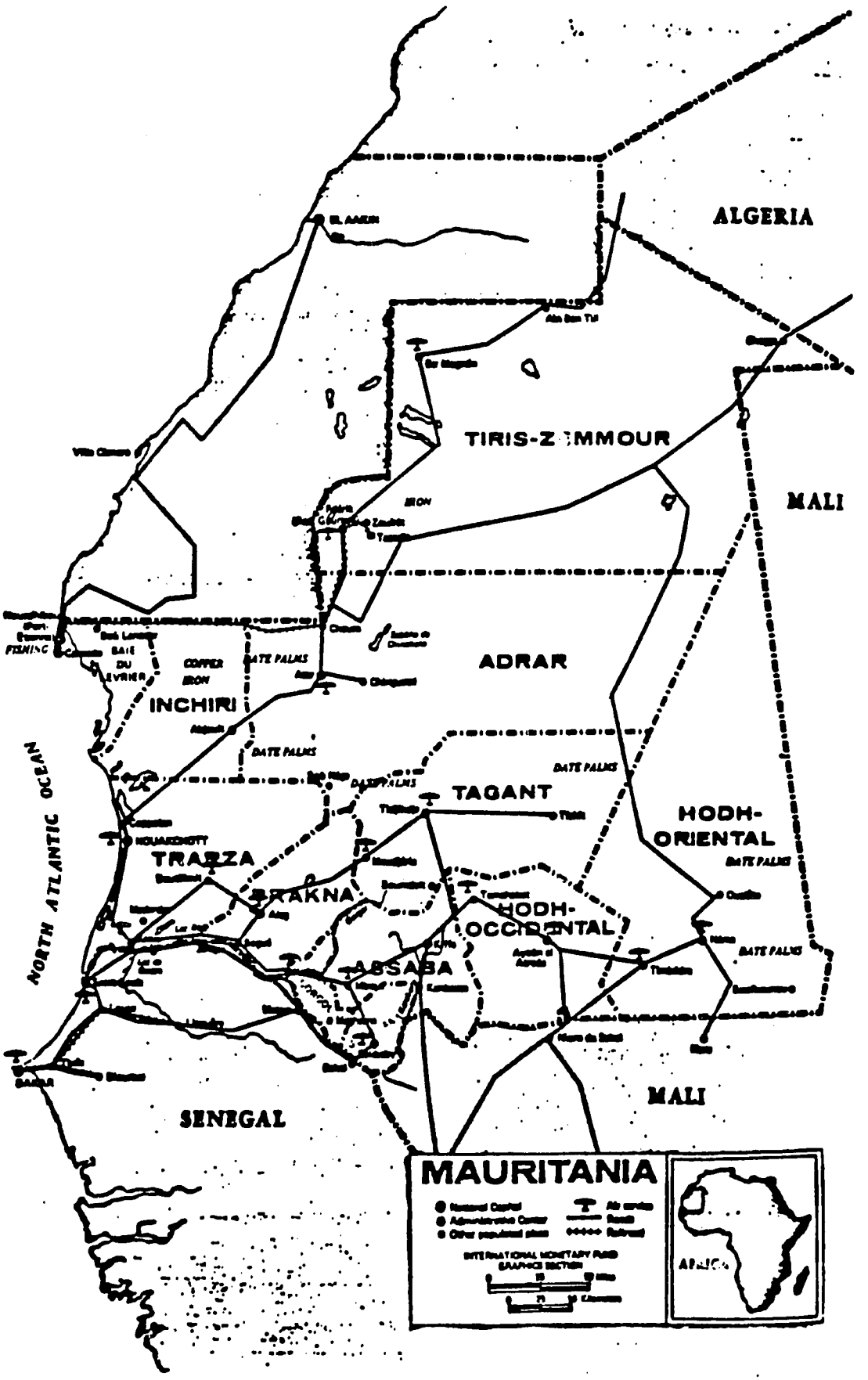
MAURITANIA

MINING

('000 metric tons)

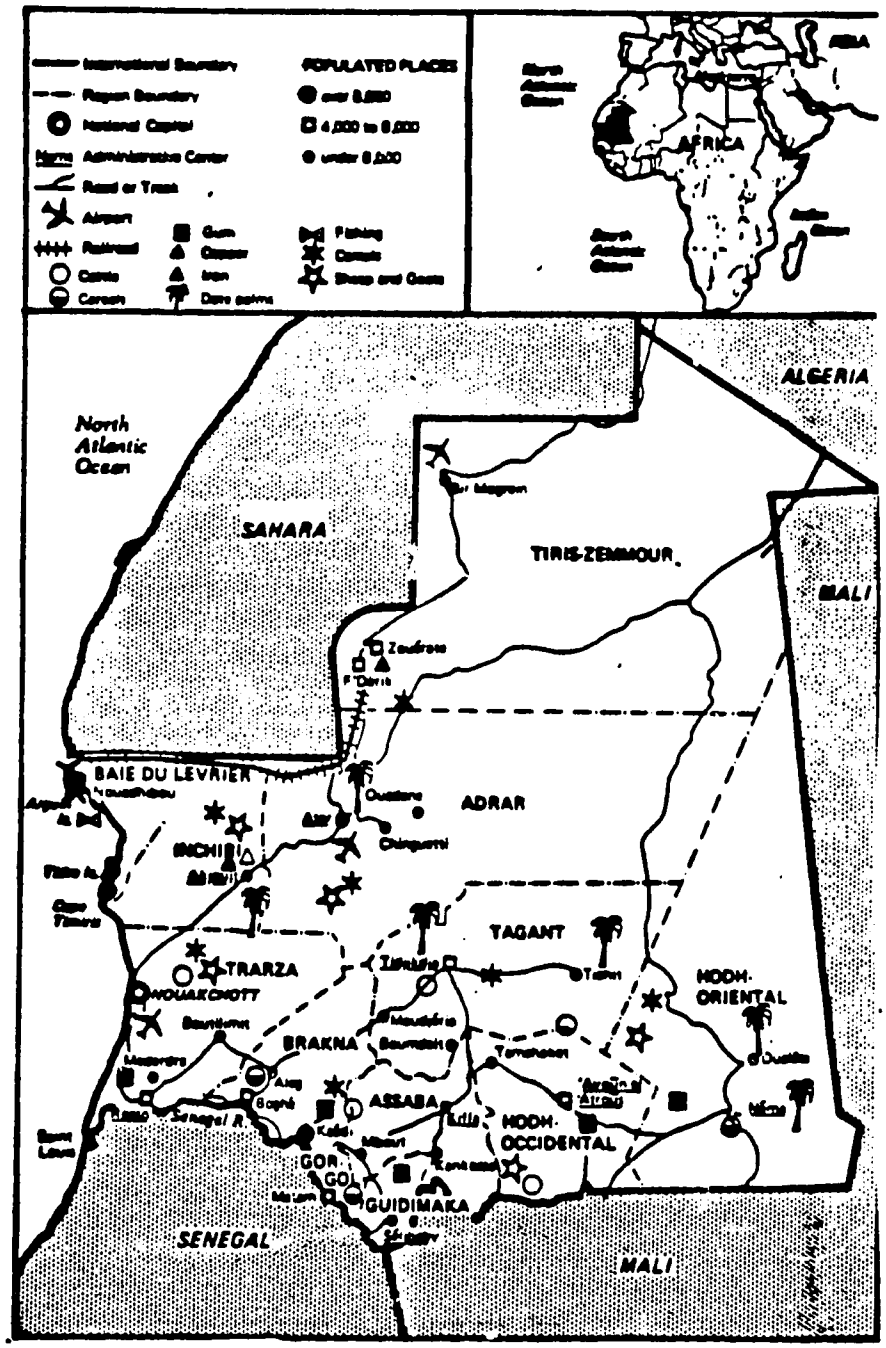
	1971	1972	1973	1974
Iron ore: gross weight	8,600	9,257	10,445	11,100
metal content	5,497	6,017	6,773	7,582
Copper ore: metal content	4.5	14.8	24.0	16.7

ANNEX 3
Figure 7



ANNEX 3
Figure 8

AGRICULTURE AND MINING IN MAURITANIA



have been discovered in the following areas: Oum Azouagen, El Rheim, El Aiouj, Atomai and Bou Bergu. These may require suporting transport in the future. Under the First Four-Year Plan the following discoveries were made:

1) High quality gypsum near Nouakchott
2) Sizeable deposits of phosphate in Kaedi and Aleg that could be utilized for fertilizers.

Estimated iron ore deposits have reached 200 million tons of 65% ore. Estimated deposits of copper have reached the 27.6 million ton level (Akjoujt). Exploration of this site began in 1971 and it is expected to operate for a period of 18 years. The annual production has reached 90,000 tons annually.(1) A road is connecting Akjoujt and the Port of Nouakchott, which can be improved to accommodate the future transportation needs of this mining site. Also, Work has started on the improvement of Nouakchott Port.

d. Development Planning

1. Agriculture

a) Rice Project

A 9,880 - acre project on the plains of Mpourie in the vicinity of Rosso is planned. Some 4,940 acres will be devoted to rice; the annual production is expected to be 6,000 tons. The entire Mpourie area (including other rice projects) is expected to be producing 12,000 tons of rice annually.

b) Agricultural Education and Training Center

The Center has been established at Kaedi and the Government is planning to develop it into an institution with a four-year course in agriculture and animal husbandry.

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(1) It is believed the mine has been closed by the new Government.

c) Cooperatives

Cooperatives will be established to facilitate the purchase of equipment, the marketing of agricultural products, and the production of certain agricultural products. These cooperatives will be established in the following areas:

1) In Hodh-Oriental, for the purchase of equipment and marketing of agricultural products.
2) In the region adjoining the Senegal, for the storage and marketing of millet and sorghum.
3) Atar Region, to encourage date and vegetable production.

F. NIGER

1. General

With very limited resources and only 3% of its territory under cultivation the Niger economy is barely viable. The annual per capita income is 25,000 (1970) francs (U.S. $ 100.8) which is one of the lowest levels in the area, and it has been declining by 5% while the population is rising at the rate of 2.8% a year.

2. Sectoral Analyses

a. Agriculture (Fig. 9)

1. Agricultural output accounts for 90% of Niger's export receipts. Land suitable for cultivation is limited and yields per hectare are generally low. This attributable to:

The lack of irrigation

Poor soils

Primitive cultivation methods

Inadequate road system to serve the needs of the cultivated areas.

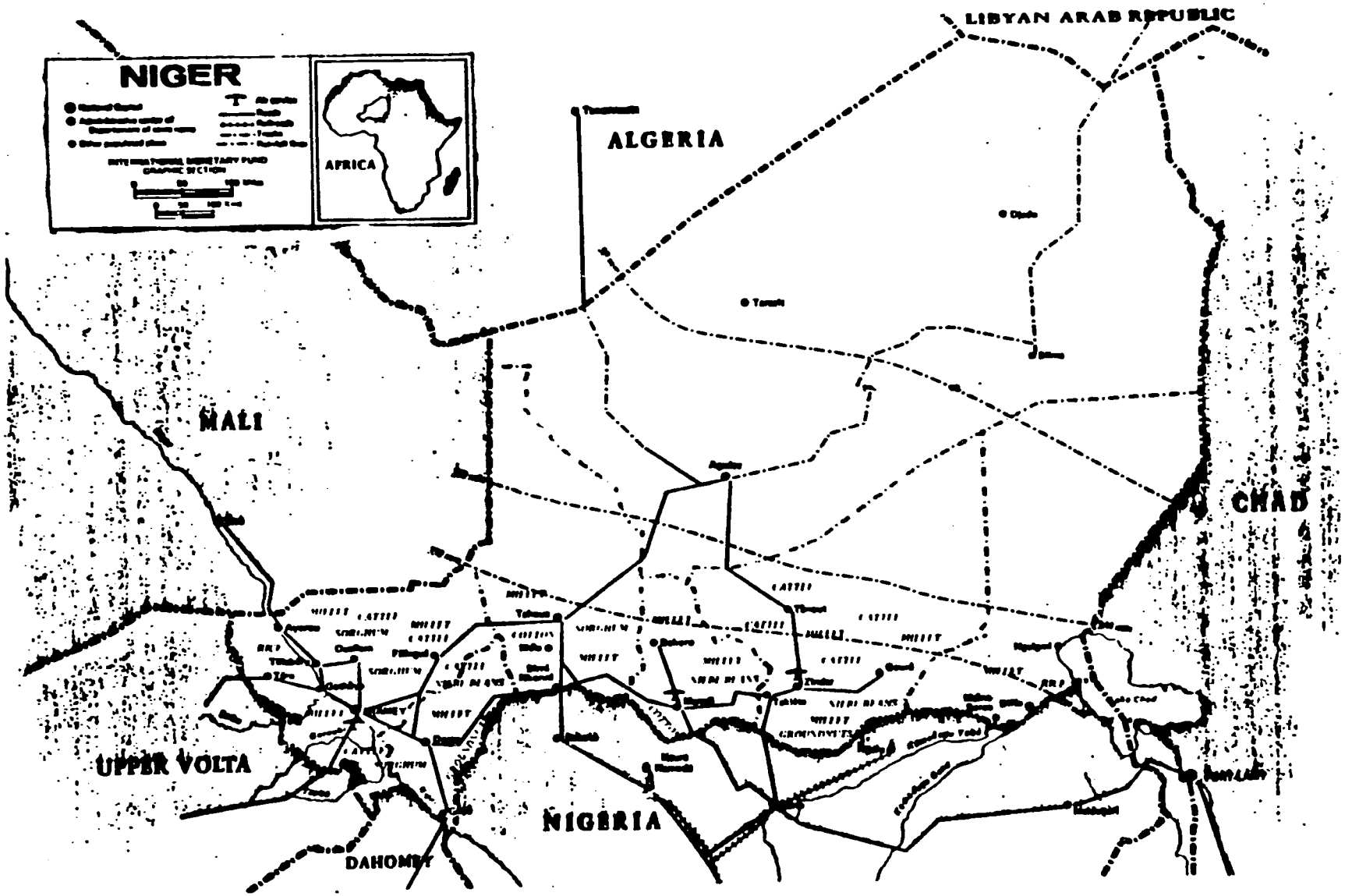
2. Millet and Sorghum

Ninety percent of the cultivated area is devoted to the production of these two crops. Output is adequate for domestic needs; in good years small surpluses are exported. The small-scale exportation of onions and other vegetables is being promoted. (Table 13).

3. Groundnuts

Groundnuts represent about half the value of marketed production and about 75% of export earnings. Groundnuts are cultivated in the narrow strip of land in Southern Niger along the border of Nigeria.

ANNEX 3
Figure 9



The area under groundnuts is more than 356,000 hectares. Output of groundnuts dropped in recent years (See Table 13) from its peak of 191,000 MT, due to insect damage.

4. Cotton

The cultivation of cotton has gained in importance in recent years, while it accounted for only 3% of total export earnings in 1967-68. Cotton is produced on small farms -- mainly in dried up-river beds in the savanna region, where the soil is suitable. The area for the cultivation of cotton has reached 16,000 hectares. In recent years, continued improvements in yields were offset by contraction in the cultivated area.
(See Table 13).

b. Industry

As in most other West African countries, manufacturing takes the form of agricultural commodity processing and import substitution. (See Table 14).

1) The textile industry consists of three cotton ginning mills operated by the French Company CDT, with a capacity of over 7,500 tons per year.

2) The manufacture of construction materials includes the country's largest industrial enterprise, a cement company which produces 20,000 tons per year; other construction material facilities are:

   i) A brickyard at Niamey with 12,000 tons output per year

   ii) A tile factory with a capacity of 120 sq. meters of tile per day.

ANNEX 3
Table 13

NIGER

AGRICULTURAL PRODUCTION

('000 metric tons)

	1973	1974	1975
Maize	3	3	5
Millet	627	883	800
Sorghum	126	219	250
Rice	46	30	35
Sugar Cane	78	75	75
Sweet Potatoes and Yams	16	16	20
Cassava (Manioc)	156	201	295
Onions	29	44	40
Beans, dry	90	133	150
Dates	5	5	5
Groundnuts (unshelled)	77	129	100
Cottonseed	5	5	5
Cotton Line	1.2	2.5	2.5

ANNEX 3
Table 14

NIGER

INDUSTRY

	1971	1972	1973	1974
Beer ('000 hl.)	29	33	n.a.	n.a.
Woven cotton fabrics (million sq.metres)	9	12	n.a.	n.a.
Cement ('000 metric tons)	25	33	73	73
Electricity (million kWh)	42	50	57	65

NIGER

MINING

		1971	1972	1973	1974
Cassiterite	metric tons	126	136	136	127
of which: Tin	" "	80	91	93	84
Uranium*	" "	441	867	948	1,228

* Uranium oxide content of ores.

3) Other manufacturing is as follows:

i) A factory near Niamey which utilizes plastic material for the manufacture of shoes; its capacity is 600,000 pairs of shoes a year.

ii) Soap and perfume plants, with a capacity of 3,600 - 4,000 tons of soap and 1,000 bottles of perfume a year.

iii) A paint factory with an annual capacity of 600 tons of paint.

iv) The metal industry includes two plants:

a. A public manufacturing enterprise engaged in the production of metal furniture and agricultural tools.

b. A private enterprise producing about 480 tons of iron scaffoldings a year.

c. Mining (See Table 15)

Various minerals are found in Niger. Few, however, have been exploited and one of the principal obstacles has been the high transportation cost of moving the minerals from the mining site to processing locations. Improved transport infrastructure will contribute to the exploitation of mineral resources. The only mineral so far developed on any significant scale is uranium, whose resources are estimated at 70,000 tons of ore. A processing plant at the Arlit uranium mine reached 1,306 tons in 1975. Additional reserves estimated at 30,000 tons have been located at Akoura near Arlit.

Other minerals found but not yet exploited, include:

i) Three iron ore deposits in the Niger Valley, each amounting to 100-200 million metric tons.

ii) Coal deposits of 30 million tons and cassiterite are found in the same area. Early exploitation seems unlikely because of presently high transportation costs.

iii) Significant deposits of manganese have been discovered northwest of Niamey. To make exploitation possible, railway feeder lines from the Niger Valley to Ouagadougou would be necessary.

iv) Deposits of lithium and molybdenum have also been found in this area, but exploitation appears to be uneconomical because of high transportation costs.

v) Cassiterite, mined at Air (output 136 tons in 1975), iron ore at Say, gypsum and phosphate at Tahoua, oil and further phosphate deposits were discovered in 1975 but their extent is not yet known.

d. Development Planning

1. Niger River Development Planning

The objective of this project is the development and exploitation of the Niger River Basin resources.

2. Niger Cereals Production II

This project is aimed at the small farmer, who will receive the benefits of improved technology and services.

G. SENEGAL

1. General

Senegal has the most advanced economy of former French West Africa. The 1960 breakup of this federation and of Senegal's federation with Mali caused considerable dislocation of trade and transport (the Dakar-Bamako railway was closed for three years), and resulted in a great contraction in the market for Senegalese industrial manufactures. The GDP has risen gradually at an average of 3% per year, one of the slowest rates in the area. A major factor was the wide fluctuation in the agricultural output, which still remains the base of the economy.

2. Sectoral Analyses

The Government is now involved in almost all parts of the economy. It owns all of the major public services - water, electricity, urban transport, railways and ports. In the agriculture sector there are now seven public enterprises and six mixed companies providing essential agricultural inputs and services handling the marketing of products and the development of agro industry.

a. Agriculture

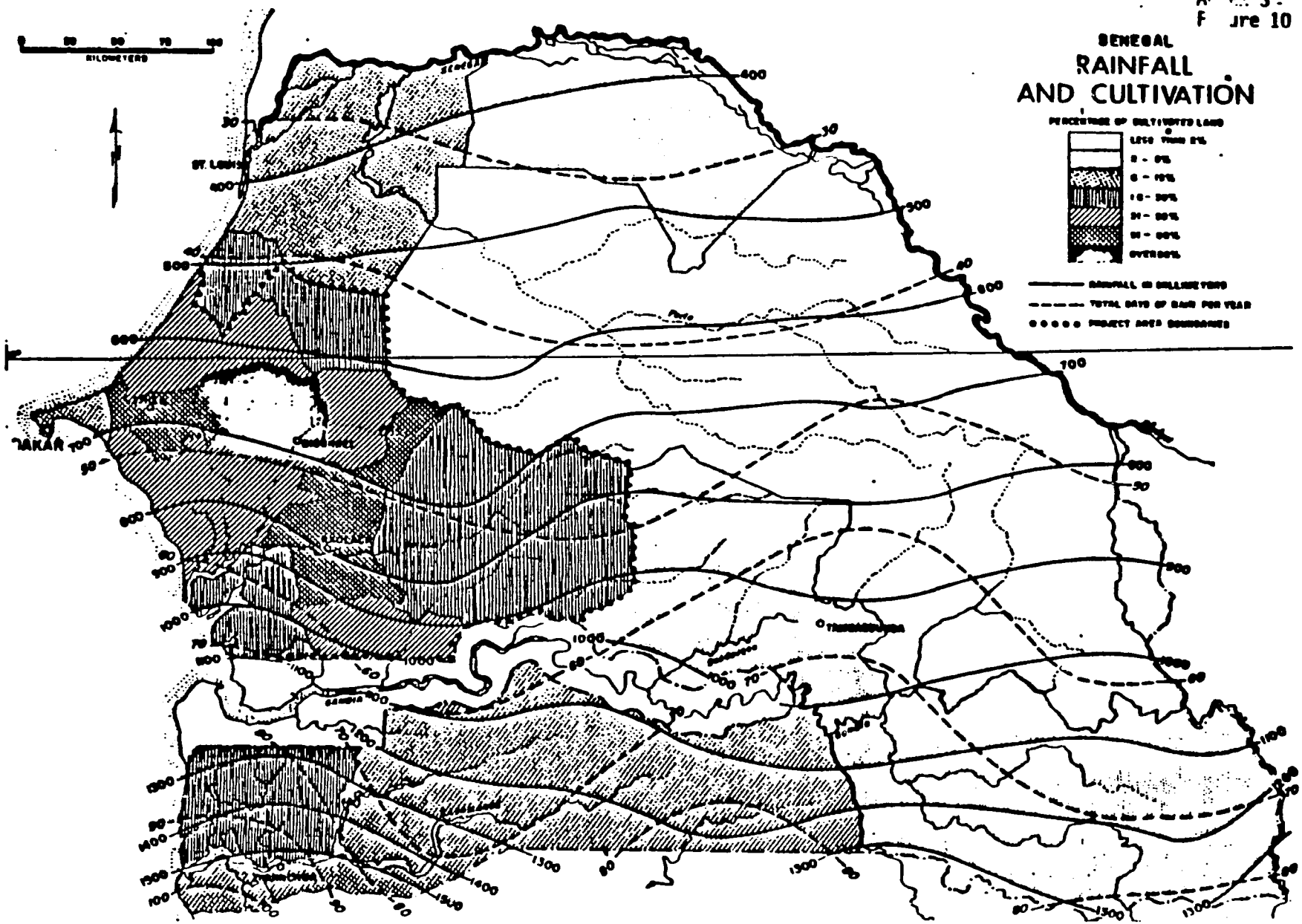
The lower reaches of the river basin in Western Senegal flood annually. These areas have fostered agriculture for centuries.

The cultivated area amounts to 60% of the country's total land area. (See Figure 10). Most of the cultivated area is in the overpopulated groundnut basin of the west, where only 10% of the country's land surface, and 60% of the population lives and is engaged in farming. Growing population pressure on the land in large portions of this region has resulted in badly depleted soils and declining yields.

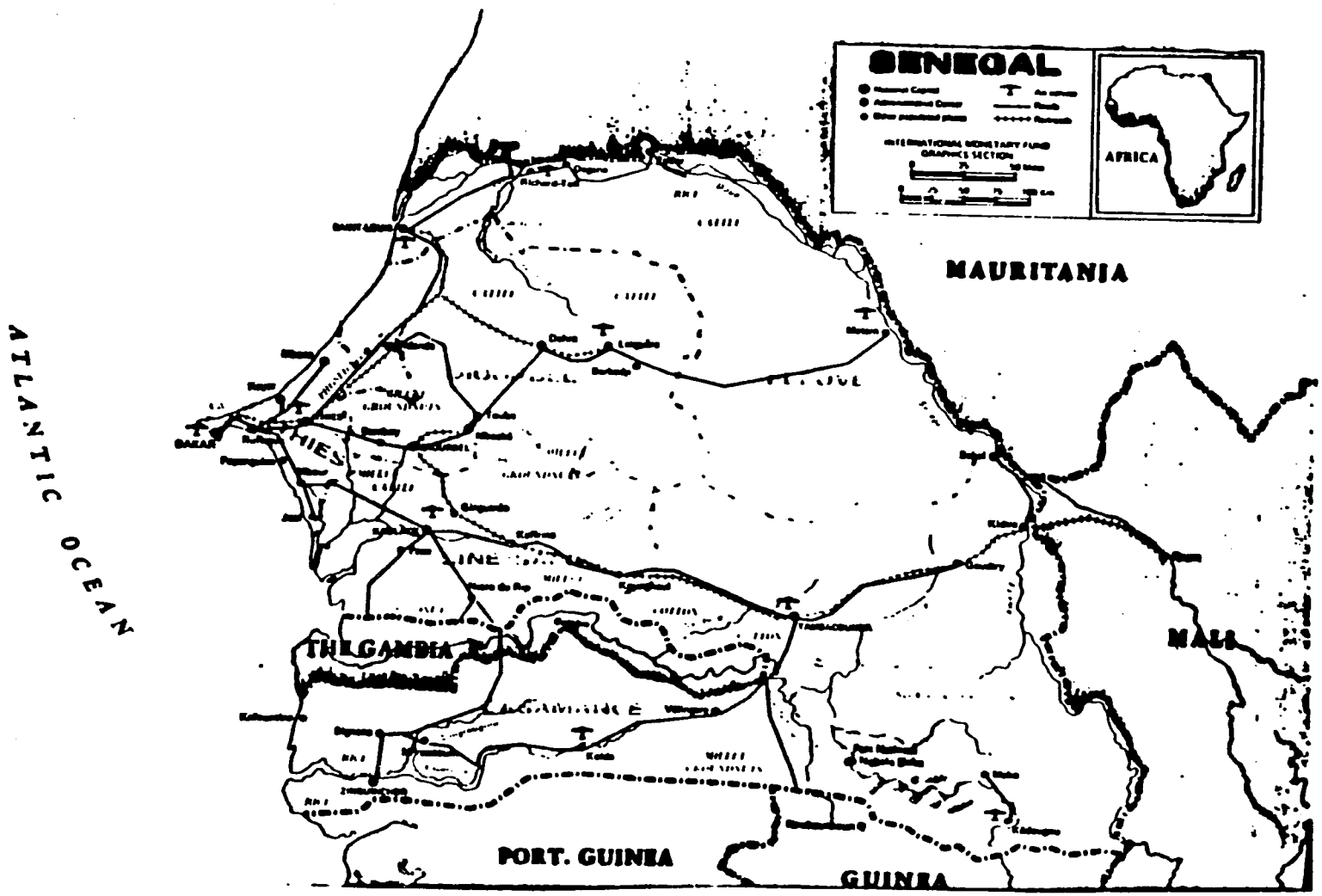
1) Groundnuts (See Figure 11)

Some 170,000 farm families are engaged in the production of groundnuts for export, usually in combination with subsistance production of drought-resistant sorghum and millet. Groundnuts have been cultivated for centuries in the northwestern portion of the basin.

ANNEX 3 -
F ure 10



ANNEX 3
Figure 11



During the early 1970's most agronomists agreeed that relatively drought-resistant groundnuts, sorghum, and millet are the only suitable crops for rain-fed cultivation in the central and northern parts of the country. Even with these crops, average yields are low. In the northern third of the country, groundnut yields attain an average of 450 pounds per acre; in the central third, the average yield is 670 pounds per acre; in the southern third, the average yields are 750 to 850 pounds per acre. The total and projected production of groundnuts are indicated in Tables 16 and 17 respectively.

2) Rice

In its campaign to increase domestic food supply the Government has emphasized the need to increase the production of rice, the customary diet of the urban population. During the 1960 - 1971 period, annual domestic production of rice averaged about 110,000 tons, whereas annual domestic consumption was 250,000 tons. The target of Government production programs is to attain self-sufficiency. Most of the rice comes from Casamance Region (See Figure 11) which provides about 80% of the national production. Total and projected rice production are indicated in Tables 16 and 17.

3) Vegetables

Truck farming of vegetables for the urban markets of Dakar and Thies and for export was expanded in the 1960's. In 1972 an additional 9,890 acres were devoted to truck farming, and about 80% of it was around Dakar in the Cap Vert Region. Some 40,000 people are employed in this activity, which will provide a livelihood for more than 200,000 people. About two crops a year produce, on average, more than 100,000

tons of vegetables a year. The industry is subject to numerous problems:

a) Lack of water for irrigation and encroachment of the desert

b) A road system that is inadequate to connect production areas with main urban markets.

4) Millet and Sorghum

Both these crops are grown chiefly in association or in competition with groundnuts since all three crops require similar soil and climatic conditions. More than 90% of all cultivated land is devoted to these three crops (2.5 million acres for groundnuts and 2.5 million for millet and sorghum - See Figure 11). Millet and sorghum production for 1973, 1974, and 1975 are indicated in Tables 16 and 17.

5) Cotton

Because the rainfall requirement for cotton growing (34-44 inches a year) is too great for most of the center and north, production is concentrated in three regions:

a) In the south of the Sine-Saloum Region near the border of Gambia

b) In Western Senegal; Oriental Region

c) In the Casamance Region

The cultivated areas consitute more than 25,000 acres. Recent and projected outputs are indicated in Tables 16 and 17, while Figure 11 indicates the areas under cultivation.

SENEGAL

Principal Crops
(000 metric tons)

	1973	1974	1975
Rice (paddy)	64	114	145
Maize	45	42	50
Millet and Sorghum	514	685	651
Potatoes	5*	5*	5*
Sweet potatoes	6*	10*	10*
Cassava (manioc)	122*	171	171*
Cow peas	15	23	23*
Groundnuts (in shell)	675	1,000	1,476
Cottonseed	21	26	24
Cotton (lint)	12	15	16
Palm kernels	7.0*	7.5*	7.5*
Tomatoes	1*	3*	6*
Mangoes	25*	25*	27*

*estimated

SENEGAL

PROJECTED GROWTH OF MAJOR AGRICULTURAL PRODUCTS TO 1980

	Prices	Rate of Growth 1960-70	Rate of Growth 1971-80
Groundnuts	current	-0.9	0.5
Millet/sorghum	constant	3.8	4.6
Rice	constant	3.5	17.5
Vegetables	constant	2.7	5.3
Sugar	constant	-	-
Cotton	constant	infinite	16.2
Others	constant	2.0	1.9
Agricultural sector		0.8	3.8

b. Industry

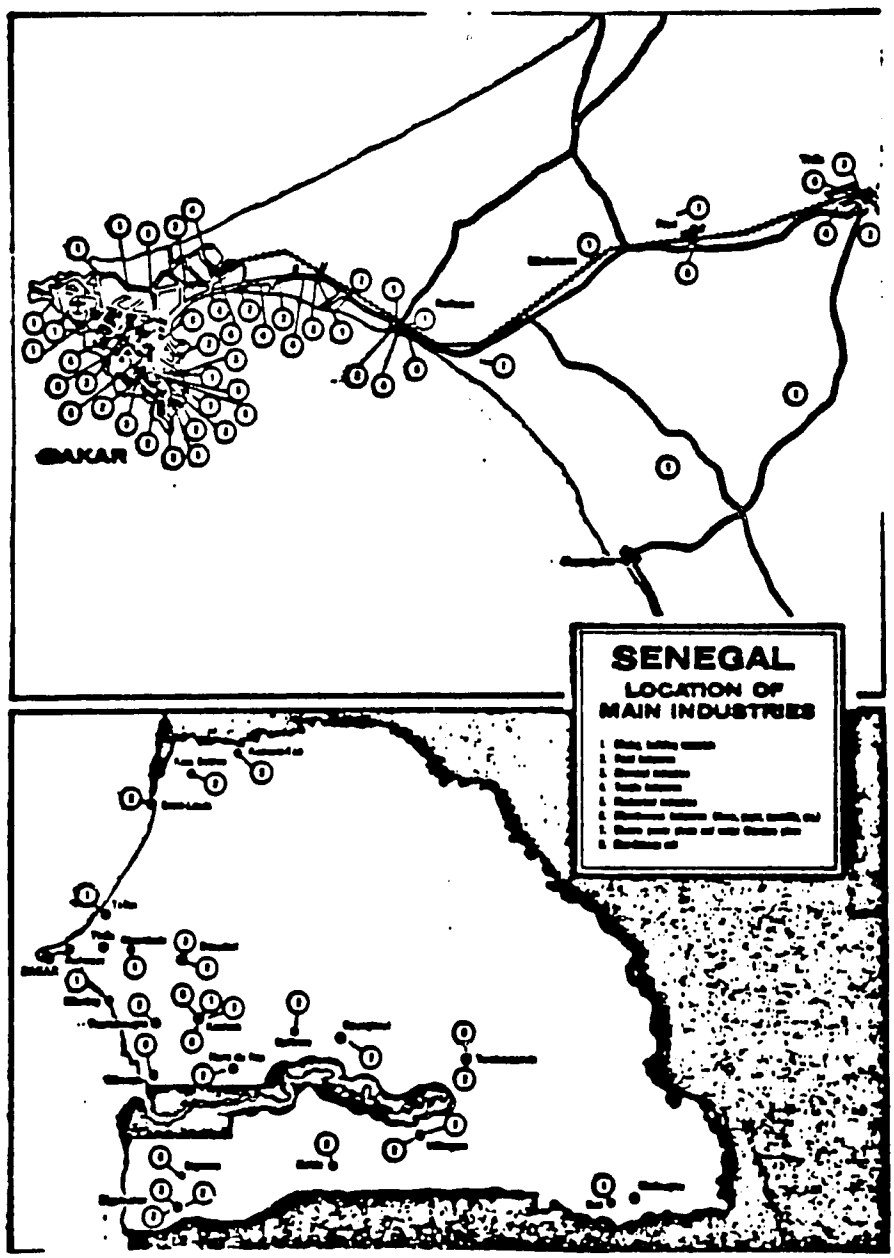
Senegal has the most developed industrial manufacturing sector in Francophone West Africa. Some 360 enterprises exist (See Figure 12). Total production is indicated in Table 18. Over 60% of output by value comes from food, beverages, and tobacco (five plants produce 1 million tons a year of groundnut oil per year). Import substitute enterprises include soft drinks and refined surgar. Senegal's textile industry is the most important in Francophone Africa, with 3 cotton ginning mills, (32,000 tons capacity). An 800,000-ton oil refinery exixts. Dakar area has been the center of all the industrial activity, which has been oriented mainly toward export.

c. Mining

The mining sector contributed about 1% to GDP in 1971 but its share has grown since then. It is dominated by phosphate production. Phosphate reserves at Thies are estimated at 30 million tons. In 1975, 1.6 million tons were produced. Output is expected to rise by 2 million tons to 3 million tons annually. Output of the two phosphate deposits mined by foreign-owned firms began in 1960 and by 1971 was contributing 12% of export earnings. (Table 19).

Some of the most important and newly discovered mineral deposits are listed below:

1) An offshore petroleum deposit of about 100 million tons located off Casamance Region
2) An extensive iron ore deposit located on the Fàlene River in the southeastern corner of the country, more than 400 miles inland from Dakar. Efficient commercial exploitation of the iron ore may be achieved if an adequate infrastructure network can be


DAKAR
SENEGAL
LOCATION OF
MAIN INDUSTRIES

SENEGAL

INDUSTRY

		1973	1974	1975
Groundnut oil	000 metric tons	129	142	251
Wheat flour	" " "	81	81	n.a.
Canned tuna	" " "	8.7	14.4	14.2
Sugar	" " "	30	22	33
Cement	" " "	296	332	359
Beer	000 hectolitres	118	113	192
Soft drinks	" "	194	223	269
Cigarettes	" million "	1,970	2,041	n.a.
Cotton fabrics (pure woven)	metric tons	600	800	n.a.
Footwear	000 pairs	3,588	4,640	5,172
Jet Fuel	000 metric tons	88	96	n.a.
Motor spirit (petrol)	" " "	103	117	n.a.
Kerosene	" " "	12	14	n.a.
Distillate fuel oils	" " "	239	206	n.a.
Residual fuel oils	" " "	203	195	n.a.
Liquefied petroleum gas	" " "	4	4	n.a.
Electricity (consumption)	million kWh.	353	364	384

SENEGAL

MINING
(000 metric tons)

	1972	1973	1974	1975
Aluminium Phosphate	166	219	405	201
Lime Phosphate	1,250	1,533	1,472	1,682
Sea Salt	135	122	150	n.a.

developed. Proposed related transport projects are the following:

a. A road system which will connect the mineral site with Dakar.

b. Extension of a spur of the railroad line from Tambacounda to the border.

c. Construction of new port facilities at Mbour, or improving the waterway between Keyes, Mali to the Senegal River, thus allowing shipments to be transported to the river port of Keyes, and shipments from there down to the Senegal River. A dam is already planned for construction at Manatali, at some distance on the Mali side of the border. This dam can provide needed, low-cost energy.

3. Development Planning

a. Agriculture

Agricultural improvement projects include the following:

i) Groundnut/Millet Productivity Project - located in the Groundnut Basin.

ii) Terres Neuves Resettlement Pilot Project-located in the Western portion of Senegal Oriental region.

iii) Casamance Agricultural Development Project.

iv) Casamance Rice Project.

v) Sine-Saloum Project.

vi) Louga-Kebemer Agricultural Development Project

b. Industry

The following industrial development projects are included in the Fourth National Development Plan:

i) Construction of an oil refinery with an annual capacity of 20 million tons of crude petroleum.

ii) Construction of an industrial complex at Cayar with a six million-ton oil refinery and a petrochemical plant.

iii) Establishment of a free trade zone in Dakar. The development planners are emphasizing programs for promoting the local processing of crops, livestock products and fish. There are also plans for more intensive industries, and for the production of semi-finished products.

c. IDA is financing a project to support a three-year program aimed at strengthening and improving government monitoring, and performance in the para-public sector as a whole. The project is intended to improve the efficiency of government organizations charged with analysis, operational supervision, and formal control. Various enterprises affected include the railways and the ports.

H. UPPER VOLTA

1. General

This state, in 1947 a colonial administrative unit, has so far shown no evidence of resources needed to be its stagnant subsistence economy. One of the worst sufferers in the Sahel drought of 1969-74, it is still recovering from disastrous losses of livestock herds and crops.

2. Sectoral Analyses

a. Agriculture and Livestock

The Government has approached rural development and expansion of agriculture on a regional basis. The country has been divided into 10 regions; rural development in each region has been entrusted to a specialized agency.

Agricultural production is indicated in Table 20.

Livestock is a leading source of money income in the rural sector and constitutes the principal economic activity in the eastern and northern parts of the country (see Figure 13), where rainfall and crop production are minimal. The livestock sector is the source of about 33.4% of the country's export earnings.

The livestock population is indicated in Table 21 . In the last few years herds have been increasing at an average annual rate of 2.3%; the expected growth rate for the next 15 years will not exceed 5%.

The activities of a number of recently established companies will foster the development and export of livestock. These companies include two cattle raising farms, one plant for the treatment and

UPPER VOLTA

AGRICULTURAL PRODUCTION
(000 metric tons)

	1973	1974	1975
Maize	58	62	62
Millet	253	370	350
Sorghum	481	705	650
Rice (paddy)	31	36	40
Sweet Potatoes	40*	27	35
Yams	45*	45	48
Cassava (Manioc)	20	30*	35
Tomatoes	1*	1*	1
Cow Peas	90*	70*	75
Other Pulses	85*	80*	85
Groundnuts (in shell)	63	65	80
Cottonseed	20	16.8	14
Cotton (lint)	12	9.8	11
Sesame Seed	5.3	8	8
Tobacco	0.8*	0.6*	0.6

*estimation

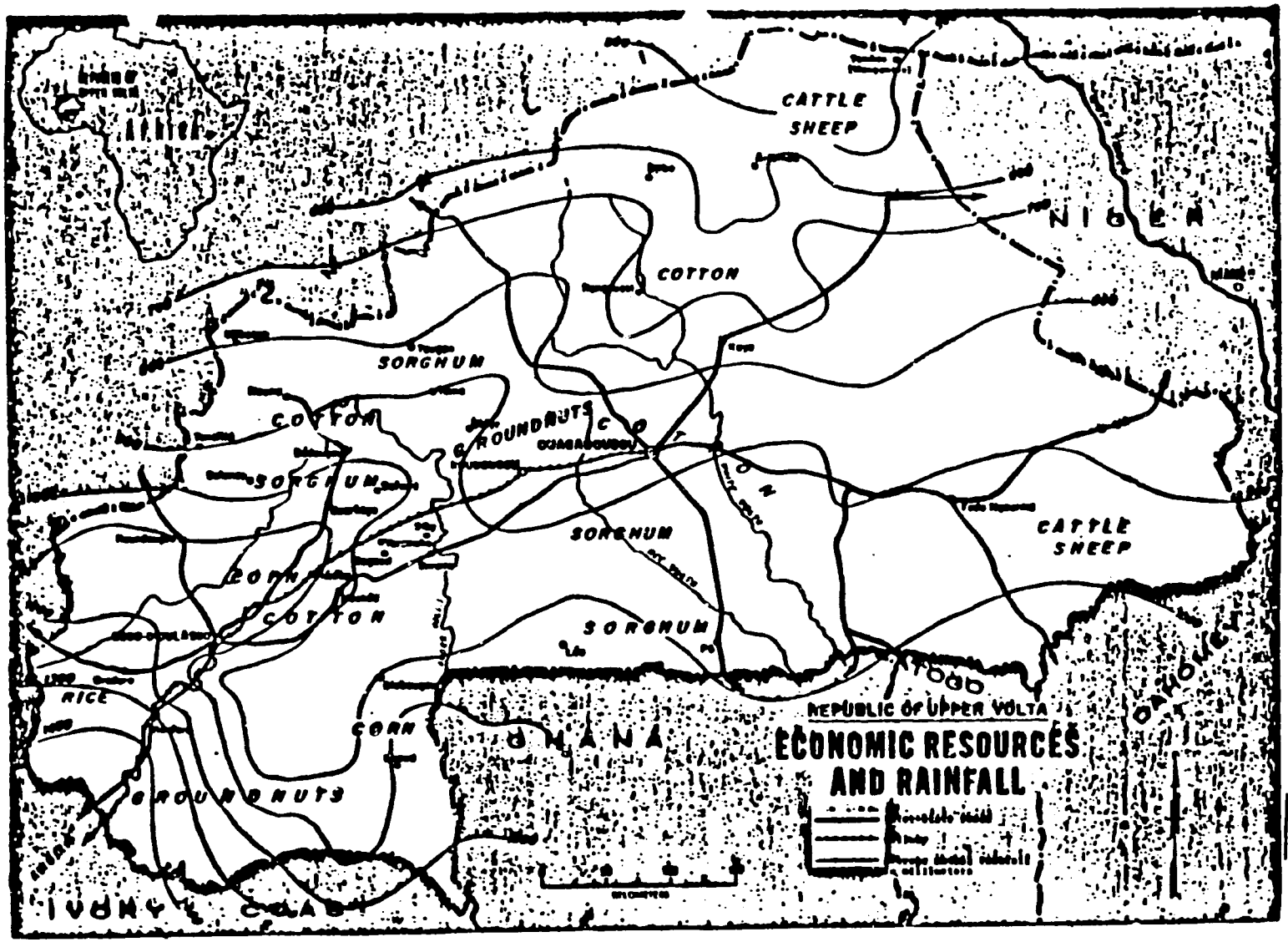
UPPER VOLTA

LIVESTOCK
(FAO estimates - 000 head)

	1973	1974	1975
Cattle	1,800	1,600	1,700
Sheep	1,050	1,000	1,100
Goats	2,200	2,000	2,100
Pigs	120	120	140
Horses	50	80	90
Asses	150	150	165
Camels	5	5	5
Chickens	7,500	6,700	7,200

LIVESTOCK PRODUCTS
(FAO estimates - metric tons)

	1973	1974	1975
Beef and veal	9,000	8,000	11,000
Mutton and lamb	3,000	3,000	3,000
Goat meat	6,000	6,000	6,000
Horse meat	2,000	2,000	2,000
Poultry meat	5,000	4,000	4,000
Edible offals	3,444	3,368	4,035
Cows' milk	42,000	38,000	45,000
Goats' milk	15,000	14,000	15,000
Butter	700	650	750
Hen eggs	2,100	1,876	1,960
Cattle hides	1,620	1,512	1,800
Sheep skins	534	506	561
Goat skins	1,218	1,103	1,155



NOVEMBER 1971

ANNEX 3
Figure 13

tanning of hides and a slaughter house in Ougadougou with an annual capacity for processing from 7,500 to 10,000 tons of meat and for refrigerating about 3,500 tons of meat a year.

b. Industry

The manufacturing sector in Upper Volta accounts for only about 5% of GDP. In 1966 there were 36 industrial plants, located in Bobo Dioulano and Doudougou. Most of them are engaged in processing domestic agricultural commodities and in producing import substitutes (Table 22).

The first industrial project of any significance is the textile plant at Koudougou. It began production in 1970 with an annual capacity of 500 tons of yarn and 760 tons of woven material, using local supplies of cotton. Another project recently completed is a sugar refinery at Banfora which produces 40,000 tons of refined sugar from local cultivation. Other industrial projects under consideration include a new vegetable processing plant, a bicycle tire plant, and a pasteurizing plant for dairy products.

Production in some cases has fallen below capacity for the following reasons:

1. Neighboring countries have established similar industries.
2. Limitations of resources and skilled labor.
3. High transportation costs reflecting an inadequate infrastructure.

UPPER VOLTA

INDUSTRIAL PRODUCTION

		1972	1973	1974	1975
Soap	metric tons	2,854	3,101	3,374	3,633
Groundnut oil	" "	852	971	426	607
Refined Sugar	000 metric tons	13.7	12.0	n.a.	n.a.
Beer	hectolitres	77,840	117,649	132,972	120,524
Soft Drinks	"	39,344	52,239	63,476	58,218
Footwear	000 pairs	982	1,145	1,182	1,531
Cotton Yarn	metric tons	800	605	540	465
Bicycles, Motor Cycles and Scooters	000	29	33	n.a.	n.a.
Bicycle and Motor Cycle Tyres	"	926	1,282	1,161	n.a.
Electric Power	000 kWh.	34,538	42,177	46,177	52,502

c. Mining

There are indications of some mineral resources but so far a limited amount has been discovered, and less is exploited. A main problem is transportation between the mining sites and the processing centers.

The major project under consideration is the development of the manganese reserves at Tambao, near the border with Mali and Niger.

Reserves of some 13.3 million tons support an annual production of around 500,000 tons and could be exploited for about 20 years. Development of this resource would raise the value of exports by some CFAF 3.3 billion annually or about 60% above the present level. The main problem facing the exploitation of this mining site is the lack of transportation between the mining site and the center of processing the minerals in Ouagadougou. An answer to this problem is the extension to Tarubou of the present railway link between Abidjan, Ivory Coast, and Ouagadougou. However, since the manganese deposits are relatively small and construction of the required railway link would entail considerable cost, the project would be feasible only if other economic activities develop in the area.

Nearby, at Tin Hrassan, limestone which could supply a cement plant with a capacity of 70,000 to 75,000 tons has been located. This project would also require an extension of the Abidjam-Niger Rail line either to Tamboa (in which case the above proposed railway extension project may be justified) or to Niamey in Niger, with a branch to Tamboa and Gao in Mali.

Other mineral resources are currently being studied, as listed below:

a Vanadium-bearing magnetite at Oussi

b Bauxite at Kongoussi

c Zinc at Tiebete

d Lead at Gam

e Nickel near Dori

THE RURAL POOR

1. The spirit of reform reflected in the "New Directions" legistation was considered by AID in prescribing indicators of poverty. These indicators apply to varying proportions of country populations -- not to countries as a whole.

   To characterize the rural poor, AID uses several rough benchmarks or standards of poverty. Falling short of any one benchmark is enough to place an individual in this mass group, which totals over 800 million people or about 3/4 of the total population of AID-assisted countries. In the Sahel more than 90 percent of the population are in this group. The following benchmarks are used:

   a. per capita income below $150 per year;
   b. daily diet of less than 2,160 to 2,670 calories, depending on the country;
   c. life expectancy at birth below 55 years;
   d. infant mortality over 33 per 1,000 children ages 0-1;
   e. birthrate over 25 per 1,000 population;
   f. accessibility to broadly defines health services available to less than 40 percent of the population.

   Though AID financed projects identify with large numbers of the poor, the primary target group for a given project will often be a limited portion of the poor majority in a country, depending on its economic and social conditions, its capabilities and priorities

and other considerations which determine the most impressive benefits to the rural poor at least cost. AID programs are designed to yield secondary benefits to as many as possible among the poor and to avoid worsening the plight of the poorest. AID assistance in the Sahel focuses on:

(1) concentrating on sectors -- food and nutrition, population and health and education affecting the basic well being of the poor.

(2) providing key components in concert with other bilateral and international donors of development packages designed to involve and affect broad segments of the poor majority, thereby multiplying the impact of AID assistance.

(3) supporting pilot programs which test new approaches with potential for affecting many people, thereby encouraging the research needed to advance the art of development.

Participation of the Poor

Programs which receive the highest priority emphasis under the congressional mandate and AID policy are those involving the active and effective participation of the poor in all facets of the development process. Ideally:

1) economic benefits are widely and significantly shared by the poor with the objective of narrowing the relatively income gap between the rich and the poor. For example: the coop which benefits small farmers;

2) decisions concerning the activities to be carried out are made preferably by those benefited -- the rural poor -- or, if not, the least with effective consultation and substantial acceptance by those benefited.

3) the activity in which they participate is ideally a learning experience for benefited persons which can be translated into other aspects of their lives.

Source: U.S. House of Representatives, Committee on International Relations. Implementation of "New Directions" in Development Assistance. Prepared by the Agency for International Development, (GPO: Washington, D.C., 1976).

TERRAIN EVALUATION OF ROADS

Work in the United Kingdom and in other parts of the world, has shown that terrain evaluation can be used for both classifying and mapping the engineering features of the ground. The system is flexible enough to handle information at all levels and thus can be used to store data accumulated during road-building projects, or any other civil engineering work.

The following points have emerged:

(1) The extent and nature of roadmaking materials and of associated road-building techniques can be displayed more effectively by land classification than by interpretation of geological and pedological mapping units. The relation of the soil properties, and of engineering problems and solutions to land classification, is the basis of terrain evaluation.

(2) At the level of the land system, broad but useful generalizations can be made about the availability of materials, suitable construction methods and costs of construction or maintenance.

(3) Land facets and land elements classify information in the detail required for road projects and thus provide a means of recording data in such a way that they can be used to design roads on similar ground elsewhere.

(4) As terrain evaluation is based on a classification of land form, it is particularly suited for use with aerial photographs viewed stereoscopically.

The initial identification of land systems is often established from single photographs or photomosaics.

(5) The storage of information from road projects, in a manner allowing reference when similar ground conditions are encountered, should lead to a decrease in the amount of survey work and an increase in its effectiveness.

(6) The frequency of soil sampling and testing in many site investigations is often disproportionate to that necessary for adequate design purposes. A terrain evaluation can be used to decide the appropriate places and frequency of sampling. Studies made so far have shown that in some cases survey effort could have been reduced by as much as 70 per cent if such information had been available.

(7) Terrain evaluation for engineering purposes uses a classification similar to that widely adopted in agricultural and land-use surveys. This leads to the possibility of integrating engineering surveys with surveys for land development.

In addition to the types of data referred to terrain evaluation can be used to record other kinds of engineering information. An example that is directly related to terrain is the quantity of earthworks associated with road building to different geometric standards. There is interest in the use of terrain evaluation as the basis of a highway sufficiency rating; if a highway sufficiency survey were combined with a land-use survey, which is also a form of terrain evaluation, this would form the foundation for an economic feasibility study.

Road location and materials surveys are often carried out without reference to variations in terrain conditions. Terrain evaluation relates the soil's properties and the associated engineering problems and solutions to a land-classification scheme, thus establishing a system for storing and relating information from one project to another. The basic unit of classification is the land facet which by definition is reasonably uniform in properties and behaviour in road engineering.

Land facets recur together in larger units called land systems which are usually identified on air-photo print lay-downs at scales above 1:80,000. At this level, the land system can store more general information relating to availability of materials, suitable construction methods and costs of construction or maintenance. A terrain evaluation can lead to a more logical soil-survey procedure, concentrating effort on problems relevant to the project. This can often lead to a decrease in the amount of survey work, together with an increase in its effectiveness.

In developing countries, especially the newly independent ones, transportation is one of the key factors for major economic and social advancement, In most, transport development receives a generous share of the national development budget and of foreign aid.

However, because the financial resources are never quite sufficient, there is always a pressing need to spread the investment as effectively as possible. For this reason, it is always desirable that transport development should be undertaken within the framework of over-all economic planning and in close coordination with other economic sectors.

In highway engineering, economic feasibility studies are being increasingly used to provide a basis for effective policy decisions and for planning investment.

In most developing countries, road distances tend to be great and site access often proves difficult. The ground is very often unmapped, and geological information, if available at all, is often too general to be of much assistance to engineers. Again, the environment generally poses problems that are unfamiliar to engineers whose training and experience are limited to conditions in the more temperate regions of the world.

In road-building, perhaps the most important difference between developed and under-developed countries is that, in the latter, there is often more freedom to choose the route of the road. It is also important to make effective use of local engineering material resources. Both of these factors affect costs and it is in response to the need to make early and effective planning decisions that rapid methods of terrain appraisal and of methods for storing engineering experience and data connected with terrain are important.

In spite of the intimate connection between all forms of civil engineering and the natural materials of the earth's surface, and in spite of the obvious benefits that can be obtained from prior knowledge of the engineering conditions of terrain, few attempts have been made to systematically record data for future use.

The most suitable method for classifying the engineering features of terrain lay in adopting the principles of land classification. These involve the recognition of distinctive patterns of landscape, brought about by the interaction of the many different components that make up the natural environment, such as rocks, soil, topography, vegetation and climate. The most important principle of land classification is that, in any number of different situations where these components have the same character and operate together in the same manner, the physical form of the landscape will be essentially the same.

Most engineers are aware of the repetitive nature of ground and, in countries that they know well, would easily recognize associations between certain rock types, hill shapes, soils and vegetation. Land classification simply sets out to define and record these relationships more accurately. When the various features of landscape have been described, the next step is to obtain values for the physical attributes of different portions of the landscape. In this way, a land classification becomes a land (or terrain) evaluation and, when the values obtained are concerned with soil strength, plasticity or any of the other properties on which the design of roads is based, the ground can be said to have been evaluated for engineering purposes.

To the engineer the importance of terrain evaluation lies in its ability to deal with a wide variety of engineering considerations which aren restricted to soils, but, in addition, include information about rocks, relief and hydrology. Moreover, because patterns of landscape can be easily identified using aerial photography, large areas of ground can be examined quickly.

Ground can be subdivided into distinctive patterns of landscape. Each pattern is made up of several components, which are generally interrelated, and recur together to give a pattern its characteristic form. These patterns can be picked out readily from aerial photographs of the appropriate scale.

Units of landscape which have a reasonably high degree of homogeneity for most practical purposes and can be readily identified in aerial photography at scales between 1:10,000 and 1:80,000 are termed land facets. They are significant units of landscape in terms of engineering and agricultural land use. Land facets are themselves comprised of smaller units called land elements. These are generally small components within the landscape and a number of related elements are linked to form a land facet. Restricted outcrops of lateritic ironstone, which may form a useful source of building material, and small, incised watercourses are two examples of land elements. Generally, land elements are too small to be idenfitied easily in aerial photography at conventional mapping scales. It can be seen, however, that they may have considerable significance in engineering terms.

Land facets recur together to form larger units called land systems. These form distinctive patterns, and are usually identified in the first instance from air-photo print-laydowns (or photo mosaics) at scales above 1:80,000.

Thus, the terrain of a region is conceived as a series of recognizable distinct land systems, each of which contains typical land facets which have similar features wherever they occur and which can be readily identified on aerial photographs. Land facets usually include a number of smaller land elements which are invariably more homogeneous than facets in engineering character. Some of these may be of special significance in road construction, especially where they present a problem or provide a source of building material.

A number of examples have been selected to illustrate the way in which terrain evaluation can be applied in different environments in Nigeria and Malaysia.

In Nigeria, an investigation was made of 30,000 square miles of the North-East State (formerly Bauchi and Bornu Provinces). It covered an extensive range of soil types derived from a wide variety of parent materials, including Basement Complex granites, Cretaceous sandstones and shales, and Tertiary sandstones, together with more recent aeolian, lacustrine and alluvial sediments. Lateritic ironstones associated with a number of separate erosion surfaces were also encountered. Climatically, the area falls within the West Africa savanna zone and is characterized by a brief rainy season in the summer months with a long dry season in the winter. The vegetation has been ascribed to the Sudan and Sub-Sudan vegetation zones.

The engineering material data were obtained from a number of road projects undertaken by the former Northern Nigeria Ministry of Works and comprised measurements of the particle-size distribution of plasticity characteristics including Atterberg limits and linear shrinkages, of maximum dry densities at different levels of compaction, and of the soil strength at optimum moisture content expressed in terms of the California Bearing Ratio. In accordance with conventional site-survey practice, samples were mostly obtained at fixed intervals along the centerlines of roads.

Initially, print lay-downs (photo-mosaics) were used to identify provisional land-system boundaries. Later, a more detailed interpretation was made using aerial photography at scales between 1:10,000 and 1:40,000. This enabled revisions to be made of the land-system boundaries where these were required. The component land facets of each land system were identified

and described. Supplementary information was obtained from geological sources and agricultural reconnaissance soil maps where these were available.

Field information obtained during the course of a number of engineering surveys was used to check the results of the photo study.

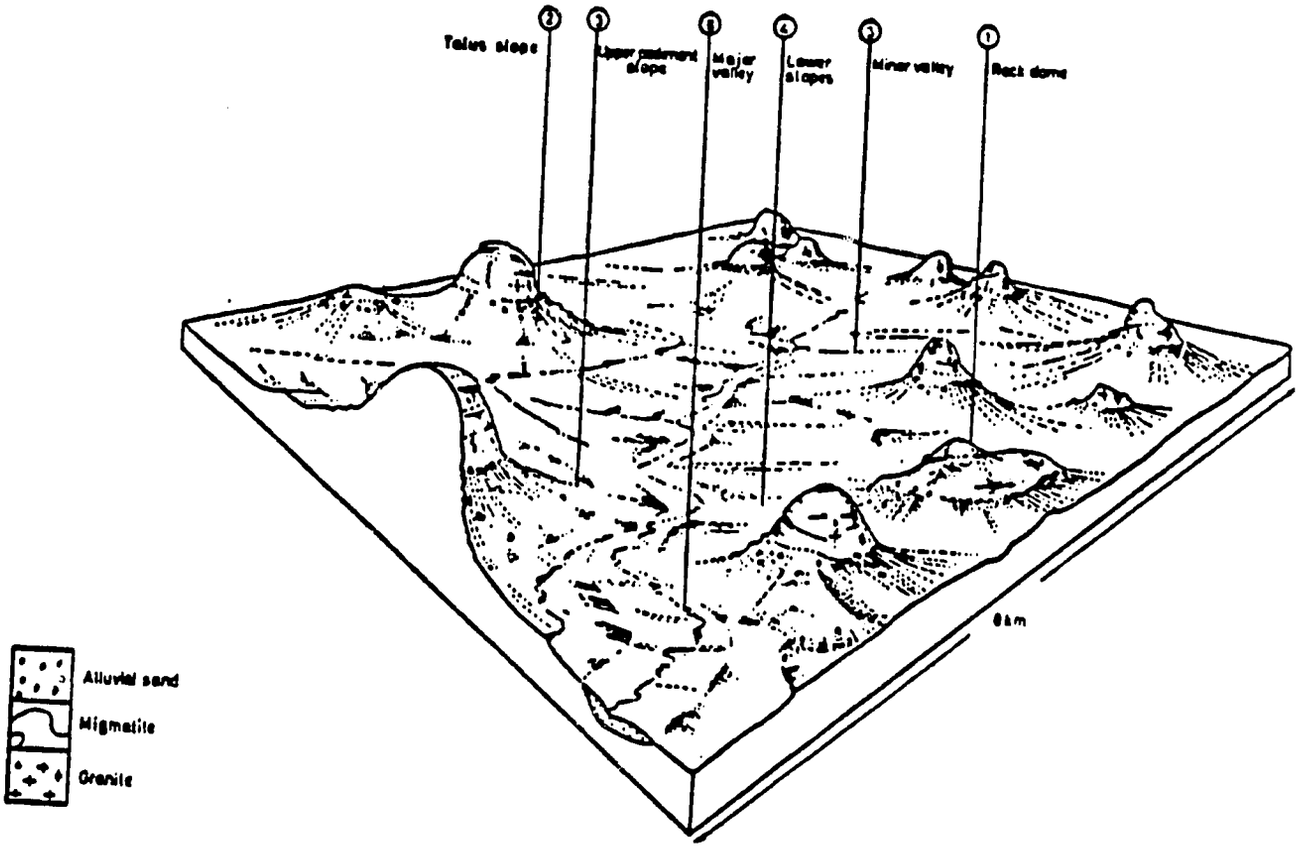
Subsequently, land-system classification of the same area was carried out by the Land Resources Division of the Directorate of Overseas Surveys, an extension of an earlier survey that had been undertaken in Adamawa Province. These results have been used to revise the land classification carried out by the Laboratory and the land-system boundaries now employed are substantially the same.

In all, some twenty land systems were defined and mapped. Each of the land systems was described in terms of its main environmental features, such as climate, geology, relief and altitude; a brief account was also given of the geomorphology, soils and vegetation. The individual land facets were described and block diagrams were prepared to illustrate their position within each land system.

The first example of a land system from Nigeria is shown diagrammatically in the block section in Figure 1. This is the Lugge land system located near Bauchi. It forms a distinctive inselberg landscape consisting of rock domes and whale backs separated by gently sloping plains and river valleys. The underlying parent rock belongs to the Basement Complex and comprises granite gneisses and migmatites. More basic gneisses occur infrequently.

A summary of the environmental features of a land system is essential for classification purposes and an example for the Lugge land system is given in Table 1.

ANNEX 5
Figure 1



LUOGE LAND SYSTEM

Climate:	Semi-arid to hot equatorial tropical (Sudan savanna zone transitional to Sub-Sudan and Northern Guinea zones), four humid months, June-September. Average daily maximum temperature above 33.5°C.
Rock:	Granite gneisses and migmatites of the Pre-Cambrian Basement Complex.
Landscape:	Inselberg landscape with exfoliated granite rock domes and whale backs. Less resistant migmatites often underlie plains. Lateritic ironstone corresponding to the Upper African Surface is developed on upper pediment slopes.
Soils:	Ferruginous soils developed on gently sloping ground with local occurrences of weakly developed soils which include a subsidiary group of lithosols. Basic gneisses give rise to occasional areas of vertisolic soils. Coarse, bouldery talus forms waste mantle to rock domes. Generally well drained, stony soils developed on pediment slopes, with sandy alluvium in valleys. Clay soils patchily distributed in small valleys and areas of locally impeded drainage.
Vegetation:	Mixed Northern Guinea Savanna woodland with transition to Sub-Sudan zone.
Altitude:	650 m. (approx.).
Relief:	350 m.

The Lugge land system comprises six land facets which recur together throughout the area occupied by the land system. One of these, land facet 3, characteristically contains extensive deposits of lateritic ironstone which form a useful source of roadbuilding gravels. During the course of a road survey, samples were obtained from four widely separated sites within the same land facet. Laboratory testing subsequently proved the homogeneity of the lateritic gravel deposits for most road-building purposes. Some of the values obtained from the four sites are shown in Table 2. A similar investigation into the engineering properties of the remaining land facets indicated that these in turn showed considerable homogeneity. Major valleys were often associated generally with coarse sands, while minor valleys were often associated with weak clays.

The second example from Nigeria is of the Gombe land system developed over Cretaceous sandstones. In this example, considerably more detail is provided. Tables 3 and 4 give a brief summary of the environmental features of the landscape, including a description of the soils, hydrology and vegetation of each land facet. A diagrammatic block section of the land system is shown in Figure 2. Tables 5,6 and 7 show the types of information that can be collected and stored for future use. These include laboratory test data on representative soils, and engineering material resources. Table 7 shows how an assessment can be made of the suitability for road location of each land facet within the land system.

The work in West Malaysia covered an area approximately 200x30 miles in the south of the peninsula. The area is backed by mountains parallel to the coast, which are mostly formed of granite. The lowlands are more commonly formed on sediments, which may be slightly metamorphosed, but the area also

SOME VALUES OF LATERITIC IRONSTONE GRAVELS OBTAINED FROM FOUR WIDELY SEPARATED SITES WITH THE SAME LAND FACET — LAND FACET 3 LUOGE LAND SYSTEM

No.	Sample No.	Linear Shrinkage %	Dry density (B.S. heavy compaction) lb/cu. ft.	Moisture content %	CBR %
1	191	4	133	9.0	80
	190	7	133	9.0	104
	189	5	134	8.9	70
	186	—	129	9.4	84
	183	—	134	7.7	117
	184	—	130	10.8	66
2	131	4	134	9.1	82
	129	12	134	10.4	44
	126	7	135	8.4	109
	125	8	134	9.4	64
	124	5	139	9.3	106
	123	8	136	8.6	64
	110	4	137	10.5	63
3	102	2	140	8.4	88
	101	8	132	9.8	82
	1A	—	136	8.0	72
	1B	6	132	10.5	94
	2	—	133	9.7	96
	14	4	135	8.2	78
4	30	8	133	9.4	116
	29	8	137	8.5	94
	27	6	135	8.8	94
	26	—	134	10.2	82
	25	10	138	7.9	80
	22	7	134	10.9	96

Table 3

GOMBE LAND SYSTEM

Climate:	Semi-arid equatorial tropical (Sudan savanna zone): three humid months (July-September), 750–850 mm rainfall. Average daily maximum temperature above 33.5°C.
Rock:	Upper Cretaceous Gombe Sandstone comprising flaggy siltstones, generally fine-grained sandstones often heavily ferruginized especially adjacent to lateritic caprock.
Landscape:	The Gombe Sandstone hills from a buried land surface and are overlain by the Palaeocene Kerri Kerri Formation. Flat-topped hills are capped by a thick lateritic ironstone, part of an old erosional surface which dips beneath Quaternary sediments of the Chad Formations. The topography comprises moderately steep, rubble-clad stopes separated by flat-floored valleys.
Soils:	Thin, stony soils on hillslopes, with fine sandy colluvium and alluvial material forming the flat, valley floors. More coarser-grained sands have been washed in from the adjacent Kerri-Kerri Formation.
Vegetation:	Sudan savanna woodland.
Altitude:	400–630 m. (approx.).
Relief:	150 m.

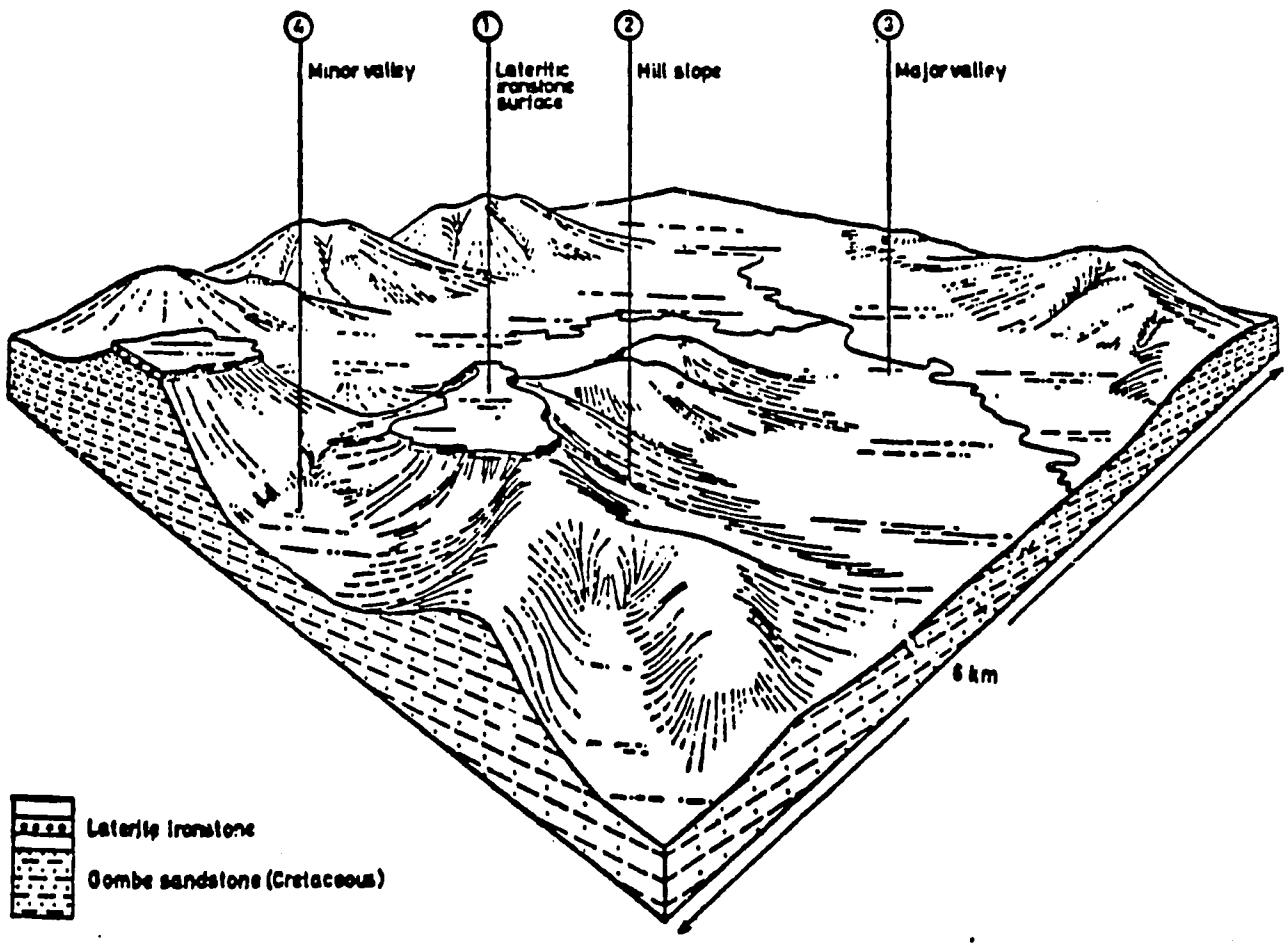
Reference: Klinkenberg, K. et al., *Soil Survey Section*, Bull. No. 21, 1963. Regional Research Station, Ministry of Agriculture, Samaru, Zaria, Northern Nigeria.

Table 4

FACETS OF GOMBE LAND SYSTEM

Land facet	*Form*	*Soils, materials and hydrology*	*Land cover*
1	Lateritic ironstone surface Flat to gently undulating mesa surface with uneven micro relief. Size may vary from 100 m² to 5 km².	Flat, hill-crests capped with hard lateritic ironstone and/or heavily ferruginised sandstones which underlie caprock. Bare ironstone, ferruginized sandstones which shallow, stony soils. Reasonably well-drained sites, with only local impedance.	Detarium woodland occurs in soil pockets.
2	Hill slope Moderate steep slopes usually less than 35°, locally steepening below caprock and occasional mid-slope rock outcrops. Gentler lower slopes, sometimes with uneven bouldery micro relief.	Thin, boulder soils up to 0.5 in thick form a conspicuous protective sheath to underlying finer-grained soils. Erosion proceeds rapidly where this armour is removed, perhaps by sliding.	Detarium woodland on upper slopes. Mixed Anogeissus woodland on lower slopes.
3	Major valley Flat to gently sloping valley floors, of large size.	Fine sandy colluvium and alluvium forming valley floors and derived in part from adjacent Kerri-Kerri Formation. Juvenile soils developed on recent alluvium. Rock occasionally exposed in valley walls and floors. Colluvium tends to be coarser in areas adjacent to land facet 2. Intensive erosion produces deep dissection of river channels.	Heavily cleared and cultivated. Elsewhere, mixed Anogeissus Savanna woodland occurs.
4	Minor valley Flat to gently sloping valley floors, often deeply dissected.		As above.

ANNEX 5
Figure 2



Block section showing the land facets of the Gombe land system, Nigeria.

ANNEX 5
Table 5

ENGINEERING PROPERTIES OF MATERIALS — GOMBE LAND SYSTEM

Land facet		Dominant engineering soil class (USCS)		Laboratory data on representative samples																			
No.	Name	Name	Symbol	Plasticity characteristics			BS compaction (heavy)			Typical particle size distribution % passing BS sieves												Depth	Drainage (internal)
				Liquid limit %	Plasticity index %	Linear shrinkage %	Maximum dry density lb/cu.ft	Optimum moisture content %	CBR% at BS (heavy) compaction 3	1½%	¾"	⅜"	3/16"	7	14	25	36	52	100	200		
1. Lateritic ironstone surface	(a) Ironstone rock																					2.5m	generally well drained but with short-lived local impedance
	(b) Residual surface gravel	GW		38	15	8	135.7	10.9	92	100	68	55	36	26	20	18	17	16	15	13	0.5m		
2. Hillslope	(a) bouldery gravel	GW/GC		46	20	12	138.5	10.6	82	100	68	54	38	29	26	26	26	26	25	24	1m		well drained, but surface scour occasionally results in erosion
				40	20	8	126.7	11.5	82	100	91	83	72	65	63	62	62	62	60	33			
	(b) sandstone (ferruginized)																						
3. Major Valley	(c) sand/silt	SW/SF		NP			108.6 (BS standard)	11.4	29.5				100	99	99	99	98	98	97	35			Well drained permeable surface soils
				23	10	5	121.7 (BS standard)	11.0	11					99	99	98	98	98	96	56			
	(b) lateritic gravels	GW		44	21	12	135.7	8.5	100	100	84	57	24	14	11	9	8	8	7	5			
4. Minor Valley	(d) sand/silt			NP			114.8	9.8	22					100	98	91	83	69	25	9			Well drained

ANNEX 5
Table 6

Engineering resources: Gombe Land System

Land facet No.	Land facet Name	Water supply	Constructing materials: Concrete sand	Constructing materials: Concrete aggregate	Constructing materials: Timber	Road works: Sub-base	Road works: Base	Road works: Chippings
1.	Lateritic ironstone surface	Very feeble. Supply unimportant due to restricted situation				Suitable but uneconomic	suitable after crushing and screening	Suitable after screening, if no better materials are available
						Surface gravels are suitable	Suitable but may require stabilization with lime or cement	Suitable after screening, if no better materials are available
2.	Hillslope			Limited supply of medium-hard flaggy, sandstone rock and boulder gravels suitable for crushing and screening		Suitable, but usually ill-sorted and with clay fines	Not generally suitable unless stabilized	
3.	Major Valley	Perennial supply from relatively shallow surface wells in permeable sand	Limited supply from alluvium		Orchard-bush suitable for kindling but not for construction	Sands are suitable, if better-graded, materials are selected. Laterites are suitable	Not generally suitable. Would require stabilization if used. Low-lying laterites suitable.	
4.	Minor Valley	Perennial supply from smaller wells				Suitable if better-graded materials are selected	Suitable but would require stabilization	

SUITABILITY FOR ROAD LOCATION: GOMBE LAND SYSTEM

No.	Land facet Name	Appraisal	Features
1	Lat..ritic ironstone surface	Unsuitable, owing to isolated facet situation.	Flat to gently undulating topography. Generally well drained with abundant supplies of gravel.
—	Hill slope	Generally unsuitable.	Moderate steep slopes, characteristically armoured with bouldery talus overlying heavier soils. Hill wash, sliding and erosion are possible hazards.
3	Major valley	Suitable	Flat to gently undulating topography. Well drained owing to permeable nature of the sandy soils. Spring lines developed at boundary with clay soils.
4	Minor valley	Suitable	Gently undulating topography. Gullying owing to erosion from hill wash may cause problems.

includes lowlands developed over granite rocks.

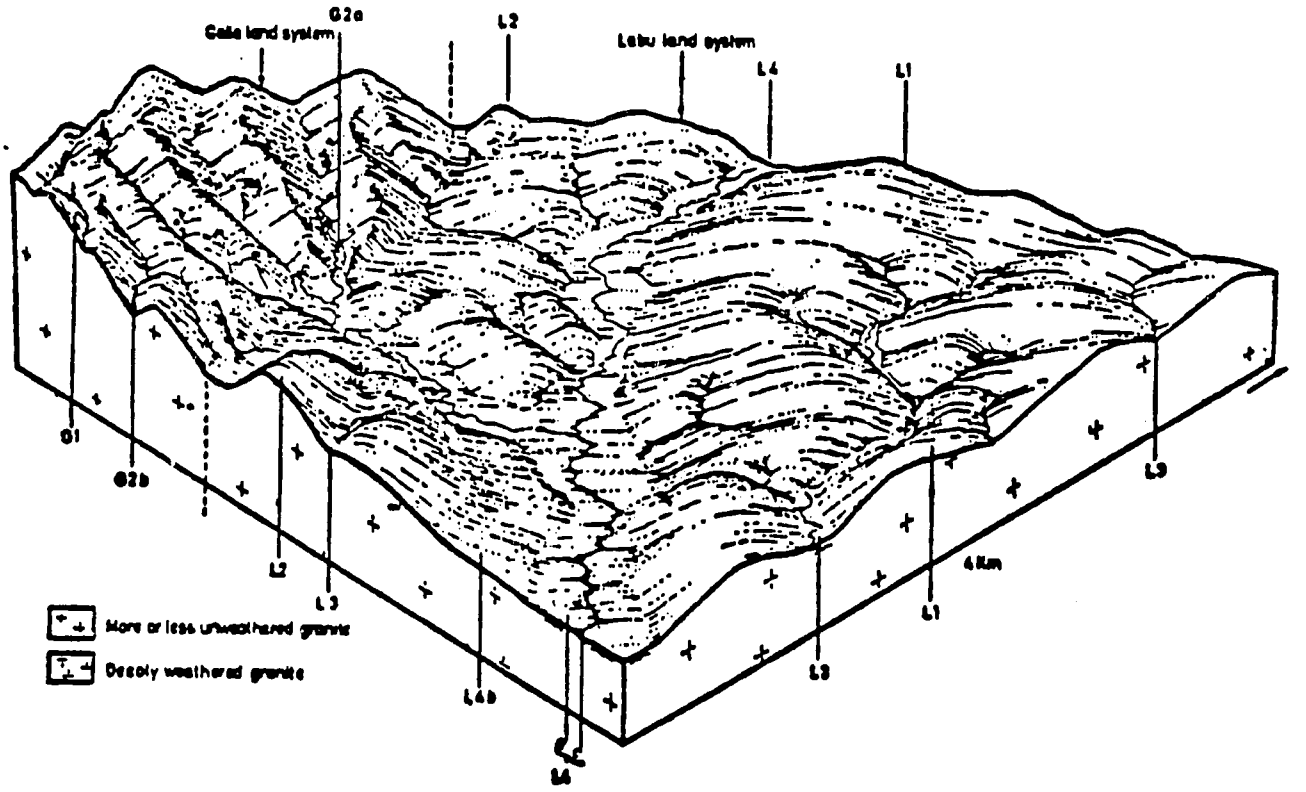
An initial division of the terrain was made from contoured 1:63,360 maps. When air photographs became available, more detailed division was possible, and a more intensive analysis was made.

From the first analysis, sites were selected for soil sampling to cover the main variations of rock type and terrain. Small samples for classification tests and larger samples for more detailed analysis were collected from boreholes, borrow pits and cuttings. A copy was also made of the test results produced over the past ten years by the Malayan Public Works Department.

Examples of Malaysian land classification are shown in the block diagram of the Galla and Labu land systems (Figure 3). A characteristic feature of the Malaysian topography in the abrupt change from mountain to lowland as shown in this diagram. Details of the environmental features of the Labu system are given in Tables 8 and 9.

The main difference between the two systems to the engineer, apart from the obvious topographical differences, is the depth of the bedrock. For road engineering purposes it can be assumed that solid rock will not be encountered in the Labu system. Weathering continues to a great depth, and low hills and gentle slopes lead to moderate depth of cut. In the Galla system, rock is present in stream channels and is often encountered in road cut. Thus this system is likely to provide good quarry sites, often with negligible overburden. However, on the end of spurs, cuttings often show 15 to 20 metres of soil and weathered granite.

ANNEX 5
Figure 3



Block section showing Labu land system, Malaya, at junction with Galla land system.

LABU LAND SYSTEM

Climate:	Monsoonal. N.E. monsoon November-March, S.W. monsoon May-September. Mean annual rainfall about 2200 mm. p.a., mean annual temperature about 27°C.
Geology:	Weathered granite of Jurassic or Cretaceous age. Depth to bedrock may be at least 15 m.
Landscape:	An undulating landscape of low, regular, straight-sided interfluves, with a dendritic network of thin fairly straight stream courses and broad flat-bottomed major valleys.
Soils:	Deep brownish and yellowish silty clays with quartz grains (Rengam and Jerangau Series)
Vegetation:	Mostly rubber plantations, with occasional patches of jungle and scrub.
Altitude:	30–60 m.
Relief:	Up to 30 m, but may be up to 50 m in the vicinity of isolated hills.

FACETS OF LABU LAND SYSTEM

Land facet	Form	Soils, materials and hydrology	Land cover
L1	Interfluves Slopes very gentle to gentle (2-5°), more or less straight; sides about 100 m long meeting in a convex elongated interfluve crest; up to about 100 m high. Margins with Facet L4 may be very gently concave or abrupt.	(i) Rengam Series. Up to 15 cm of dark greyish-brown friable sandy clay loam over brownish-yellow sandy clay which may be 2-15 m deep. (ii) Jerangau Series. Similar to Rengam except that subsoil is strong brown to yellowish red sandy clay loam.	Almost entirely planted with rubber; small patch of jungle remains in the south.
L2	Isolated hills Straight, moderate to steep slopes (up to 30°), usually elongated in plan sides meeting in narrow ridge crest; up to 600 m long and 10-30 m high; occur locally at N. end of land system.	As Facet L1, but depth to bedrock may be less.	Sundry tree cultivation; rubber on less steep slopes.
L3	Minor valley floors Flat, more or less straight, narrow, but width may suddenly varied between 10 and 100 m; valley heads often about 50 m across; abrupt margins with facet L2. Sinuous stream course a few m wide.	Perak Series. Grey, mottled yellow silty clay loam over blue-grey silty clay loam over alluvium; iron concretions may occur. Imperfectly drained; streams flow for short periods after rain.	Mostly rubber, with occasional small patches of grassland.
L4	Major valley floors (a) Floor. Level, fairly straight, 150-500 m across; margins with facet L1 Sinuous in plan. (b) Footslopes. Level to very gently sloping; straight or slightly uneven slopes; 150-600 m wide, 400-1,200 m long, irregular out-line in also Upper margin with Facet L4a may be a short steep bluff up to 2 m high, or gently merging. Occurs locally only in N. part of land system at the foot of the adjoining granite hills (Galla land system). (c) Small stream. Very narrow (few metres wide), and sinuous.	(a) As Facet L3 (Perak Series). (b) As Facet L1 (Rengam Series). (c) Perennial flow.	(a) Flattest areas under paddy fields, better drained parts mostly sundry tree cultivation; small areas of rubber and scrubland. (b) Rubber plantations.

The soils in both of these systems are very similar as all are derived from the weathering of granite rocks. In the Labu system the soils have highly plastic fines, with liquid limits ranging from 55 to over 100. The range is normal for this soil type as a single soil-profile may show great variation. In the upper layers of these soils, plasticity increases with depth, and this leads to the presence of perched water tables after heavy rainfall. In general, these soils are permeable and free draining and tend to have low in-situ densities. At Kuala Lumpur airport, the weathered granite soil had a relative density of 85 percent B.S. heavy compaction, and in construction, two feet of soil was excavated and recompacted to achieve a suitable foundation.

In the Galla system, a typical soil profile consists of a red granite soil overlying decomposed granite over fresh granite. The properties of the soils are very similar to those of the Labu system and, in both systems, the soils are influenced by the texture of the parent rock. The results of plasticity and compaction tests on soils derived from fine and coarse grained granite are shown in Table 10.

PLASTICITY AND DENSITY CHARACTERISTICS OF GRANITIC SOILS

	Liquid limit %	Plastic limit %	Plasticity index	Linear shrinkage %	Max. B.S. Dry density lb./cu. ft.	Optimum moisture content %
LOWLANDS (LABU)						
Coarse granitic soil	85	34	51	16	109.5	16.0
Coarse granitic soil	88	40	48	18	108.5	16.4
Fine granitic soil	64	30	34	16	89.5	28.8
MOUNTAIN (GALLA)						
Coarse granitic soil	69	36	33	15	111.5	16.0
Decomposed coarse granite	39	29	10	5	108.2	17.1
Fine granitic soil*	62	35	27	15	93.0	22.5

* Samples taken outside area shown in Fig. 5.

It can be seen that the soils derived from fine granite have a lower maximum dry density and tend to be of lower plasticity than those derived from the coarse granite. The decomposed granite is of much lower plasticity, reflecting the lower degree of weathering.

These soils have a high rating as subgrade material, combining good strength with a free draining soil profile. Laboratory tests show that the addition of cement or lime can produce base-quality material, and soil stabilization has been used in airfield construction at Kuala Lumpur and Singapore.

Discussion

One of the most important aims of these investigations was to prove that, with the assistance of aerial photography, it was possible to extrapolate the information gained from one land facet to another area where the same land facet occurred. Thus, it enabled survey effort to be reduced in those areas where the soils were known to present few problems and little variation, so permitting greater survey activity in the more difficult situations.

In current survey practice, the frequency of sampling seems to bear little relationship to the complexity of terrain; terrain evaluation can therefore do much to improve existing methods of survey.

By examining a wide range of soil types, it became apparent that much of the effort put into soil surveys is wasted. Under some roads, the variation in subgrade conditions is so small that the design can remain unchanged in essentials for many miles. Often the sources of borrow materials are restricted. Any information, therefore, which can identify the available engineering material resources in advance of surveying on the ground can produce substantial savings in time and costs.

Landscape classification is being carried out by a number of organizations throughout the world.

ROAD NEEDS OF IRRIGATION PROJECTS

Assuming that about 2 million hectares of land will be developed in future irrigation projects, we roughly estimate that road requirements will be of this order:

	length, km	cost per km $	total cost $ millions
service roads within projects (low class dirt surfaced feeder road)	19,500	6,000	117
access roads to dam, dike and spillways (gravel surfaced access road)	500	15,000	7.5
main connecting roads (all weather secondary)	4,000	25,000	100
total	24,000		$224.5

These figures are derived from the study of polder projects in Mali, and Morocco. Additionally, figures for a large Peruvian project were consulted. In general, we observed for internal project roads a ratio of about .01 km per hectare of irrigated area. The roughest part of the estimate is for the cost of main connecting roads, since this figure cannot be derived using the ratio rule.

In all, a total cost of $200 million to $225 million is estimated for the road needs of the projected 2 million hectares of irrigated land in the Sahel.

Example A. (Mali)

two polders serving

4,000 hectares of rice

entire project area 11,000 hectares

All weather road network on top of dikes in polder area - 70km. 3.5 m. wide 32 km. to be imp oved to all-weather or the existing Lai-Banga road making all weather access to the project area. Access provided to all villages within the poldered area.

Total road construction 102km.

The accompanying map indicated the polders will be completely surrounded by a road system .0175 km/hectare for dike area, however no dikes go across the polder area for this small an area so large areas may increase the km/ hectare.

Access to the area from the villages would need to be provided in Mali and possible upgrading of the existing road between Mopti and Kona.

Example B. (Viet Nam)

Tieng Irrigation Project 1978; (#1987 a VN) 42,000 ha

20 km of new roads for access to dam, dike and spillway and quarry areas

6.5 m width; no shoulders

30 cm crushed stone for heavy traffic along dam, dike and spillway.

+ 200 km of all-weather inspection and access roads in the irrigation service area. 50 km along the diversion and west main canal and 150 km along the large secondary canals.

6.5 m

20 cm gravel or crushed rock for road along the main canal

4.5 m

20 cm laterite or crushed rock for road along large secondary canals.

-.005 km of road/ha for the 200 km of road and 20 km of access to the dam, spillway and dike.

Example C (Morocco)

Doukkala II Irrigation Project
Kingdom of Morocco Project 14312-MOR 1977

20,000 Tons/yr	6m asphalt
6,000 - 20,000	4m gravel
6,000 tons/yr.	4m dirt

Dirt farm roads at 76km/ha - .016km/ha

Ref. L-7 World Bank Debi-Lampsar Irrigation Project

Debi perimeter 1,100 ha.

Lampsar perimeter 2,220 ha.

Roads built inside the perimeter to provide access to each plot.

Main roads	13.6km	7m with 5m of laterite
Tracks	43km	4m-3m of compacted soil and 1m of berms.

.013 km/ha. of perimeter orads

The southern side of Lampsar has a paved highway along its perimeter and secondary all-weather roads mostly on dike crests already serve all populated points within the Delta.

TABLE

ROAD NEEDS OF PROJECTED IRRIGATED AREAS

Examples 1/	Irrigated Land Hectares	Main Roads	Access Roads to Dam, dike and spillway in km	Service Roads With-in the Project to Polder areas, to Main and Secondary canals in km	Access Roads in km/100ha	Main Road in km/100ha
B.	42,000	Existing 90km - sufficient	20	200	0.52	.2
A.	4,000	30km Existing + 32 km new		70	1.75	1.5
C.	3,320			57	1.3	
Estd. Future Consequent Sahel Road Regions	2,000,000	4,000	*500	*19,500	* 1.0	* .2
		$100 million at $25,000/km	$7.5 million at $15,000	$117 million at $6,000	Access roads vary from dirt compacted roads to 30 cm of stone and from 3 m to 7 m wide	*Estimated

1/ Examples from selected countries and projected needs of the Sahel.

ANNEX 6

Table 1

SAHEL ROAD MAINTENANCE/CONSTRUCTION

SOME SALIENT FACTORS ... 1978

TABLE 1

SAHEL ROAD MAINTENANCE/CONSTRUCTION:
SOME SALIENT FACTORS -- 1978

Country	Heaviest Rainfall Months (In general): June or July to Sept. or Oct.	Usual Road Construction Period	Availability of Unskilled Labor	Use of Intensive Labor Technology	Government Capabilities	Private Contractors	WAGE RATES Minimum Non-Agr	Agr	Shadow	Problems
Cape Verde	July-October		Unskilled labor available Use labor intensive maint. and emergency rehab.	Labor intensive maint.	Lack spare parts for equip.	No contractors in country				
Chad	June-October						'68 21.00 CFA	'68 18.50 CFA	Unskilled labor 30% Min. Wage Skilled labor 15% Min. Wage	Limited budget Idea equip. Low moral Low training
Gambia	(See Senegal)									
Mali	Rainy season 4-5 months June-Sept.				Lack spare parts for equip.	Usually new const. Maybe expand to maint. role				Inadeq. maint. budgets Under citicized equip. " " staff Inappropriate maint. policies
Mauritania	June-Sept.		Very high illiteracy rate among maint. personnel. Trained personnel leave.		-equip. utilization is very low -does not measure truck weights -org. & mgmt. weak -poor equip.		'69 37.00 CFA	'69 35.00 CFA		

TABLE 1 (Cont'd.)

SAHEL ROAD MAINTENANCE/CONSTRUCTION
SOME SALIENT FACTORS -- 1978

Country	Heaviest Rainfall Months (In general): June or July to Sept. or Oct.	Usual Road Construction Period	Availability of Unskilled Labor	Use of Intensive Labor Technology	Government Capabilities	Private Contractors	WAGE RATES Minimum Non-Agr	Agr	Shadow	Problems
Niger	June-Sept.	2 years for Fada N'Gourma Niamey primary			-Centralized supply too concentrated -insufficent 2nd workshops					Lack of and poor cond. of equi Lack of data on traf. & Rd. co Lack funds Lack skill training
Senegal	3-5 month wet season (months not given)				-not enough maint. Personnel + they need training	priv. contractors do 43% of maint.	50.60 CFA	43.85 CFA		Lack mechanics Lack spare parts
Upper Volta	July-October	2 years for Fada N'Gourma Niamey primary (priv. contractor)			Financial limits Lack qualified personnel Tools & equip. shortage	23.00 CFA	27.00 CFA			

TRAINING

1. A Current Case History

The difficulty of maintaining a road network is not limited to the poorer African countries; these problems are common to others as well. For example, one of the more prosperous and technically advanced countries in Africa, Nigeria, is faced with considerable road maintenance problems.

Consideration of the maintenance program in Nigeria confirms the need for qualified practical assistance for developing an ongoing effective program. Over the past four years, this country, with the assistance of a European management consulting firm, has conducted pilot maintenance programs in two of its States. The plan was to develop effective programs in the two States which would then serve as prototypes for the rest of the country. However, after the considerable expenditure of funds on capital facilities and classroom training, very little has been accomplished in terms of an effective highway maintenance program. The World Bank plans to allocate part of the proceeds from a highway loan it is presently negotiating to correct this problem. The Bank has proposed that DOT recruit personnel and administer a program to provide practical maintenance assistance.

In a recent visit to Nigeria, our DOT representative concluded that while physical facilities for training and field operations were impressive, the quality of practical technical assistance was lacking. What is needed are fewer advisors in theory and more at the operating level, able to provide in-service training to their counterparts until local counterparts are capable of assuming full responsibility.

Too often, over-sophisticated approaches have been introduced in developing countries where sound basic practical approaches would be preferable. This applies to road maintenance and construction as well as to other phases of technology, administration and development.

2. The Regional Center for Training in Highway Maintenance (CERFER), Lome, Togo

Training courses for highway foremen, mechanics, equipment operators and road laboratory assistants are given by the Regional Center for Training in Highway Maintenance (CERFER) in Lomé (Togo). The Center was created with the technical and financial assistance of USAID, FAC and EDF 1/ and operated by Togo on behalf of the five countries belonging to the Conseil de l'Entente: Benin, Ivory Coast, Niger, Togo and Upper Volta. The Center's facilities and services are also open to other African countries and, since 1964, hundreds of West Africans have attended the nine-month training sessions of CERFER, most of them as Government employees.

In conversations with USAID and World Bank staff members we determined the following regarding CERFER's past record and current situation:

1) The Center receives no USAID or international donor assistance now; it is currently on its own;
2) Its record of performance was very good up to the early 1970s; then USAID assistance ended;
3) Because of financial constraints, the Center has reduced its English programs, though francophone instruction has remained unchanged;

1/ FAC (Fonds d'Aid et de Cooperation, France)
EDF (European Development Fond)

4) Technicians presently graduating from CERFER are not well recognized even by their own Governments due to the Center's current poor reputation;

5) Poor training of local administrators and instructors seems to be the main reason for the Center's present deteriorated situation;

6) With new equipment and technical assistance the Center could regain its previous good record of performance.

Conclusions:

1. It appears that technical assistance was prematurely withdrawn; that indigenous personnel had not been trained to competently replace their instructor/counterparts; the outcome supports that conclusion.

2. If CERFER were upgraded with financial and technical assistance from USAID and/or other donors, the Sahel countries might utilize its facilities to meet their training requirements for public works personnel up through the rank of foreman, or at least benefit by drawing on their organizations, curricula, shop tools lists, inventory techniques, repair manuals already in French, etc. - rather then "re-invent the wheel". Also, Frederick R. Harris consultants are preparing instructional materials for AID in Francophone Haiti. See them for cross-feed.

We note that a 1968 IDA loan to Chad for the Highway Maintenance and Engineering Project, #TO-645a, called for the training of Chadian equipment operators and mechanics at the Lomé training center, so this facility may have been used by a number of Sahel countries for training their personnel in the past.

ANNEX 9 GEOGRAPHY OF THE SAHEL

A. Location and Size

The Sahel countries lie between Lat. 8N. and Lat. 28N, a central band of Africa approximately 1,725 km wide stretching from the Atlantic Ocean to the western frontier of the Sudan, a distance of 4242 km. The Cape Verde Islands, with a total land area of 4033 sq. km, lie in this band, approximately 402 km off the coast.

To comprehend the spatial characteristics of the Sahel and the consequent magnitude of its transportation problems, one should be mindful that the total Sahelian area amounts to nearly 3/4 the area of the continental United States. Table A-1 indicates the respective sizes of the Sahelian states.

Table A-1

AREAS OF
THE SAHEL AND THE UNITED STATES

COUNTRY	AREA (Sq. Km.)
Sahel Countries	
Cape Verde	4,033
Chad	1,284,000
The Gambia	11,295
Mali	1,240,000
Mauritania	1,030,000
Niger	1,267,000
Senegal	196,192
Upper Volta	274,200
TOTAL Sahel	5,306,720
Continental U.S.	7,687,200

B. Climatic Zones and Their Principal Characteristics

The climate is characterized by a rainy season (summer) from July to October and a dry season (winter) from November to June. In summer, rain-bearing southwesterly winds blow from the South Atlantic, and in winter these are replaced by dry northerly or north-easterly winds blowing from the Sahara. There is a very close correlation between latitude and total rainfall, latitude and the length of the rainy season, and latitude and the variability of rainfall. The pattern becomes less favorable as one goes northward from the coast. Four principal climatic zones are represented in the area. They are, from north to south:

a) the Sahara Zone, with less than 10 inches of rainfall;

b) the Sahel Zone, 10 - 20 inches;

c) the Sudan Zone, 20 - 40 inches; and

d) the Guinea Zone, with over 40 inches.

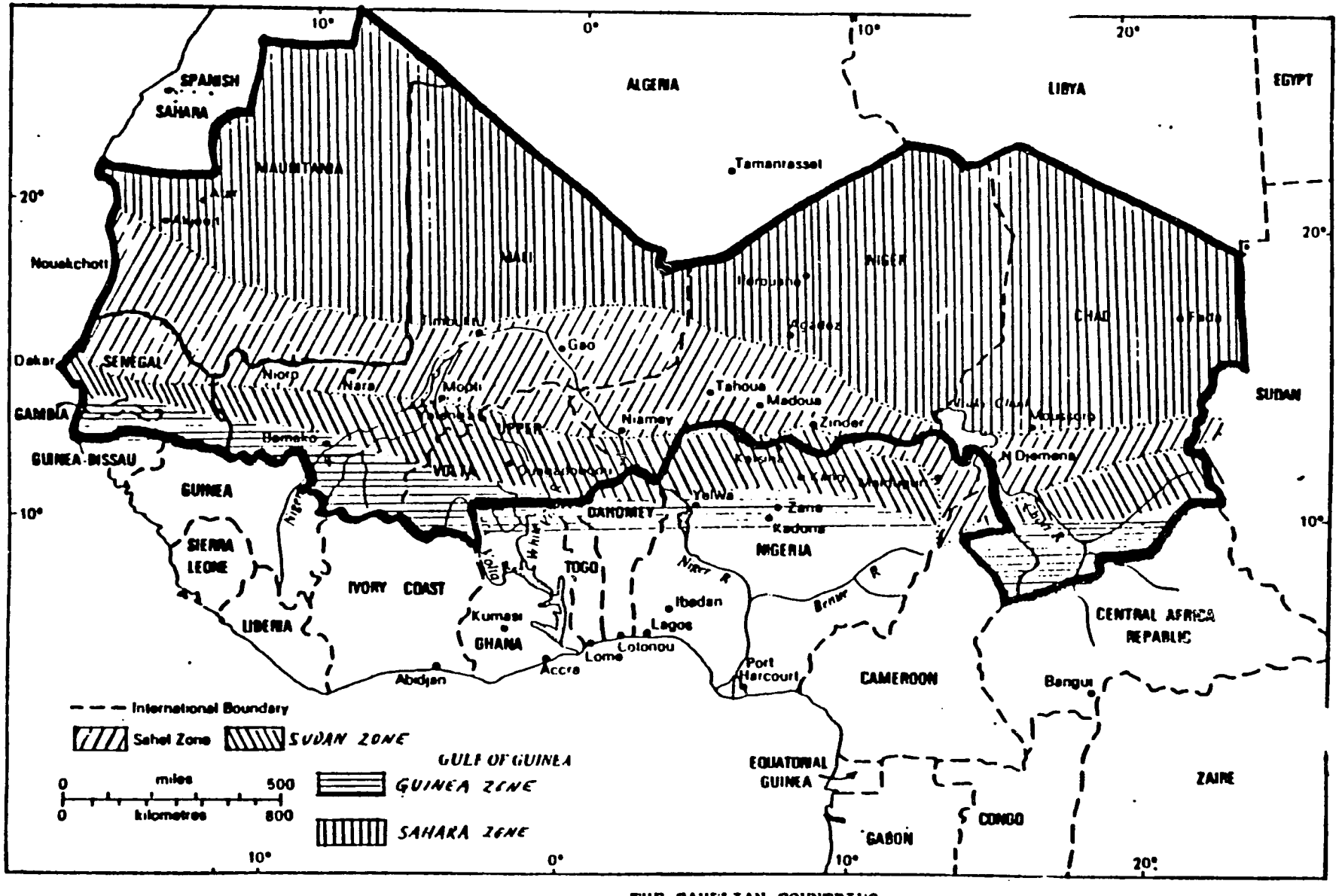
Table B-1 and Figure B-1 show the zonal composition of the respective countries, while Table B-2 indicates the principal characteristics of the respective climatic zones.

Table B-1

ZONAL COMPOSITION OF SAHEL COUNTRIES

COUNTRY	TOTAL LAND AREA (Km^2)	CLIMATIC ZONE			
		SAHARA (%)	SAHEL (%)	SUDAN (%)	GUINEA (%)
Cape Verde	4,033	0	100	0	0
Chad	1,284,000	51	10	35	4
The Gambia	11,295	0	0	20	80
Mali	1,240,000	44	27	20	9
Mauritania	1,030,000	71	15	4	0
Niger	1,267,000	60	30	10	0
Senegal	196,192	0	21	61	18
Upper Volta	274,200	0	8	77	15
TOTALS	5,306,720	51	21	23	5

Figure B-1



THE SAHELIAN COUNTRIES
CLIMATIC ZONES

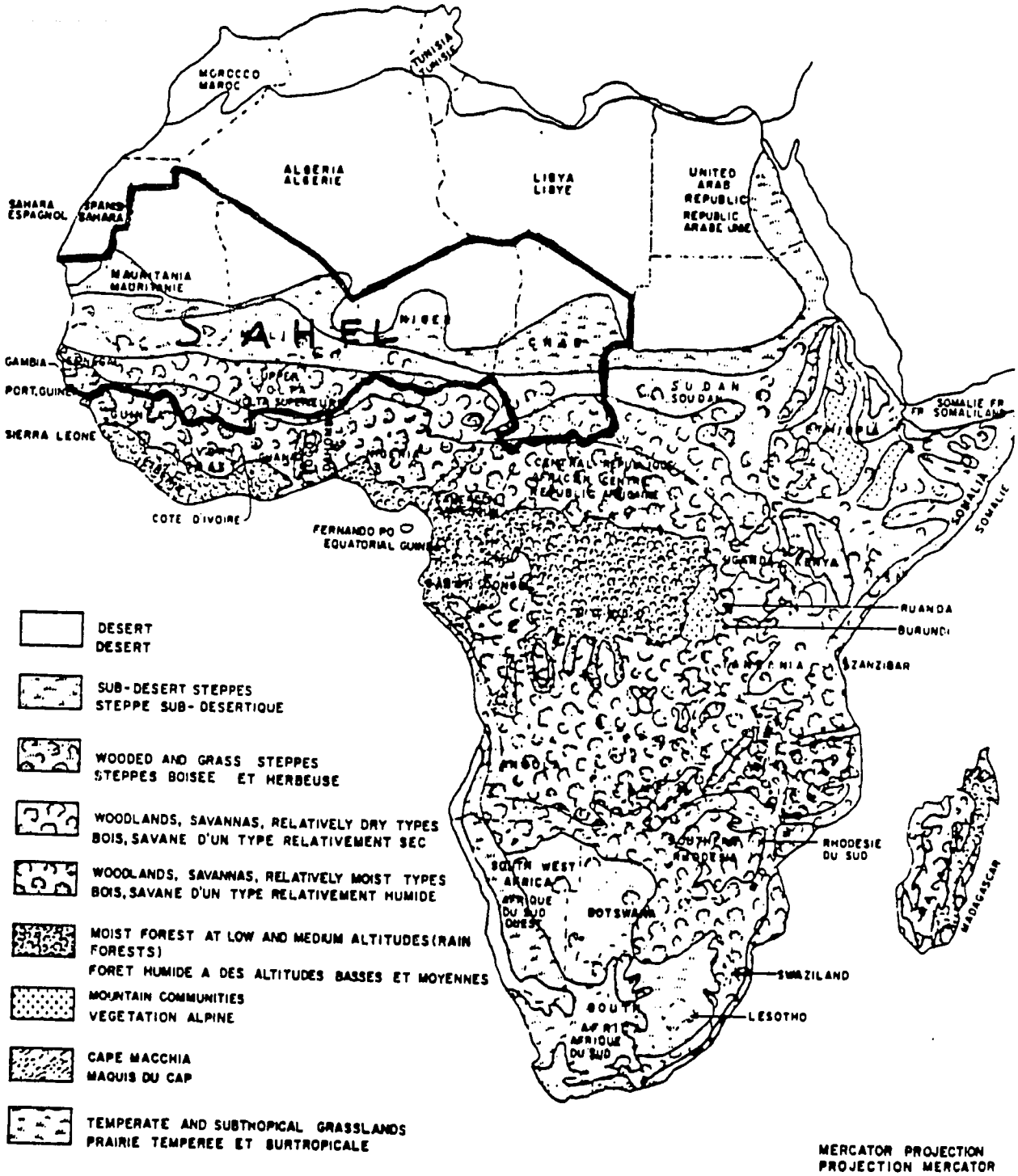
Table B-2

PRINCIPAL CHARACTERISTICS OF SAHELIAN CLIMATIC ZONES

CLIMATIC ZONE	Annual Precipitation (inches)	Rainfall Months	Average Daily Temperature (°F)		Natural Vegetation	Major Environmental Handicaps to Economic Development	Agricultural Significance and Potential	Other Comments
			Minimum	Maximum				
SAHARA	Less Than 10	July through August	40	110	Desert. Scattered oases with palms and drought - resistant shrubs and grasses.	Receives only traces of rain during rainy season. Very inhospitable environment Extreme temperature variations.	Main outputs: livestock and oases products. Little agricultual significance and very poor potential.	Inhabited primarily by nomads.
SAHEL	10 - 20	June through September	50	100	Drought-resistant grasses, shrubs, scattered acacia trees, and small areas of woods.	Droughts, extreme temperature variations.	Main outputs: livestock, subsistence agriculture, low-yield cereals. Pastoral operations are most important economic activity.	Represents a base for nomadic pasteralists during rainy season.
SUDAN	20 - 40	June through October	75	86	Open grassland and scattered trees.	Cycles of drought.	Can suppot relatively intensive systems of agriculture. Good pasture land. Millet, sorghum, cowpeas, cotton, groundnut. Substantial possibilities for further diversification into other crops such as maize and soybeans.	Supports the bulk of the population.
GUINEA	40 - 60	April through October	75	95	Tropical-Sub-Tropical Grasses and Woodlands.	Diseases: river-blindness, trypanosomiases, malaria, etc., especially in Upper Volta and Mali. Tropical Forest cover.	Major part of area is farmland. Cotton, rice, peanuts, sorghum, millet, etc. Substantial possibilities for further diversification into other crops.	Humidity about 80% during rainy season. WHO launched major river-blindness eradication program in Upper Volta.

Figure B-2, a vegetation map, provides a graphic view of the types of Sahel vegetation. For road construction purposes there is no wood available except in the Sudan and Guinea zones.

Figure B-1



VEGETATION MAP OF AFRICA (after AETFAT, 1959)
CARTE DE LA VEGETATION EN AFRIQUE (d'apres AETFAT, 1959)

C. Topography and Soils

1. General

With the exception of the Cape Verde Islands, the topography of the Sahel countries is generally flat and soil variation is considerable in the south but slight in the north.

2. Cape Verde

Except for the low-lying islands of Sal, Boavista and Maio, the Cape Verde Islands are mountainous, craggy and deeply furrowed by erosion and volcanic activity. The highest point is 2,614 meters high.

3. Chad

In Chad, the primary landscape consists of sub-arid plains and plateaus. A broad western and central bowl rises to uplands and minor mountains in the south and east, while the Tibeste Mountain Range of extinct volcanos in the north - a major landmark of the Sahara Desert - reaches elevations above 2,700 meters. The only large permanent lake, Lake Chad, receives a heavy flow from the wet southern border area via the Chari-Lagone river system. The associated flood plains and swamps of this river system are economically important. Soils in the southern half of the country vary considerably, but broad areas of the old Chadian Basin are primarily alluvial layers deposited by ancient lakes and rivers associated with them. The alluvial soils and sand left behind when the former lakes and swamps disappeared are potentially good farmland, providing cotton, peanuts, and several cereals. In the central basin the older soils were originally deposited by water, but they have been shifted about by the desert wind and mixed with sands blown in from the northeastern plateaus. Although the

mixed soil is potentially productive, little water is available. At the edge of Lake Chad sandy but productive soils are found among the old sand dunes, which are held in place by vegetation and are no longer subject to erosion and movement by the desert winds. These ancient dunes extend for miles into the lake. Other areas along the lake shore are shallow lagoons during the wet season, with dense, waterlogged clay soils. Eastward, away from the lake there are some swampy areas of clays and dark alluvial soils, but most of the central area of Chad is sandy and relatively unproductive. On the plateaus of eastern and southeastern Chad much of the soil is thin. The north is mostly desert, containing little or no useful soil.

4. The Gambia

The Gambia is essentially the flat valley of the navigable Gambia River, one of Africa's best waterways. Mangrove extends 160km. upstream, the limit of the tide in the rainy season, although in the dry season the tide penetrates upstream another 60km. Some mangrove on the landward sides has been removed for swamp rice cultivation. Behind it are seasonally flooded marshes with fresh water grasses, and then on the upper slopes of tertiary sandstone there is woodland with fallow bush and areas cultivated mainly with groundnut and millet, the important cash and food crops. Ocean vessels up to 19 feet in draft can always reach Kuntaur, 242 km. upstream, and those of lesser draft, Georgetown, 283 km. upstream River vessels regularly call at Fatoto, 464 km. upstream, the last of 33 wharf towns served by schooners or river boats. The Gambia River is underutilized as a navigable waterway, however, because it is largely cut off from its natural hinterland by the nearby boundary with Senegal.

5. Mali

Nearly one-half of Mali is occupied by desert. The ancient Basement Complex rocks of Africa have been uplifted to form the Adrar des Iforas mountains of the north-east, whose dry valleys are evidence of formerly wetter conditions. Otherwise the Precambrian rocks are often covered by primary sandstones with bold erosion escarpments. Where the Niger River crosses a sandstone outcrop below Bamako, rapids obstruct river navigation, giving an upper navigable reach above Bamako, and another one below it from Koulikoro to Ansongo, near the border with the Niger Republic. Loose sands cover most of the rest of the country, and are very extensive on the long border with Mauritania and Algeria. The Niger River, a vital waterway and source of fish, flows across the heart of the country. As the seasonal flows retreat, they leave pasture for livestock and damp areas for cultivation. The Inland Niger Delta, located in the central part of the country, is the remnant of an inland lake in which the upper Niger once terminated. The eastern part of the delta is criss-crossed by "live" flood-water branches of the river, while the channels of the slightly higher western part of the delta are never occupied naturally by flood water and so are "dead". However, the latter channels are now used in part for irrigation water retained by the Sansanding Dam, which has raised the Niger by an average of 4.3 meters.

6. Mauritania

Geologically, Mauritania is part of the vast western Saharan shield of crystalline rocks, but these are overlain in parts with sedimentary rocks. 40% of the country has a superficial cover of unconsolidated sand, which varies in color and composition. Fixed dunes are composed of coarse, fawn-colored sand, while mobile dunes are composed of fine, dustlike, reddish-colored sands that can be carried by the winds. Heavier blue, gray, and black sands form a crusty surface over soft, loose sand in the plateaus. Relief has a general northeast/southwest trend, and a series of westward-facing scarps separate monotonous plateaux, which only in western Adrar rise above 500 meters. Some of these plateaux have been eroded, so that only isolated peaks remain. These are often minerally enriched, the most famous being the "iron mountains" of the Kedia d' Idjil, where 8 - 10 million tons of high-grade iron ore are now mined annually. Copper is mined at Guelb-el-Moghrein, near Akjoujt. Battering surf and shifting sand banks mark the entire length of the shoreline that sweeps in a great smooth arc from Cape Blanc to the mouth of the Senegal River. The Cape Blanc peninsula is 48 km. long and 13 km. wide; it forms one of the largest natural harbors on the West Coast of Africa, Levrier Bay, which measures 43.5 km. long by 32 km. wide at its broadest point.

Most of Mauritania has typical desert soil with little or no vegetation. Sands begin to give way to clay as one approaches the Senegal River valley in the southeast. The valley, a narrow belt on the north bank of the river, is rich in alluvial and clayey soil and is Mauritania's most fertile region.

7. Niger

Two thirds of Niger is desert, with most of the northeastern part of the country being uninhabitable. The country is a plateau, with altitudes ranging from 200 to 500 meters, except for the partly volcanic Air Massif and the Plateau du Djado in the north. Niger's water resources are scarce and poorly developed. The Niger River traverses the extreme western part of the country for only 500 km. The Komadougou Yobe, which flows into Lake Chad in the east is the only other river within Niger's boundaries. A number of depressions also provide water for limited periods after the rainy season. In the north-central part of the country many dry water-courses remain from earlier wetter conditions.

8. Senegal

Most of Senegal's land area is a flat plain, a western segment of the broad savanna that extends across the continent at the southern edge of the Sahara. The country is mostly an ancient sedentary basin. Most ridges or other highly visible physiographic features have long since been smoothed by erosion into a gently undulating plain and ancient valleys or depressions have been filled with alluvium and windblown sand. Volcanic action created the Cap Vert peninsula and the nearby islets. Metamorphic and igneous rock formations appear only in the southeastern part of the country. Except for several hills near Thies, a few miles inland from the Cap Vert peninsula, the southeast is the only area with elevations of more than 90 meters above sea level; even there, only a few ridges exceed 350 meters. Because gradients are so shallow, all the largest rivers - the Senegal, Sine, Saloum, and Casamance - are sluggish, marsh-lined streams emptying into ill-defined estuaries along the Atlantic Ocean. The various types of soils in the country are distributed in zones extending approximately east and west, correlating loosely with the level of rainfall and the density of the vegetation from which the necessary components of soil are derived. Most soils are acidic, especially in the south. The red-brown soils extending across the northernmost area of the country have a fairly good organic content but are likely to become very hard during the dry season. The soil of the Senegal River valley in the northern border area is benefited by annual deposits of alluvium borne by the annual flood. The Savanna types of soil lying in a broad belt across central and southern Senegal vary considerably, but all of them are

thin soils, low in organic content. North of the Gambia the soil is sandy and permeable, except for accumulations of clay in swamps and flood-plains. The coastal belt dunes and swampy areas north of The Gambia extend inland as much as 25km. Some dunes are as much as 30 meters high and are interspersed with depressions of clay soil. No streams reach the sea in the coastal belt, but during the short rainy season temporary watercourses empty into these depressions to form a series of freshwater swamps or lakes. During the dry season these damp, fertile bottomlands are green oases of luxuriant growth, surrounded by subdesert conditions. Along the tidal reaches of all the estuaries salt water invades the land during the dry season and, unless controlled by dikes, creates sterile salt flats unsuitable for cultivation. In the southern part of the country, the soil is strongly acid and heavily leached, contains much free iron, and tends to laterize. Impermeable and very weak laterites are common in southeastern Senegal, where heavy rains penetrate subsurface soil layers leaching out all kinds of nutrients and organic compounds and carrying them to levels below the reach of root systems. As a result, the soil lacks plant nutrients and contains a high proportion of iron, aluminum oxides, and hydroxides. Such lateritic soil becomes acidic, tends to harden, and is difficult to work. At its worst it can form a barren, hard crust several feet deep.

9. Upper Volta

In Upper Volta the land is generally flat. Towards the southwestern border with Mali there are primary sandstones, terminating eastward in the Banfora escarpment. As in Mali, where there are also great expanses of these rocks, their residual soils are poor and water percolates deeply within them.

Although most of the rest of Upper Volta is underlain by granite, gneisses and schists, there is much loose sand or bare laterite; consequently, there are extensive infertile areas. The poor soil has been subjected to erosion by heavy downpours in the rainy season (from July to October), aggravated, in populated areas, by destruction of the natural vegetation. The most fertile areas of Upper Volta are in the southwest and along the rivers; semi-desert conditions prevail in the northeast. A shortage of water limits agriculture over much of the country, and rivers and wells often run dry several months before the annual rains begin. The southwest is drained by branches of the Komeo River; the central part by three branches of the Volta (Volta Noire, Volta Rouge, and Volta Blanche); and the northeast by branches of the Niger. These rivers reach the sea to the south, but none navigable to the sea. By the rivers, the simulium fly, whose bite leads to blindness, is common. In the Gourma swampy area to the east the tsetse fly transmits sleeping sickness.

D. Population Distribution

In 1975 the eight Sahel countries contained over 27 million people. Of these, 3.24 million (or 12.5%) were nomads and a similar number lived in towns; the remaining 23.80 million were sedentary agriculturist. At current growth rates, the population will approach 51.5 million inhabitants by the year 2000. (See Tables D-1, D-2, D-3).

The nomadic sector of the population constantly moves with the climate. Such migration is particularly prevalent among young men in the 15 to 34 age group; in the farming areas of the southern savannah, the proportion of males 15 to 34 years of age migrating during the dry season is in the range of 20 -50%. Not all migration is to destinations outside the savannah; some is within the savannah to towns --even small towns--as demonstrated by the increase of population of Mopti in Mali by about 20% every dry season.

Some long-term movements are less obvious; as modern roads penetrate the Sahel, there are shifts of people and whole villages to their vicinity. Those who make such a move tend increasingly to become part of the modern economy, while those who remain in relatively inaccessible villages live in much the same way as their parents did. There is also a net migrational movement from the north to the south in the savannah countries. The existence of large-scale migration accompanied by flows of wealth in the opposite direction, and the recognition by the community of migration as a possible alternative way of life provides a counter to the effects of drought.

Table D-1

SAHEL POPULATION PROFILE

(1975)

COUNTRY	1975 POPULATION (000's)	ANNUAL GROWTH RATE (%)	SEDENTARY* (%)	SEMI-SEDENTARY* (%)	NOMADIC* (%)
Cape Verde	294	1.9	100	0	0
Chad	4,035	2.1	60	21	19
The Gambia	519	2.2	90	10	0
Mali	5,677	2.3	70	20	10
Mauritania	1,322	2.7	20	10	70
Niger	4,562	2.6	60	20	20
Senegal	5,000	2.7	88	10	2
Upper Volta	5,900	1.8	75	22	3
TOTALS	27,309	2.3	69.5	17.8	12.5

* Rough Estimates

Table D-2

CURRENT AND PROJECTED
POPULATION IN THE SAHEL

Country	1975 Mid-Year Population (000's)	Rate of Growth	UN-Median Projection for 2000	Crude Birth Rate	Crude Death Rate	Life Expectanc at Birth
Chad	4035	2.1	6900	44	-24	39
Niger	4562	2.6	3600	52	26	39
Upper Volta	5300	1.8	11000	48	26	38
Mali	3677	2.3	11000	30	26	36
Senegal	5000	2.7	3300	48	21	40
Mauritania	1322	2.7	2400	45	25	39
Gambia	519	2.2	900	43	21	40
Cape Verde	294	1.9	400	29	9	50
Total	27,309	2.3	51,500	--	-	-

Table D-3
SAHEL COUNTRIES
MAJOR URBAN/MARKET CENTERS

Country Cities and Towns	Estimated Current Population (000's)	Geographic Location	Annual Growth Rate%
Cape Verde	294		1.9
Praia	40	Sao Tiago Is.	
Mindelo	28.7	Sao Vincente Is.	
Chad	4035	District	2.1
N'Djamena	179	Chari Baguirmi	
Sarh	43.7	Moyen Chari	
Moundou	39.6	Logone West	
Abeche	28.1	Ouaddai	
Kelo	16.8	Logone West	
Bongor	14.3	Mayo Kebbi	
Doba	13.3	Logone East	
Pala	13.2	Mayo Kebbi	
The Gambia	519	District	2.2
Banjul	39.1		5.0
Georgetown		MacCarthy Is.	
Farafinni		Lower River	
Basse Santa Su		Upper River	
Kour		MacCarthy Is.	
Yundum		Western	
Mali	5677	Geographic Area	2.3
Bamako	400	SW (Central) Region	
Segou	31	SW (Central)	
Kayes	29	W Region	
Mopti	-	S (Central) Region	
Sikasso	-	SW Region	
San	-	S Region	
Tombouctou	-	Central Region	
Mauritania	1322	District	2.7
Nouakchott	102	Tearza	
F'Derick	25	Tiris-Zemmour	
Nouadhibou	23	Baie Du Levrier	
Zouerate	20.8	Tiris-Zemmour	
Kaedi	20	Gorgol	
Atar	19	Adcar	
Rosso	18.5	Trarza	
Niger	4562	Region	2.6
Niamey	150	SW Region	
Maradi	42	S Region	
Zinder	40	SE Region	
Tahoua	30	NW (Central) Region	

Table D-3 (cont'd)

Country Cities & Towns	Estimated Current Population (000's)	Geographic Location	Annual Growth Rate %
Senegal	5000	District	2.7
Dakar	436	Cap Vert	
Kaolack	96	Sime-Saloum	
Thies	91	Thies	
Saint-Louis	81	Fleuve	
Ziguinchor	46	Casamance	
Upper Volta	5900	District	1.8
Ouagadougou	168.6	Centre	
Bobo-Dioulasso	121.5	Hauts-Bassins	
Koudougou	35.8	Volta Noire	
Ouahigouya	25.1	Volta Noire	
Kaya	18.4	Centre	
Banfora	12.2	Hautes-Bassins	

Movement to the south toward the Guinea coast is an annual event among many sedentary farmers and possible fallback in times of emergency for the Sahelian nomads. Migration from the north to the south occurs in every Sahel country, in a general pattern: nomads and semi-sedentary farmers move south for about four months during the dry season; the time of migration from the north to the south takes approximately one month each way. The remainder of the year these people live in their settlements to the north. Such migratory movements do not occur beyond a certain latitude (e.g., in Upper Volta they do not happen beyond the Yako area).

Cattle raising has been the main economic activity of nomads in the south. These migratory movements have a positive effect on the area's economic activity by enlarging the existing market of foodstuffs and basic goods. Overall, though, such southward movements imply increased demand for basic ingredients of livestock-raising which are scarce in this area. Consequently, the government does not favor such migratory movements. International migration was also on a large scale: from Mauritania to Mali and Senegal; from Mali to Senegal, Ivory Coast, Upper Volta, Dahomey, Togo, Nigeria and Ghana, in spite of its restrictive immigration policy; form Upper Volta to the Ivory Coast, Ghana (where Mossi, who are found on both sides of the border, can easibly enter), Dahomey and Togo; from Niger to Nigeria and Sudan. From northern Mali and Niger pre-existing small-scale movements into Algeria grew in volume (as they presumably also did from northern Chad into Libya), encouraged by the good seasons that North Africa has been enjoying as well as by employment in the oil and other industries. Some of this northerly movement went further north to the Common Market, thus supplementing a small direct migration from francophone West Africa which had been increasing in

magnitude during the 1960s.

Nomadic movements also appear to be focusing on the towns more than in the past, partly because many are no longer moving with animals and partly because the drought-stricken countryside has few jobs to offer. This may, however, be an indication of future trends, for nomads, like food gatherers and hunters in other parts of the world, are often happier, if forced to take the leap from their kind of life to urban employment rather than to farming which is a far more specialized way of life with a mystique all of its own. In some places the refugee camps tended to operate as sectors of the town and as bases for both urban relief and urban employment (the camp at Nouakchott, the capital of Mauritania, was developing this way by mid-1973). In the Sahelian countries, the towns increased considerably in population, most of the refugees apparently being able to claim accommodation with relatives (thus demonstrating the importance even to nomads of having family members as permanent migrants to the towns forming beachheads there). Among the larger towns most affected were Nouakchott, Bamako, Mopti, Gao, Ouagadougou, Niamey, Zinder and N'Djemena, but the impact was also considerable on such smaller Sahelian towns as Akjoujt and Atar in Mauritania, Agadez and Iferouane in Niger and Moussoro and Fada in Chad.

An unprecedented number of nomad family groups moved southward from the normal area of seasonal cyclic movement into the towns of the savannah or even the better watered areas nearer to the coast. A large number of nomads still with animals either failed to move north at all during the 1973 wet season or moved only far enough to reduce the impact of the tsetse fly on their cattle.

E. Effect of Agro-climatic Conditions on Transport

The cumulative effect of climatic and soil conditions on transport in the Sahel is demonstrated in the citations provided below, and in Table E-1.

Table E-1

EFFECTS OF AGRO-CLIMATIC conditions
ON TRANSPORT REQUIREMENTS

Climatic Zone	Daily Temperature Range		*Rainfall		Vegetation 2/	Erosion	Agricultural Output		Major Effect On:	
	Max. °F	Min.	Annual	Period			Commodity	Lot Size (M T)	Roads	Vehicles
SAHARA	110	40	Less than 254mm	July-August	General absence, desert, scattered oases with palms & drought--resistent shrubs and grasses	Landslides in mountainous areas, wind erosion-drifting sand and moving sand sand dunes			Water shortage for compaction sand on roads, loose sand-unstable. Wood shortage for construction	Overheating and excessive engine wear from heat
SAHEL	100	50	254mm to 508mm	June-Oct	Drought-resistent grasses, shrubs, scattered acaia trees, and small areas of woods	Some wind erosion 1/	Millet, cotton, Sorghum, cattle, sheep, goats		(water shortage for compaction) some sand drifting on roads; loose sand-unstable, water erosion-deteriorates road; wood shortage for const. poor drainage-saturates road.	Overheading & excessive engine wear from heat, wear & tear on tires & suspension
SUDAN	86	75	508mm to 1,016mm	June-Oct	Open grassland and scattered trees	1/	Millett, sorghum, groundnut, rice, cotton, cattle sheep		rainy season, delay, black clays-unstable, high water table-unstable, wood shortage for const., water erosion-deteriorates road; poor drainage-saturates road	Wear and tear on tires and suspension
GUINEA	95	75	over 1,016mm	April-Oct	Tropical-subtropical grasses and woodland	1/	Millett, Sorghum, groundnut, rice, maize, cotton		(high water table, swamps, black clays-unstable) rainy season- delay, pour drainage- saturates road	Overheating & excessive engine wear from heat, wear & tear on tires & suspension

1/ See Table E-2 for air photo interpretation of tropical soils - summary. There is a mixture of these soil groups in all three climatic zones E-3

2/ See also Figure E-1

*1000mm = 39.4"

Sahel Soils

Table E-2 shows the wide range of soil groups in Africa, each with its own characteristics; all of these categories are present in the Sahel. Within some groups there can be a wide range of engineering properties related to their suitability for road construction. No. 4 - Lateritic soil for instance, can range from poor to excellent for roadway subgrade.

Figure E-1 indicates the locations of black clay soils, considered the most troublesome group with respect to raod construction. These clays also vary in engineering properties; some can be utilized at much less expense than others for road construction. The very troublesome soils must have special engineering treatment to support a roadbed under normal traffic. The figure indicates that the lower third of Chad has considerable amounts of these clays in the areas where agricultural activity is concentrated.

Figure E-2, a moisture map of Africa, indicates the relative differences expected in drying time for soil to be compacted and the time lag to be expected after the rainy season until equipment would be able to traverse the clay and silt type soils.

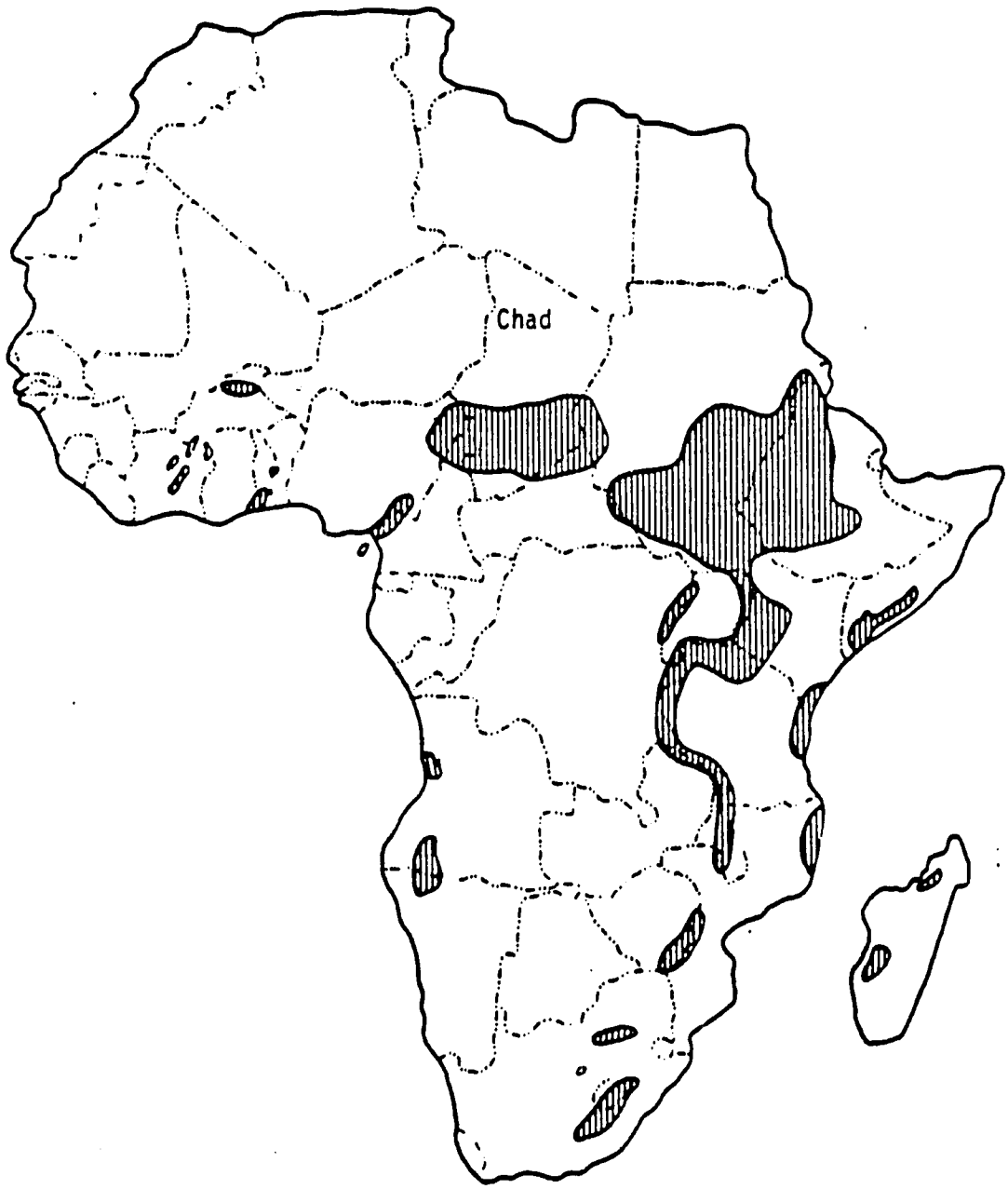
Table E-3 indicates the geological products of the weathering which takes place in the Sahel.

Table E-2

Airphoto Interpretation of Tropical Soils—Summary (after Liang, 1964)

Soil Groups	Topography (land Form)	Drainage	Erosion	Gray Tone	Vegetation	Remarks
1. Laterite Crust LC	Cap rock (relatively flat hilltops): Ledges on slopes	Little surface drainage	Little; rockfalls on edges of cap	Light	Grass or low shrubs	
2. Laterite Gravel LG	Flat hilltops to rolling ground	Little surface drainage	Little; gullying erosion starts on slopes below the gravel layer	Light	Grass or low shrubs	
3. Laterite (Hardening upon exposure) LH	Subdued to rolling ground intervened by flat valleys at high to intermediate slopes	Little surface drainage	Little erosion	Light	Variable; Plantations; Swidden agriculture	General absence of landslides; suitable for golf course or cemetery development; possibility of excavation pits
4. Lateritic Soil LS	Rolling ground, at high to intermediate slopes	Variable; less surface drainage with more advanced stage of and deeper laterization	Variable; less erosion with more advanced stage of and deeper laterization	Light to medium	Variable; Plantations; Swidden agriculture common; Intensive agriculture in high rainfall area	Termite hills are common
5. Red and Brown Clays CR	Variable; all forms except in basins	Considerable surface drainage development	Gullying erosion; depth of gullying indication of depth of soil to rock; slides	Medium to dark	Variable; intensive agriculture common	
6. Black Clays CB	Gentle lower slopes and flat depressions	Little surface drainage; high water table	Little erosion	Dark	Intensive agriculture	Quality of clay depends on source of material and mode of deposition
7. Desert Soils SD	Variable	Dry drainage channels	Wind erosion	Light	General absence	
8. Saline Soils SS	Low, coastal land; water table near surface	Tidal drainage channels	Little erosion	Light patches (dark in special cases)	General absence	
9. Swamps SW	Low, flat land; water table at surface	Tidal drainage channels	Little erosion	Dark	Mangrove and other swamp vegetation	
10. Alluvium SA	Low, flat land bordering stream	Little surface drainage	Little erosion	Light to medium	Recent – little vegetation; Old – intensive agriculture	
11. Rock and Thin Soils SR	Rolling to hilly, at high slopes	Variable	Variable	Light to medium	Variable; no agriculture development	

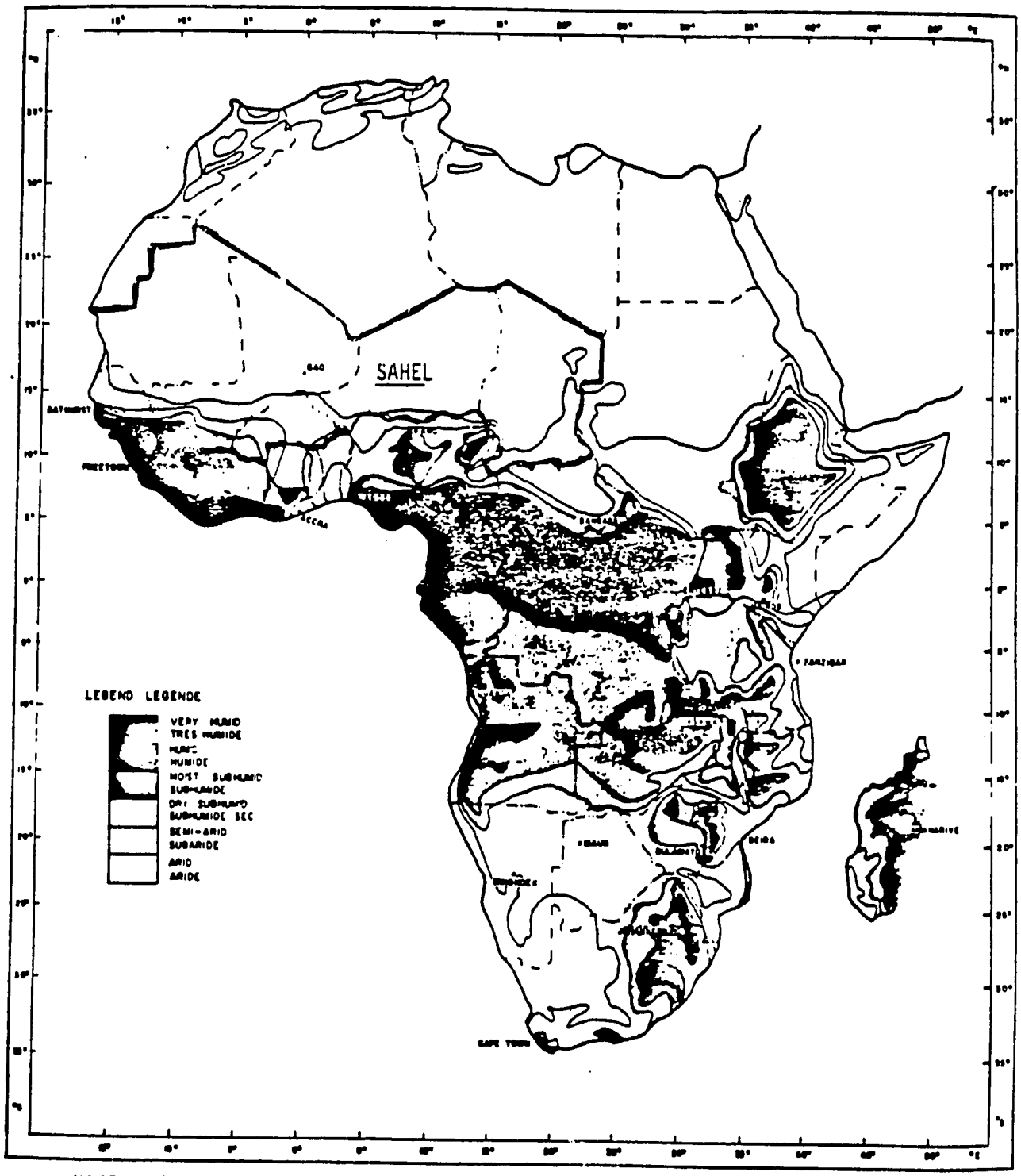
Figure E-1



DISTRIBUTION OF BLACK CLAY SOIL IN AFRICA

DISTRIBUTION DES SOLS ARGILEUX NOIRS EN AFRIQUE

Figure E-2



MOISTURE REGIONS OF AFRICA (after Oxford Regional Economic Atlas of Africa, 1967)
REGIONS HUMIDES ET SECHES D'AFRIQUE (d'après Oxford Regional Economic Atlas of Africa, 1967)

Table E-3

Weathering Products in Relation To Environments

Environment	pH (mean)	Eh	Behavior of Metallic Ions	Mineralogy
Nonleaching, hot rainfall 0-12 in	Alkaline	Oxidizing	Some loss of alkalies, iron present in ferric state	Partly decomposed parent minerals. Illite, chlorite montmorillonite, and mixed layered clay minerals, Hematite, carbonates and salts. Organic matter absent or sparse.
FERRUGINOUS– Moderate leaching hot climate rainfall 24-72 in.	6.3	Oxidizing	Loss of alkalies and alkaline earths. Some loss of silica. Concentration of alumina, ferric iron and titania	Hematite, goethite, and kaolinite. Organic matter absent or sparse.
FERRISOLS Intense leaching hot climate rainfall over 50 in.	5.9	Oxidizing	Loss of alkalies, alkaline earths and silica. Concentration of alumina, ferric oxide and titania.	Predominantly kaolinite with goethite; hematite and gibbsite less common. Organic matter sparse to abundant.
FERRALLITIC Intense leaching hot climate rainfall over 60 in.	4.7	Oxidizing to Reducing	Loss of alkalies, alkaline earths and silica. Concentration of alumina. Iron may be lost under reducing Eh and concentrated under oxidizing Eh.	Gibbsite, goethite with kaolinite. Organic matter may be abundant.

ANNEX 10: THE ECONOMY OF THE SAHEL

A. Current and Projected Economic Activity

1. Introduction

The Sahel countries are recognized as among the very poorest and least developed economies in the world. This is true by measures of development such as:

a. GDP per capita

b. Social facilities per person

c. Energy use per person

d Share of labor force outside agriculture

e. Road mileage per km^2

f. High Inflation Rate (See Table A-1)

Sahelians are among the world's most dependent people:

a. On weather for their existance;

b. On a basic and delicate ecological balance for survival;

c. On imports of fuel for energy and food for human consumption;

d. On investment capital imports for economic modernization;

e. On imported manpower for the performance of many specialized jobs.

They are dependent also in the sense that they lack control over major aspects of their economic welfare because of:

a. Large and uncontrolled frontiers;

b. Monetary and budgetary constraints in their small revenues and their institutional connections with France;

c. Inadequate administrative and technical capabilities

Specific causes of stagnation, obstacles to economic expansion include:

a. Poor resource endowment, particularly the poor quality of soils;

TABLE A-1

CONSUMER PRICE INDEX (As of June 1978)

Country	1971	1972	1973	1974	1975	1976	1977
Cape Verde							
Chad	71.6		77.7	86.5	100.0	103.4	112.1
The Gambia	62.6	68.0	72.7	79.4	100.0	171.1	131.6
Mali 1/	33.0	33.0	33.0	37.1	51.5	51.5	N/A
Mauritania	68.2	73.7	79.4	89.0	100.0	114.4	132.0
Niger	72.3	79.4	88.7	91.7	100.0	123.5	152.3
Senegal	64.0	67.0	72.0	82.0	100.0	106.0	113.0
Upper Volta	74.2	72.0	77.4	84.2	100.0	91.6	121.9

1/ This is the price index for millet and sorgham for Bamako (FM/KS)

b. Low levels of education;

c. Severely limited organizational and economic decision making capacities;

d. Limited knowledge of the environment; and

e. Extremely unfavorable physical location; some states are from 1,100 to 2,400 km from seaports, with consequently high transport costs because of underdeveloped infrastructure.

2. Agriculture

The overriding casue of economic privation has been bad weather; since the late 1960's, the region has been the victim of successive years of abnormally dry weather and some years of severe drought. Further, since 1972 the Sahel has been caught up in the traumatic changes occurring in the world economy, - notable increases in energy and manufactured goods price levels at rates without parallel in the past. Climatic conditions combined with unfavorable price changes have created a situation characterized by marked agricultural stagnation and decline, particularly in Mauritania, Niger, Mali, and Upper Volta. See Table A-1.

Table A-1a

Sahel - Countries

Agricultural Production, Principal Crops, 1966/67 - 1974/75
(1,000 tons)

	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	Forecast 1974/75
CEREALS: Millet + Sorghum									
Chad	674	711	700	651	610	631	590	-	-
Mali	738	800	556	700	715	715	474	530	910
Mauritania	90	110	50	110	81	80	50	25	-
Niger	1,120	1,350	948	1,384	1,100	1,230	1,130	780	1,134
Senegal	423	655	450	635	401	583	323	467	650
Upper Volta	-	860	925	830	770	772	769	1,138	900
Subtotal	3,345	4,516	3,629	4,310	3,677	4,011	3,336	2,940	3,594
Corn									
Senegal	42	67	35	49	39	39	20	20	30
Upper Volta	-	64	66	69	72	66	2	-	-
Subtotal	42	131	101	118	111	105	22	20	20
Rice									
Chad	37	32	35	37	39	51	25	30	35
Mali	-	103	80	96	98	117	60	48	120
Niger	20	33	39	38	37	27	32	23	28
Senegal	125	138	58	156	91	108	37	50	90
Upper Volta	-	28	29	31	36	37	29	-	-
Subtotal	182	334	241	358	301	340	183	151	273
CASH CROPS:									
Cotton									
Chad	123	102	149	117	95	109	104	115	121
Mali	-	39	50	51	59	74	72	58	67
Niger	7	6	7	11	10	8	5	1	11
Senegal	1	4	10	12	12	21	23	34	-
Upper Volta	-	-	32	36	24	28	33	27	29
Subtotal	131	151	248	227	200	240	237	235	228
Groundnuts (unshelled)									
Chad	125	88	99	115	96	75	75	76	60
Mali	159	119	96	136	158	152	134	120	145
Niger	202	209	177	207	144	171	140	50	84
Senegal	857	1,005	830	789	582	988	570	643	989
Upper Volta	-	73	75	75	78	66	67	63	-
Subtotal	1,343	1,494	1,277	1,322	1,058	1,452	986	952	1,298
Total: Cereals	3,569	4,981	3,971	4,786	4,089	4,456	3,541	3,111	3,887
Cash Crops	1,474	1,645	1,525	1,549	1,258	1,692	1,223	1,187	1,526
Grand Total:	5,043	6,626	5,496	6,335	5,347	6,148	4,764	4,298	5,413

The magnitude of national income and agricultural sector losses in several countries due to the 1972 drought is shown in Table A-2 the drought and its disastrous effects continued in 1973-74; Niger was the worst hit; the production of cotton in this country fell to almost nothing and other agricultural production declined in all the countries in this area.

The dry years between 1970 and 1974 severely deterred agriculture because little of the agricultural output in the region comes from irrigated cultivation. Most is rain-fed, supplemented by river flood production along the Niger, Senegal and Chari rivers. The rainfall deficiencies of 1970 and 1971 were bad enough; low rainfall, poorly distributed, led to a decline in the utilization of marginal areas on the northern edge of the cultivable Sahel Zone. Areas south of the 700 mm. isohyet were generally less affected. But in the severe drought of 1972-73, the rivers and Lake Chad reached their lowest levels since the beginning of the century, and the river flood component of the Sahel's agricultural output drastically declined.

Table A-2

REAL OUTPUT IN 1973 AS % OF 1972 OUTPUT 1/

	Mali	Mauritania	Senegal	Upper Volta
Gross Domestic Product	-6	+1	-19	-9
Agricultural Sector Output	-21	-13	-20	-16

1/ The net effect on demand for transport probably increased in view of foreign food imports

3. Mining

There are a wide variety of known mineral deposits in the Sahel region; some are being mined; others are of commercial size and grade but are not yet recognized as economically feasible. Table A-3 indicates locations of the most important mineral deposits. The most likely candidates for additional discoveries are oil and gas in the numerous untested formations and metallic ores in veins which do not outcrop at the surface. However, discovery of mineral resources does not necessarily translate into production, especially in the interior of Africa. The cost of transporting ores to markets is prohibitive for most minerals located away from major rivers or coastlines. The vast iron ore deposits at Fort Gouraad in Mauritania might have remained undeveloped if they were located farther from the ocean in Mali or Niger. A small deposit of petroleum or gas near the coast can be of great value, but in the center of the semi arid region only a very large deposit will justify laying the

Table A- 3

Sahel Mineral Deposits
1977

Country	Mineral	Comment
Cape Verde	Pozzalano	684 MT produced in 1975.
	Salt	20,941 MT produced in 1975.
Chad	Uranium and Thorium	
	Geothermal Steam	Prospects
Mali	Geothermal Steam	Prospects
	Mangasese	
	Banxite	
	Phosphates	
	Salt	
Mauritania	Iron Ore	Major Deposits
	Salt	

Table A-3 (contd)

Country	Mineral	Comment
Niger	Uranium and Thorium	
	Iron Ore	Prospects
	Tin	
	Salt	
Senegal	Oil and Gas	Indications of deposits.
	Phosphates	
Upper Volta	Manganese	

requisite pipelines. The exploitation of mineral resources in a region has a number of peripheral economic and social impacts which expedite and enhance overall national development programs. The transportation networks, involving roads and rail lines, and communication systems established to support mineral production also can be designed to promote development plans.

4. Industry

The countries of the Sahel Region are among the world's least industrialized countries; except in Senegal and Niger, manufacturing was less than 6% of GDP in the late 1960's as compared with an average of 14% in other less developed countries. A more detailed description of each country's industry is contained in Annex 3.

B. Resultant Transport Flows

1. Exports

Despite significant increases in mineral sales since 1963 exports from the Sahel countries continue to consist largely of agricultural products, the value of exports depending primarily on:

a) Weather conditions

b) Acreage planted and intensiveness of cultivation

c) Changes in world commodity prices

2. Imports

Although overall import expenditures of the Sahel countries have been rising annually since 1967, the rate of increase varies considerably among countries. In most of these countries, marketed crops generate the greater part of cash income; therefore the level of import expenditures closely reflects the value of agricultural exports. Variations in imports also arise from other factors, the most important being the availability of foreign financing on which the major part of capital development depends.

France accounts for roughly half of the area's trade in both directions. Nevertheless, the French share of the area's trade is declining with respect to both exports and imports.

Trade with EEC countries other than France expanded considerably since 1967 in both directions. Also, countries outside the franc and EEC areas have slightly increased their share of both imports and exports. Increased marketing of mineral products contributed to the expansion of imports, mainly from the U.S. and the United Kingdom.

Table B-1 and indicates the main commodities traded and their transport routes. This is supplemented by specific country trade data in Section 3, below.

Annex 13 presents maps showing the principal transport routes serving this region.

Table B-1

COUNTRY / PRODUCTS	FROM / TO	TYPE OF TRANSPORT MODE	SPECIAL NOTES
1. Chad	a) N'Djamena-Maiduguri/ Port Hourcourt	Road	48% of total Import/Exports
	b) N'Djamena-Duala (Cameroon)	Road and Rail	Most attractive road route.
	c) Transequatorial Route via *Bangui (Central African Empire) *Pointe-Noire (Congo)	Road	Declining in importance. Handles only 12 % of total freight.
2. The Gambia	a) Dakar/Zinguichor	Trans-Gambia Highway	Plays important role in bringing the imports from Dakar to Casamance River area.
	b) Bangul/Daker., Bangul/Zinquichor	Roads	Important for the Buthurst Port freight movements.
3. Mali Mainly groundnuts and cotton and all imports	a) Bamako/Dakar (Senegal)	Rail	Within Mali is to Bamako with primary roads from Segou, Goco, Mopti 70% of total exports/ imports freight
	b) Bamako-Ouagadougou (Upper Volta) Abidjan (Ivory Coast)	Paved road network.	Carries 30% of total trade.
4. Mauritania All imports and exports	a) *Rosso is the main transport trade center between Maurintania's network and Dakar or Nouakchott ports.	Road	All imports and exports.
	b) Nouadhibou/F'Derik	Rail	All iron ore production

Table B-1 cont'd

5. Niger		a) Niamey-Gaya/Cottonou	Niamey-Gaya-Parakou (Road) Parakou-Cotonou (Rail)	20% of groundnuts exports
		b) Kano / Lagos	To Kano (Road) From Kano to Lagos) (Rail)	80% of groundnuts.
		c) Niemy/Ouagadougou (Upper Volta)/Abidjan	Niamey (Rail) Ouagadougou Abidjan (Rail)	
6. Senegal		a) Dakar/Kidiri b) Dakar/St. Louis c) Branch to Linguere	Rail	Most of Mali's imports and exports. Also, all the phosphate production of Senegal.
7. Upper Volta	All imports and exports	a) Ouagadougou/Abidjan	Rail	Carries 90% of country's imports and exports.
		b) Ouagadougou/Abidjan	Road	Of limited use.
		c) Ouagadougou/**Bobo-Dioulaso-Banfora	Road	Important for accommodating the potential agricultural production in SW Region.
8. Cape Verde				

3. Specific Country Data

a. Cape Verde

The foreign trade of the country is in negative balance In 1975 total imports were valued at $26,120,000 and exports at $1,583,000. In 1976 both imports and exports fell to $23,536,000 and $1,241,000 respectively. Portugal is the main trading partner, with Angola second. (See Table B-1) .

b. Chad

In recent years, imports of consumer goods have accounted for about half of all imports, the remaining half being shared, about equally between petroleum products, raw materials and equipment. Among consumer goods, petroleum, products and sugar are by far the most important. Cotton is the most important crop and small amounts of gum arabic are also exported. In 1973, exports still consisted almost entirely of agricultural products-principally cotton, meat, and livestock. Apart from ginned cotton and a few assembled transitor radios, there were scarecely any manufactured or processed exports. (See Table B-2).

c. The Gambia

Domestically produced groundnuts long have constituted a small part of the country's exports, but there is also a substantial re-export trade, partly illicit, with surrounding territory of Senegal. The state of trade in the Gambia, therefore, depends partly on the movements of purchasing power in Senegal. The main influence of Gambia's

Table B-1

Cape Verde

FOREIGN TRADE

('000 escudos)

Imports	1975*	1976*
Animal and animal products	53,449	30,232
Vegetable products	253,381	181,902
Beans	53,837	18,437
Corn	109,142	79,759
Fats and oils	68,439	71,123
Pork fats and lard	44,967	38,859
Foodstuffs and beverages	185,541	161,978
Milk and cream	39,407	20,227
Wheat-flour	41,444	12,939
Wines	40,218	30,397
Total (incl. others)	1,010,853	910,877

Exports	1975*	1976*
Animals and animal products	10,989	14,165
Fresh, frozen and chilled fish	6,612	6,185
Crustaceans and molluscs	4,298	7,624
Foodstuffs and beverages	5,882	7,265
Prepared and preserved fish	3,546	4,921
Water for ships' stores	1,892	977
Mineral products	1,642	4,380
Salt	1,580	4,370
Total (incl. others)	61,277	48,034

* Provisional.

(b)

MAIN TRADING PARTNERS

(contos)

Imports	1975*	1976*
Angola	109,277	21,974
Netherlands	36,947	46,258
Portugal	634,301	530,961
United Kingdom	28,442	27,371
U.S.A.	20,690	16,342
Total (incl. others)	1,010,853	910,877

Exports	1975*	1976*
Angola	n.a.	6,920
Central African Empire	602	1,320
Guinea-Bissau	747	1,598
Portugal	54,397	30,147
São Tomé e Principe	n.a.	1,794
United Kingdom	2,301	2,168
Zaire	n.a.	2,570
Total (incl. others)	61,277	48,034

Table B-2

(a)

CHAD

FOREIGN TRADE

IMPORTS	1971	1972	1973
Beverages	389.2	335.4	373.0
Cereal Products	573.9	550.7	851.7
Sugar, Confectionery Chocolate	1,307.0	1,972.9	2,048.4
Petroleum Products	2,719.0	2,122.6	2,954.2
Textiles, Clothing, etc.	1,002.8	913.1	985.4
Pharmaceuticals, Chemicals	642.2	578.8	642.7
Minerals and Metals	1,232.7	959.0	1,311.4
Machinery	997.7	968.4	906.3
Transport Equipment	2,349.4	1,613.5	1,524.9
Electrical Equipment	810.4	701.0	570.5
TOTAL (incl. others)	17,219.6	15,475.7	18,213.5

EXPORTS	1971	1972	1973
Live Cattle	279.4	374.1	439.0
Camels	87.7	85.7	98.8
Meat	1,501.6	931.7	638.0
Fish	32.1	95.6	47.6
Natron	11.6	90.3	41.0
Gums and Resins	37.3	44.7	22.8
Hides and Skins	90.9	112.7	219.9
Raw Cotton	5,224.6	6,056.1	5,380.5
TOTAL (incl. others)	7,786.6	9,028.3	8,483.2

1974: Cotton 5,880 million francs CFA.

(b)

CHAD

PRINCIPLE TRADING PARTNERS

IMPORTS	1972	1973	1974
Beigium/Luxembourg	176.8	592.9	762.6
Cameroon	404.7	725.7	932.8
Central African Empire	222.5	232.6	285.1
China, People's Republic	204.5	254.8	218.7
Congo People's Republic	567.2	774.5	474.9
France	7,472.4	7,728.8	7,642.6
Gabon	446.9	489.4	229.4
Germany, Fed. Republic	466.6	410.9	651.0
Italy	282.3	224.7	386.0
Netherlands	535.1	232.9	827.9
Nigeria	1,690.5	2,194.3	2,562.4
Senegal	417.9	616.0	669.0
Taiwan	313.2	418.7	281.6
United Kingdom	266.9	255.4	373.4
U.S.A.	492.3	720.8	2,025.1

EXPORTS	1972	1973	1974
Cameroon	300.4	197.1	128.2
Central African Empire	164.5	208.4	180.4
Congo People's Republic	351.6	397.9	316.9
Denmark	4.9	44.2	10.9
France	145.4	215.0	297.6
Gabon	68.3	75.3	64.8
Germany, Fed. Republic	22.5	92.1	10.9
Libya	80.2	129.3	70.5
Nigeria	487.4	538.9	387.8
Spain	17.8	54.6	68.2
United Kingdom	30.7	15.3	18.0
Zaire	562.6	121.9	496.5

Prosperity is, however, the value of groundnuts exports. The following tables indicate the main commodities of trade and the flows respectively. (See Table B-3).

d. Mali

A basic reason for Mali's financial difficulties lies in the chronic deficit on foreign trade, even though exports tripled between 1969 and 1974 (mainly owing to higher cotton and groundnut sales). The problem was not solved mainly because much higher imports of cereals in 1973/4 and the rise of oil prices pushed up imports by an average of 60% a year in 1973 and 1974. Consequently, imports were almost treble exports in 1974. Between 1960 and 1972, livestock exports have more than doubled. (See Table B-4a). The main customers are the Ivory Coast and Ghana, though exports to the latter have decreased considerably due to impport and currency restrictions. The trade flows are indicated in Table B-4.

e. Mauritania

The most direct and spectacular impact of mineral development has been on foreign trade. Mauritania's exports increased from $14.5 million, in 1959, to $16.8 in 1975, in which $13.7 came from iron ore. In general, imports have risen less rapidly-from $3.0 million in 1959 to $12.0 in 1974. A summary of main import and export activity and the flows of such activity is indicated in the following table: (See Table B-5).

f. Niger

Niger, principal exports are groundnuts which have shown a steady increase until 1973. Since 1970 uranium has been the major factor in export growth,

TABLE B-3

(a)

GAMBIAN FOREIGN TRADE

('000 dalasi)

IMPORTS	1972/73	1973/74	1974/75
Food and Live Animals	8,119	14,436	17,100
Beverages and Tobacco	3,039	3,810	4,130
Crude Materials (inedible) except Fuels	2,512	2,117	2,459
Mineral Fuels, Lubricants, etc.	2,490	3,380	7,887
Animal and Vegetable Oils and Fats	98	81	159
Chemicals	4,306	5,231	8,040
Basic Manufactured Goods	19,500	20,269	25,977
Textile Yarn, Fabrics, etc.	13,379	13,469	22,458
Machiney and Transport Equipment	8,405	8,031	17,486
Miscellaneous Manufactured Articles	4,632	4,651	8,147
Other Commodities	1,318	1,490	1,964
TOTAL	67,798	76,965	115,807

EXPORTS	1971/72	1974/75
Groundnuts, shelled	19,379	46,651
Groundnut meal and cake	3,010	7,691
Groundnut oil	11,061	26,126
Palm kernels and palm nuts	455	667
Fish and fish preparations	414	1,694
Hides and skins	107	80
TOTAL	34,426	82,909

TABLE B-3

(b)

GAMBIAN TRADING PARTNERS

(dalasi)

IMPORTS (FROM)	1972/73	1973/74	1974/75	EXPORTS (TO)	1972/73	1973/74	1974/75
Burma	1,659,400	2,695,458	4,760,248	France	6,690,945	15,309,239	7,229,797
China (Taiwan)	7,278,193	6,406,216	10,148,085	Germany, Fed. Republic	2,974,734	4,648,234	2,783,546
France	2,341,133	3,201,260	3,296,537	Italy	2,424,434	3,725,473	9,886,706
Germany, Fed.Republic	1,887,503	2,709,559	4,470,579	Netherlands	735,465	11,402,720	16,803,296
Japan	5,899,768	2,646,476	3,982,327	Portugal	1,363,898	5,144,606	11,788,824
Netherlands	1,649,901	3,583,072	5,228,576	Sierra Leone	190,092	313,331	365,423
Poland	1,003,462	3,169,663	1,776,001	Switzerland	4,145,584	121,419	148,149
Senegal	2,434,635	2,939,594	3,488,802	United Kingdom	13,262,980	28,847,503	34,849,431
United Kingdom	15,411,324	15,440,924	21,206,242				
U. S. A.	1,368,231	2,987,476	2,903,511				
TOTAL (incl. others)	54,410,[illegible]	63,494,509	88,348,975	TOTAL (incl. others)	33,690,542	67,607,230	84,833,973

TABLE B-4

(a)

MALIAN FOREIGN TRADE

(million Mali francs)

IMPORTS	1970	1970	1972	EXPORTS	1970	1971	1972
Sugar	3,249	3,415	4,900	Live Animals	6,759	5,365	4,700
Cerals and Products	529	2,914	3,800	Fish (dried and smoked)	1,521	1,214	960
Other Food Drink and Tobacco	2,912	3,530	5,600	Groundnuts	1,470	2,264	2,150
				Other Oilseeds	585	1,108	N.A.
Petroleum Products	2,077	3,152	4,100	Vegetable Oils	748	1,196	1,850
Chemicals	1,186	2,177	3,500	Groundnut Meal	423	701	
Rubber and Products	595	595	N.A.	Cotton	4,794	4,726	7900
Textiles and Clothing	1,729	1,705	2,200	Hides and Skins	67	36	N.A.
Machinery (non-electric)	979	2,901	6,400	Coffee	N.A.	143	N.A.
Electrical Apparatus	702	1,603		Gum Arabic	165	211	600
Road Vehicles	1,587	3,042	3,700				
Iron and Steel	1,130	2,407	N.A.				
Total (incl. others)	26,200	34,870	42,500	Total (incl. others)	18,240	22,580	17,233

1974 (million Mali francs): Cotton 6,100; Groundnuts 1,780; Fish 210.

TABLE B-4

(b)

MALIAN TRADING PARTNERS

(million Mali francs)

IMPORTS	1969	1970	1971
Belgium/Luxembourg, Italy, Netherlands	1,129	1,088	1,563
China, People's Republic	1,706	1,356	2,030
France	7,770	6,925	14,620
Germany, Fed. Republic	572	467	1,189
Ivory Coast	1,725	2,334	3,462
Japan	131	332	518
Senegal	1,705	1,445	2,069
U. S. S. R.	1,976	2,531	1,986
United Kingdom	239	169	799
U. S. A.	539	195	1,804
TOTAL (incl. others)	20,099	26,200	34,870

1972 (million Mali francs): France 15,200; Ivory Coast 4,200; Senegal 3,200.

EXPORTS	1969	1970	1971
France	1,431	3,370	4,030
Germany, Fed. Republic	9	262	204
Ghana	1,876	1,733	1,575
Ivory Coast	3,505	6,315	5,443
Japan	22	94	360
Senegal	388	2,715	1,611
U. S. S. R.	212	288	334
United Kingdom	94	510	320
Upper Volta	230	466	498
TOTAL (incl. others)	8,941	18,240	22,580

1972 (million Mali francs): France 3,700; Ivory Coast 7,400.

import and export activity and the flows of such activity are indicated in Table B-5.

f. Niger

Principal exports are groundnuts, which showed a steady increase until 1973. Since 1970 uranium has been the major factor in export growth; it became the major export since 1973 (See Table B-6a). By far the leading category among Niger's imports consists of manufactured goods, chiefly for industry. The drought, greater food imports and the rise of oil prices in 1974 increased the deficit sharply. (See Table B-6a) France has remained the main import and export market for Niger. (See Table B-6).

g. Senegal

Groundnuts are the main export product, supplemented by the continuous increase of phosphate production. Groundnuts and phosphate combined contribute 57 percent of total exports. (1975).

Exports to France decreased in 1967 but are rising since that year; exports to the United Kingdom, almost exclusively phosphates, have been increasing after a stagnating period during 1965-67. (See Table B-7).

Mauritania

Table B-5

(a) FOREIGN TRADE

(million francs CFA)

IMPORTS	1970	1971	1972
Fish and Preparations	1,060	n.a.	n.a.
Cereals and Preparations	558	861	837
Rice	309	511	378
Sugar and Honey	897	1,342	n.a.
Green Tea	255	258	345
Petroleum Products	1,050	1,089	1,170
Chemicals	1,002	n.a.	n.a.
Iron and Steel	626	1,102	1,843
Machinery (non-electric)	2,508	3,074	3,163
Electrical Equipment	964	776	1,081
Railway Vehicles	949	525	562
Road Motor Vehicles	1,324	1,887	1,786
Aircraft	17	149	460
Ships and Boats	58	217	52
TOTAL (incl others)	15,517	15,780	17,980

EXPORTS	1970	1971	1972
Iron Ore	20,924	20,847	18,475
Fish	2,029	2,137	2,842
of which: Salted and dried	805	693	744
Fresh and frozen	856	481	353
Natural Gums	492	434	700
Copper Concentrates	—	1,035	2,715
TOTAL (incl. others)	24,680	25,129	26,959

Iron ore (million ouguiya): 5,720 in 1973, 5,864 in 19[illegible], 6,153 in 1975.

TRADING PARTNERS

(b)

(million francs CFA)

IMPORTS	1970	1971	1972
Belgium/Luxembourg	566	235	579
China, People's Republic	308	278	921
France	5,544	6,147	7,410
Germany, Federal Republic	459	811	981
Italy	457	178	194
Japan	6	24	256
Senegal	976	909	1,260
Spain	1,329	290	496
United Kingdom	1,369	1,131	1,298
U.S.A.	2,189	1,664	1,013
TOTAL (incl. others)	15,517	15,780	17,980

EXPORTS	1970	1971	1972
Belgium/Luxembourg	3,464	3,286	3,357
Congo People's Republic	446	432	336
France	4,857	5,362	5,452
Germany, Federal Republic	2,886	2,908	2,257
Italy	3,607	2,882	3,663
Japan	1,634	1,623	2,446
Senegal	584	510	66
Spain	2,246	2,168	3,033
United Kingdom	4,082	4,13[illegible]	4,790
Zaire	n.a.	14	405
TOTAL (incl. others)	25,023	25,129	26,959

TABLE B-6

NIGER FOREIGN TRADE

(a)

(million francs)

IMPORTS	1971	1972	1973	EXPORTS	1971	1972	1973*
Cotton Fabrics	2,416	2,570	1,074	Live Cattle	1,703	2,209	1,873
Road Vehicles	2,181	1,896	1,840	Live Sheep and Goats	270	302	423
Petroleum Products	1,120	1,467	1,533	Leather and Hides	397	435	N.A.
Machinery	1,377	1,408	N.A.	Raw Cotton	594	194	880
Sugar and Confectionery	448	836	596	Onions	192	181	112
Cereals	125	319	323	Groundnuts, Shelled	3,413	4,597	1,844
Pharmaceuticals	N.A.	301	166	Groundnut Oil	967	1,221	833
Tobacco	228	247	178	Groundnuts, Cake	265	356	262
Electrical Equipment	624	232	352	Uranium	1,737	2,369	5,428
Beverages	141	186	N.A.				
Iron, Cast Iron, Steel	427	913	N.A.				
Metal Products	788	N.A.	N.A.				
TOTAL (incl. others)	14,975	16,576	15,281	TOTAL (incl. others)	16,670	13,712	12,698

* Provisional figures. Revised totals (in million francs CFA) are: Imports 19,098; Exports 13,817
Uranium exports (million francs CFA): 6,322 in 1974; 11,882 in 1975.

NIGER TRADING PARTNERS

(b)

(million francs)

IMPORTS	1971	1972	1973*
China, People's Republic	391	293	344
France	6,466	7,721	6,585
Germany, Federal Republic	1,154	1,325	1,058
Italy	454	402	581
Ivory Coast	807	1,259	580
Netherlands	797	739	535
Nigeria	348	463	875
Senegal	295	312	100
United Kingdom	565	423	454
U. S. A.	1,172	810	1,195
Venezuela	341	420	392

EXPORTS	1971	1972	1973*
Dahomey (Benin)	478	145	274
France	5,509	5,260	6,775
Germany, Federal Republic	0.5	924	710
Ghana	120	88	152
Italy	363	710	727
Ivory Coast	264	300	145
Nigeria	2,726	3,772	2,931
United Kingdom	199	147	343

TABLE B-7

(b)

SENEGAL FOREIGN TRADE

(million francs CFA)

EXPORTS	1973	1974	1975	IMPORTS	1973	1974	1975
Groundnuts	419	1,404	1,324	Dairy Products, Eggs and Honey	1,781	1,986	2,411
Groundnut Oil	8,324	25,655	31,123	Fruit and Vegetables	2,638	3,002	2,319
Oilseed Cake	6,532	6,918	7,871	Wheat	2,619	2,858	4,623
Fresh Vegetables	547	578	771	Rice	9,519	18,032	6,050
Fresh Fish	1,265	2,440	2,321	Sugar	5,223	9,082	7,598
Preserved Fish	2,519	3,428	3,644	Petroleum Products	4,833	15,476	14,782
Crutaceans and molluscs	851	1,304	1,297	Parachemicals	1,737	2,638	2,987
Cement	503	840	1,194	Paper	2,248	3,466	3,495
Phosphates	4,943	24,946	22,226	Textiles	3,266	3,714	4,732
Petroleum products	2,537	5,309	6,948	Base Metals	2,869	5,344	3,481
Sea Salt	493	793	810	Machinery	7,984	9,866	17,827
Phosphatic Fertilizers	831	2,549	1,508	Electric Apparatus	3,227	4,843	4,877
Cotton Fabrics	1,545	1,459	1,641	Vehicles and Spares	4,961	6,129	9,367
Footwear	859	977	1,235				
TOTOAL (incl. others)	43,237	93,973	99,101	TOTALS(incl. others)	79,766	119,376	124,616

TABLE B-7

(b)

SENEGAL TRADING PARTNERS

(million francs CFA)

IMPORTS	1973	1974	1975
Belgium/Luxembourg	1,160	1,921	3,001
Brazil	1,119	9,018	2,213
China, People's Republic	4,269	3,461	1,854
France	37,140	44,306	51,647
Germany, Federal Republic	3,781	6,711	6,726
Iraq	1,500	4,012	4,392
Italy	3,175	2,653	3,617
Ivory Coast	3,321	3,731	5,258
Netherlands	1,956	2,324	3,514
Nigeria	1,913	6,592	5,118
Pakistan	417	2,958	2,388
Thailand	2,871	3,530	1,880
U. S. S. R.	551	6,025	1,725
United Kingdom	989	1,643	2,364
U. S. A.	5,962	7,542	9,215
TOTAL(incl. others)	79,766	119,376	124,616

EXPORTS	1973	1974	1975
Belgium	190	767	1,059
Finland	N.A.	621	1,406
France	20,556	51,915	47,857
Germany, Federal Republic	293	746	1,238
Greece	488	2,381	2,846
Italy	1,733	1,365	2,873
Ivory Coast	3,598	1,411	4,471
Japan	554	1,707	1,313
Lebanon	183	1,064	855
Mali	1,639	1,927	2,808
Mauritania	3,083	4,211	5,220
Netherlands	1,600	4,857	3,614
Spain	1,147	1,235	793
United Kingdom	1,107	4,673	5,981
TOTAL (incl. others)	43,237	93,973	99,101

h. Upper Volta

Like most other countries in this group, Upper Volta suffers a chronic and substantial trade deficit. The widening in the trade gap reflects a much more rapid rate of import growth (12% a year since 1968) while export earnings have eased by an average of almost 2% a year. The stagnation in exports is explained in large part, by the drought which has hit shipments of livestock (the value of cattle exports was halved between 1968 and 1971 but almost doubling again by 1974). Imports, on the other hand, have been boosted by industry's demand for raw material, official investment programmes and the effect of the drought of food supplies. The following Table B-8, indicates the volume of the major trading commodities and the current flows of trade respectively.

Table B-8
Upper Volta
(a)
FOREIGN TRADE

(million francs CFA)

Imports	1973	1974	1975
Food, beverages and tobacco	4,035.7	11,073.3	6,111.1
Petrol and oil	1,219.1	2,220.1	2,828.4
Cotton, textiles and clothing	1,142.0	1,863.0	1,923.2
Electrical equipment	752.0	1,268.3	1,096.8

Exports	1973	1974	1975
Live animals	2,286.6	3,061.0	3,380.9
Hides and skins	1,310.7	1,632.5	1,724.7
Meat	154.8	162.4	116.8
Cotton fibre	1,205.6	1,545.6	1,524.5
Cotton seed	54.8	46.3	n.a.
Groundnuts (shelled)	655.0	1,698.0	1,440.1
Karité nuts and butter	72.6	357.9	637.7
Sesame seed	229.9	318.2	533.5
Fruit and vegetables	152.8	268.1	320.2

TRADING PARTNERS

(b)

(million francs CFA)

Imports	1973	1974	1975
Congo People's Republic	67.1	22.6	4.9
France	8,407.3	13,876.2	13,988.4
Germany, Fed. Republic	863.4	4,244.7	1,345.1
Ivory Coast	2,254.8	3,010.3	3,829.0
Mali	520.4	888.5	205.6
Netherlands	510.7	497.0	827.3
[illegible]	277.8	302.5	368.4

Exports	1973	1974	1975
France	1,469.4	3,095.4	1,761.1
Ghana	389.0	593.2	244.7
Italy	425.4	374.8	618.6
Ivory Coast	2,268.1	2,962.6	4,507.7
Japan	75.4	181.3	152.2
Mali	126.9	387.0	3.3
United Kingdom	147.6	137.6	607.9

C. National Revenues vs Public Expenditures in the Transport Sector.

The following statistical tables indicate National Revenues and Public expenditures for transport by each country. All the figures are based on 1971 prices and Exchange Rates. Because of conflicting and contradictory data sources our estimates are quite rough.

The following table provides the main economic indicators related to the transport sector, mainly the Highway expenditures, of all the Sahel countries. The figures are beased on each respective time period indicated in column one.

Table C-1

Road Expenditures as a Percentage of GNP and Total Budget Expenditures for Sahel and Other West African Countries.

Country	Date of Figures	G N P (1976) (Million)	Gov't Budget Expenditures (1970) (Million $)	Road Maintenance and Investment (Million $)	Highway Expenditures % GNP	% Budget
Togo	75/76	560	71	20.7	3.7	29.2
Ghana	74/76	5,860	475	29.3	.4	5.9
Nigeria	76/77	29,320	3,928	1850.0	6.3	47.1
Liberia	75/76	640	74	18.5	2.9	25.0
Ivory Coast	75/76	3,630	791	90.7	2.5	11.5
Niger	74/77	590	139	31.0	5.2	22.3
Senegal	72/76	1,800	321	12.2	.7	3.8
Gabon	67/72	1,360	91	7.8	.3	8.6
Upper Volta	75/76	640	72	13.8	2.0	19.2
Congo	75/76	670	172	n.a.	n.a.	n.a.
Sierra Leone	76/77	610	99	8.1	1.3	8.2
Chad	75/77	460	86	4.5	1.0	5.2
Benin	75/76	390	77	10.9	2.8	14.2
Cameroon	76/77	2,050	343	64.0	3.1	18.7
Mauritania	75/76	420	92	28.0	6.7	30.5

Guinea	74/75	750	153	20.3	2.7	13.3
Gambia	76	90	13	n.a.	n.a.	n.a.
Mali	73/74	530	106	8.9	1.7	8.4
C.A.E.	75/76	390	86	7.7	2.0	8.9
Eq. Guinea	71/75	100	n.a.	.5	.5	n.a.
Guinea Bissau	76/77	70	n.a.	n.a.	n.a.	n.a.
			S.W.A.			
			Average All Countries		4.4	31.0
			Average Excluding Nigeria		1.7	11.5
			Average Sahel Countries		2.2	12.1

The Sahel Countries

Source. IBRD

SCOPE OF WORK FOR DOT ADVISORY SERVICES TO THE AID SAHEL PROGRAM

Under RSS Agreements DOT shall provide advisory services in transportation matters to the Bureau for Africa as follows:

1.0 Provide one senior economist, GS-13 level to furnish advisory assistance to the Office of Sahel and Francophone West Africa Affairs, AID/W, on matters concerning transportation and related infrastructure in the Sahel, including participation in the work specified in Sections 2.0 and 3.0 below.

2.0 Furnish further personnel services to the Office of Sahel and Francophone West Africa Affairs to accomplish the following specific tasks related to the definition and refinement of AID policy on transportation investments in the Sahel.

2.1 Using appropriate sampling techniques, survey the grant and loan files of a representative sample of AID-sponsored road projects in the four AID Geographic Bureau Areas. For each area, obtain data on primary, secondary and tertiary road projects.

1. Analyze these road projects in terms of the following factors:

- o Year of Construction completion
- o Terrain
- o Precipitation
- o ADT; present; projected
- o Design standards

- o Construction cost; financial; without bridges, but with culverting; $/km.
- o Maintenance cost; financial; $/km.
- o Shadow prices of unskilled labor
- o Total beneficiaries in Project Area
- o Construction cost/beneficiary
- o Maintenance cost/beneficiary
- o Capital/labor mix
- o Economic ROR; B/C or IRR
- o Employment created in road construction; agriculture; other
- o Increased family income attributable to construction and maintenance over 15 years
- o Projected completion date vs. actual completion date

2. From available data analyze, in the same manner, road transport projects in these geographic areas financed by other donors.
3. Consider projects which were financed as well as those which were not approved for AID financing. In the case of the latter, determine why the project was not approved.
4. Attempt to determine the contribution to the welfare of small farmers made by each classification of road-primary, secondary, and tertiary.

2.2 Consider the role of alternative transport modes in a manner similar to that prescribed in Section 2.1, above.

2.3 Review the Foreign Assistance Acts of 1973 and 1975, the relative Conference Reports, Senate and House hearings and reports on the bills and Senate and House appropriations reports for the two years. Through these reviews determine the sense of the Congress in the prescribed legislation.

2.4 Analyze the role of transport infrastructure income distribution in less-developed countries generally, and specifically in the Sahel.

2.5 On the basis of the findings in Sections 2.1 and 2.2 develop a methodology and conduct the necessary analyses to determine, for each transport mode, and for each road classification, i.e., primary, secondary, and tertiary, the extent to which it, combined with other development imputs, promote development consistent with the spirit and intent of the AID New Directions Mandate, as specified in the Foreign Assistance Acts of 1973 and 1975. Determine the extent and under what conditions transport infrastructure conforms with the Congressional mandate to reach the rural poor, promote more equitable income distribution, and reduce risks inherent in Sahelian agriculture.

2.5. Develop guidelines to enable AID field personnel in the Sahel to identify and develop transport improvement projects designed to maximize benefits reaching the rural poor, as mandated in the Foreign Assistance Legislation.

3.0 Furnish other advisory assistance in transportation as may be required.

Annex 12; Retrospective Evaluation of 35 Transport Infrastructure Projects.

The terms of reference call for the review of a representative sample of AID and other donor sponsored transport projects. The objective of this review would be to obtain the actual as opposed to the planned costs and times of completing the projects, to develop data regarding the economic and social impact of the project, and to provide a perspective of the results of grant and lending programs with a view toward improving the effectiveness of these development efforts.

While it was possible to obtain some of this retrospective information on projects funded by the World Bank, it was not possible to do so for the AID projects. Apparantly very few AID projects have been subjected to carefull and formal reviews after project completion, and for those that were reviewed, the information is not readily available. It is recommended that AID initiate formal post-project appraisal on a sampling of projects in order that management may develop a perspective on the results of AID operations , with a view toward improving its effectiveness as a development agency. In addition, this information would be valuable to recipient countries. According to the World Bank experience, and this organization has reviewed more than 200 projects during FY 75, 76, 77 the cost of such an effort is reasonable. For example, the cost of including a provision for project monitoring and evaluation for agricultural and rural development projects range from considerably less than 1% of project cost to 6%. The medain cost is just over 1%, and in two-thirds of the cases the cost is less than 3%.

A. COSTS

Table A12-1 presents an overview of the performance of 25 road projects, 6 rail projects and 4 port (sea and air) projects. Of the road projects, 17 were completed with a cost within 10% of the original estimate. Four had overruns with one exceeding almost 70%, and three projects had underruns ranging up to 27%. On the average there would be an overrun of about 8% with a typical road project's cost being estimated at $27.7 million and with an actual cost of $29.9 million.

A different reason existed for each of the four overruns. For one project the difficulty of the geological conditions and the remoteness of terrain were underestimated. Another project was prepared without adequate detailed engineering. The third project overrun was caused by a combination of factors involving inflation, delay in project execution, and the devaluation of the dollar. And the final overrun could attributed to delay in the start of project execution.

The sample of rail and port projects was not large enough to allow general deductions about cost performance. Four projects were within 10% of the estimated cost, four projects had an overrun between 20 and 25%, and one small project had a large overrun of 120% because it suffered a delay in start of project execution of three and a half years. The total cost of implementing the 9 rail and port projects amounted to $1855.3 million vs. the estimate of $1881.5 showing a small overrun of about 1%.

B. IMPLEMENTATION TIME

Of the 25 road projects, seven had an actual construction period within 10% of the estimated time. The remaining 18 projects had a construction time ranging from 10 to 200% higher than the estimated time. The project with the largest slippage in schedule took 4.5 years to complete instead of the planned 1.5 years. On the average the implementation time for a project was 4.9 years rather than the planned 3.4 years, representing an overrun of 42%.

Thus, most projects took longer to complete than expected. The main reasons for the slippage were generally similar to those mentioned for the cost overruns. Unforeseen problems were frequently encountered during project execution, and in a number of cases the loan or credit became available considerably later than originally scheduled.

The rail and port projects also took considerably longer to complete than expected. The average completion time required 6.7 years vs. a planned time of 3.2 years, and

representing a slippage of more than 100%. The largest slippage occurred with a port project that took 13 years to complete, nine years longer than originally estimated. The delays occurred from encountering serious technical problems with the design of berths, and efforts to make the maximum use of local contractors to save foreign exchange.

C. ECONOMIC RETURNS

Of the road projects 80% had an economic rate of return higher than estimated at the appraisal. This predominantly favorable result is partly due to the sharp rise in motor fuel cost since the 197 -73 "oil crisis", which had not been anticipated during the project preparation, and which led to increased vehicle operating cost savings. Another important was the large increase in vehicle traffic over that originally estimated.

For the railroads, economic returns are only slightly lower than those estimated at appraisal, and range between 10 - 32% against appraisal estimates of 10-36%. Only one of the four port projects had an actual rate of return lower than the appraisal estimate.

D. TRAFFIC PROJECTIONS

Traffic potential was generally underestimated for highways and overestimated for railways, and wide variations exsisted in the values of forecast traffic and actual traffic. There is thus a need for improving traffic forecasting techniques or, where this is not possible given the current state-of-the-art of traffic forecasting, allowing for margins of uncertainty in the design of roads. This can be done by selecting highway design principles that are flexible, such as stage construction, and that can accomodate unexpected increases in traffic levels without substantial increase in project cost. Even so, improved traffic forecasting techniques will have a considerable payoff and there is a clear need for further research

to raise the present level of forecasting technology. A useful direction would be placing the systematic collection of traffic data and projection of future traffic growth in the context of a sector of subsector survey.

E. ROAD MAINTENANCE

Four of the road projects were maintenance projects. Three of these fell short of achieving planned targets, while the benefits from one were remarkably high. Many problems were encountered. In general, equipment was not periodically renewed, in some cases maintenance allocations and equipment were diverted to other purposes such as construction, and the need for technical assistance and training were underestimated. Greater emphasis should be placed on financing the road maintenance from the governments current operating budget.

F. SOCIAL IMPACT

The evaluation of actual social impact of transport projects in terms of changes in the distribution of income, better health, and increases in trips to social and administrative activities requires a substantially larger effort than is practical for most projects, and was not done for the projects discussed in this chapter. Even before the project is implemented a base line survey must be performed to collect data on those economic and social indicators that are of interest and that may change due to project. This considerable effort requires extensive household interviews and survey of trip patterns, and survey of the economic and agricultural activity. Similar types of data must then be also gathered some time after the completion of the project in order to develop comparative information on the impact of the project.

Though there were no assessments of the socio-economic impact of the 25 road, 6 rail, and 4 port projects discussed in this chapter, it was possible to identify 6 other road projects which had been subjected to a detailed ex-post socio-economic

impact evaluation. These are fully discussed in section C of Chapter V of this report.

Table A12-1: Summary of Transport Project Performance Audits on IBRD Projects Initiated Between 1964 and 1972.

Project by Sector	Loan Amount (US $Million)	Project Execution (Years) Estimate	Project Execution (Years) Actual	Project Expenditures (US$ Millions) Estimate	Project Expenditures (US$ Millions) Actual	Economic Rate of Return % Estimate	Economic Rate of Return % Actual
TRANSPORT							
Highways							
Botswana II Road	2.0	2.8	2.5	6.2	6.7	19	13
Ethiopia IV Highways	21.2	3.9	6.3	38.4	41.6	10	11
Madagascar Highway Reconstruction	10.0	8.0	8.0	12.8	12.5	11	15
Uganda I Highway	5.0	3.1	4.4	7.2	6.3	10	10
Benin Highway Maintenance & Engineering	3.5	3.4	4.0	4.1	4.3	30	42
Cameroon I Highway	19.0	3.3	5.3	25.1	35.2	14	18
Central African Empire I Highway	4.2	2.8	3.2	5.6	4.8	14	14
Central African Empire Highway Maintenance	4.3	4.5	4.6	5.4	5.7	28	-20
Congo, P.R. Highway Improvement	1.5	2.8	2.8	2.0	2.4	17	21
Gabon II Highway	6.0	2.3	2.5	8.0	8.2	28	28
Ivory Coast I	5.8	2.5	3.0	7.9	7.7	10	21
Niger I Highway Maintenance	6.5	4.0	6.7	9.0	9.4	10	30
Nigeria Western Road	14.5	3.8	4.5	21.0	19.4	13	23
Nigeria Highway Rehabilitation	10.6	1.5	4.5	17.1	24.2	15	28

Table A12-1 Summary of Transport Project Performance Audits on IBRD Projects Initiated Between 1964 and 1972.

Project by Sector	Loan Amount (US $Million)	Project Execution (Years) Estimate	Project Execution (Years) Actual	Project Expenditures (US$ Millions) Estimate	Project Expenditures (US$ Millions) Actual	Economic Rate of Return % Estimate	Economic Rate of Return % Actual
Senegal I Highway	2.1	1.5	2.0	2.5	2.4	10	4
Togo Highway Maintenance	3.7	4.2	5.1	4.4	4.2	50	19
Papua New Guinea I Highway	9.0	4.0	3.6	13.1	22.2	30	36
Thailand IV Highway	23.0	4.0	4.2	48.7	35.5	24	28
Jordan I Highway	6.0	2.3	4.5	8.7	11.7	10	16
Morocco I Highway	14.6	3.5	4.3	21.2	23.3	15	20
Yugoslavia IV Highway	40.0	3.6	6.3	97.5	106.8	14	12
Brazil II Highway	100.0	2.8	6.3	255.1	260.1	27	36
Ecuador II National Highway	71.0	4.6	10.6	55.0	69.2	6	10
Trinidad & Tobago Highway	8.6	3.8	7.8	17.1	21.3	15	30
Railway							
Cameroon I Railways	5.2	3.5	4.8	20.6	20.6	36	17
Congo, Peoples Republci of Railways	6.3	n.a.	2.8	25.0	33.4	24	11

Table A12-1: Summary of Transport Project Performance Audits on IBRD Projects Initiated Between 1964 and 1972.

Project by Sector	Loan Amount (US $Million)	Project Execution (Years) Estimate	Project Execution (Years) Actual	Project Expenditures (US$ Millions) Estimate	Project Expenditures (US$ Millions) Actual	Economic Rate of Return % Estimate	Economic Rate of Return % Actual
Mali I Rialways	9.1	3.8	8.5	11.1	11.4	15	11
Senegal I Railways	9.0	3.8	7.4	13.9	12.9	25	23
India XI Railways	75.0	n.a.	n.a.	)	)	10	10
India XI railways	80.0	n.a.	n.a.	) 1,738.0)	) 1,743.0	13	13
Ports (Sea & Air)							
Cameroon I Douala Port	1.5	1.9	3.9	2.8	3.5	18	25
Gambia Banjul Port	2.1	3.1	6.6	2.4	5.3	18	14
Senegal Dakar International Airport	3.0	2.5	3.0	4.0	4.8	15	17
Pakistan II Karachi Port	17.0	4.1	21.8	37.5	46.6	9	20

Source: IBRD

AFRIQUE DE L'OUEST - RÉGION DU SAHEL
Villes et agglomérations
Capitales
Fleuves
Frontières
Le tracé des frontières indiqué sur cette carte ne signifie nullement que celles-ci ont été reconnues ou acceptées par la Banque Mondiale ou par les institutions affiliées
RESEAU DE TRANSPO
D'IMPORTA
RÉSEAU DE TRANSPORT
RESEAU EXISTANT:
Revêtues en dur
Gravier (sélectionnées)
Terre-gravier, terre, sable (sélectio
AMÉNAGEMENT DES ROUTES:
En construction
Project en cours de conception
Etude de faisabilité en cours
Zones du project du Groupe de la Banq sont situées les routes de desserte
Chemins de fer
Aéroports internationaux
Autres aéroports/aérodromes
Voies d'eau navigables
Nombre de mois navigables en année
Faisabilité douteuse à cause du Barra
MAROC
Aaiun
Tindouf
ALGÉRIE
SAHARA ESPAGNOL
Villa-Cisneros
F. Derick
Nouadhibou
Akjoujt
MAURITANIE
Tidjikda
NOUAKCHOTT
Rosso
St Louis
Richard Toll
Kaedi
Kiffa
Néma
Linguère
Thiès
DAKAR
SÉNÉGAL
Sénégal R.
Kaolack
Tambacounda
Koyes
BANJUL
GAMBIA
Ziguinchor
Kédougou
Bafata
GUINEE BISSAU
BISSAU
Labé
GUINÉE
Kouroussa
Mamou
Kankan
Océan Atlantique
CONAKRY
Kissidougou
FREETOWN
Bo
SIERRA LEONE
MONROVIA
Buchanan
LIBERIA
Harper
Ganta
Man
Odienné
Daola
Gagnoa
San Pedro
ABIDJAN
CÔTE D'IVOIRE
Bouaké
Agnibilekrou
Bole
Volta Noire
Volta Blanche
Navrongo
Tamale
Berekum
Kumasi
GHANA
Tema
ACCRA
Cape Coast
Sekondi-Takoradi
LOME
TOGO
DAHO
Mopti
Tombouctou
Gao
Niger
Ségou
BAMAKO
San
Djoulasso
Sikasso
Bougouni
HAUTE VOLTA
Ouahigouya
Ouagadougou
NIAMEY
MALI
Vers Oran
KILOMÈTRES
MILES
Golfe de Guin

AVEC PRINCIPAUX ITINÉRAIRES
ON ET D'EXPORTATION

PRINCIPAUX ITINÉRAIRES ACTUELS D'IMPORTATION ET D'EXPORTATION

1 Principal itinéraire du pays

2,3,4, 5,6 Itinéraires complémentaires et voies d'eau intérieures

+ Autre port utilisable

a, b, c Itinéraires provenant du même pays pour se fondre en un seul hors de la Région du Sahel

Ports

Sénégal
Mauritanie
Mali
Haute Volta
Niger
Tchad

TRANSPORTATION NETWORK WITH PRINCIPAL IMPORT/EXPORT CORRIDORS

TRANSPORTATION NETWORK

EXISTING ROADS:
- Hard surfaced
- Gravel (selected)
- Earth-gravel, earth, sand (selected)

ROAD DEVELOPMENTS:
- Under construction
- Project design phase
- Feasibility study phase
- Feeder road project areas, Bank Group

Railways
International airports
Other airports/airfields

Navigable waterways
Number of months usable for normal year
Feasibility questionable due to Kainji Dam

PRESENT PRINCIPAL IMPORT/EXPORT CORRIDORS

1 Principal corridor for country

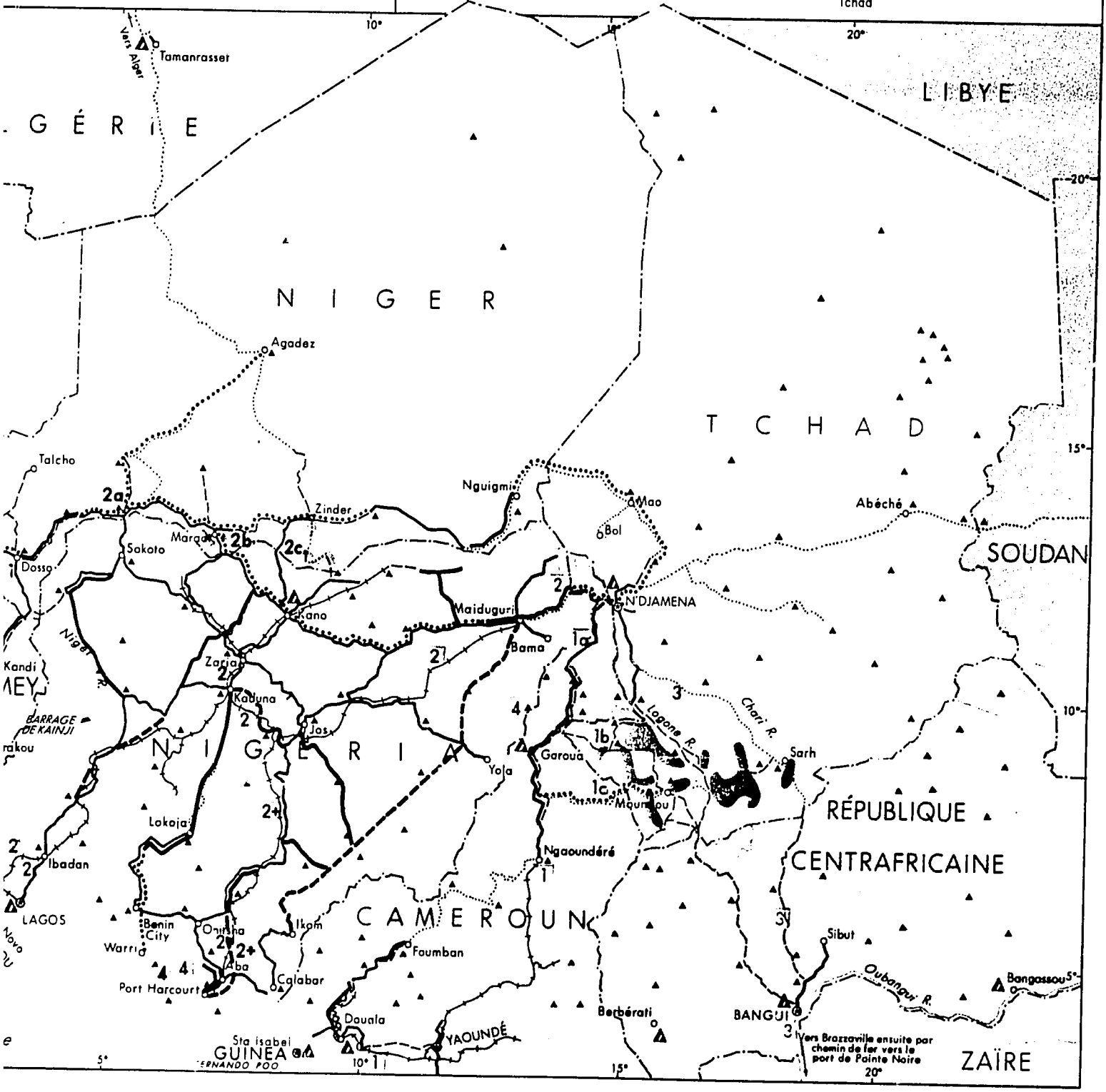
2,3,4, 5,6 Complementary corridors including country waterways

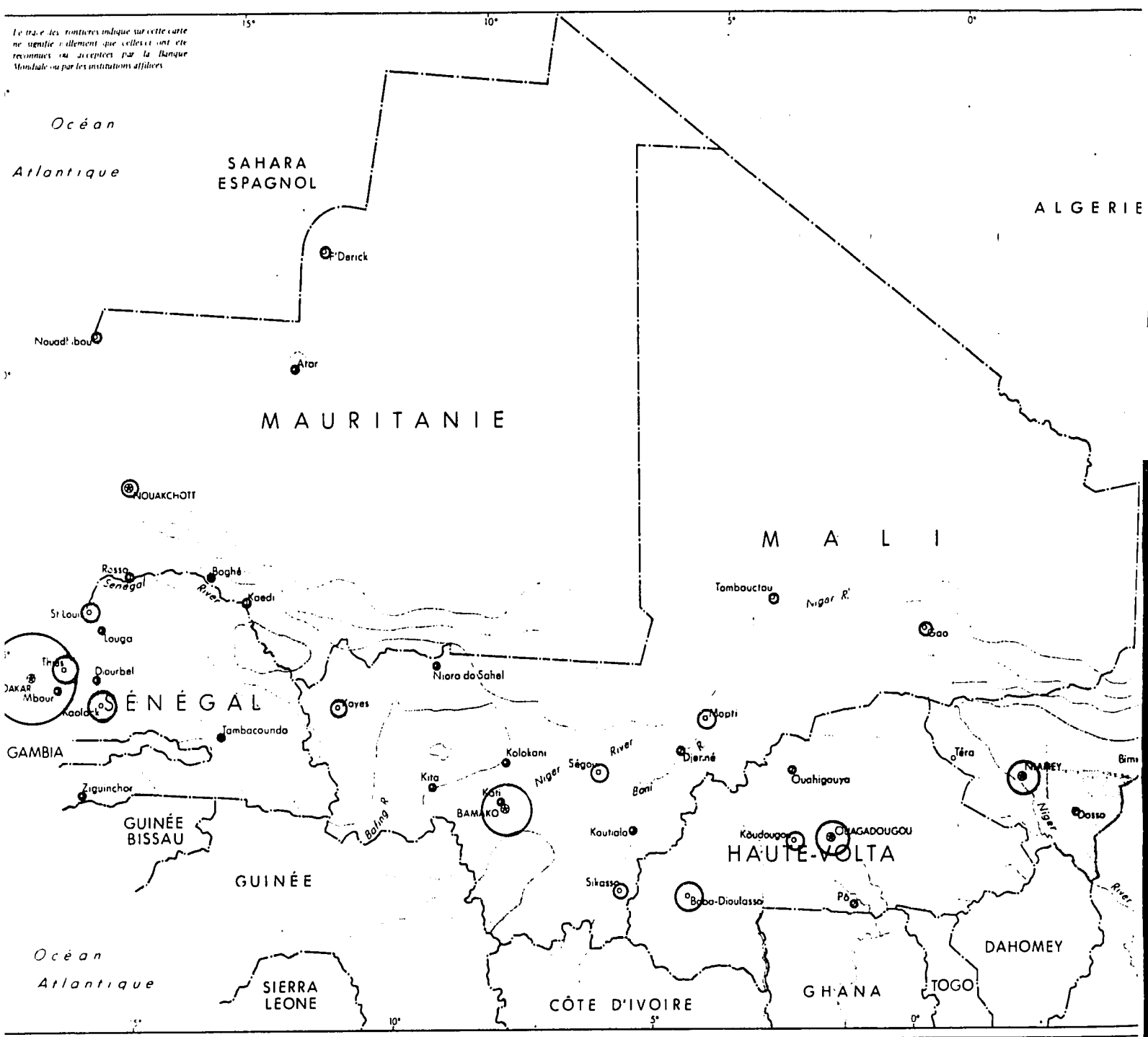
+ Alternate port available

a, b, c Multiple country corridors which merge to a single corridor outside Sahel Region

Ports

Sénégal
Mauritanie
Mali
Haute Volta
Niger
Tchad





JUIN 1974

RÉPARTITION DE LA POPULATION - SÉDENTAIRE ET URBAINE (ESTIMEE)

DENSITÉS DES POPULATIONS RURALES SÉDENTAIRES
(nombre d'habitants au km²)

- 00 - 05
- 05 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- >200

CENTRES AYANT UNE POPULATION ESTIMÉE SUPÉRIEURE À 10,000 HABITANTS

650,000
200,000
100,000
50,000
25,000
10,000

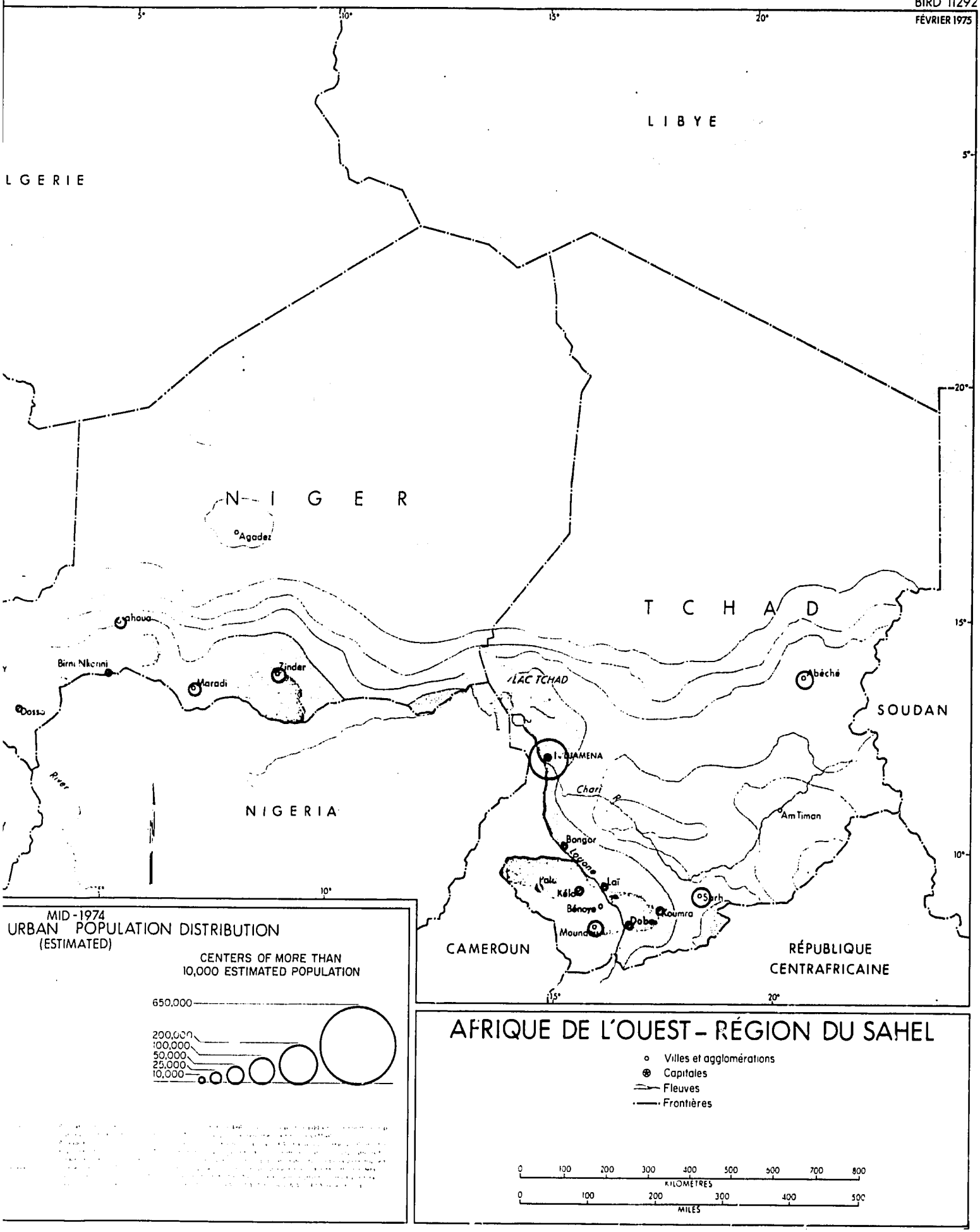
MID

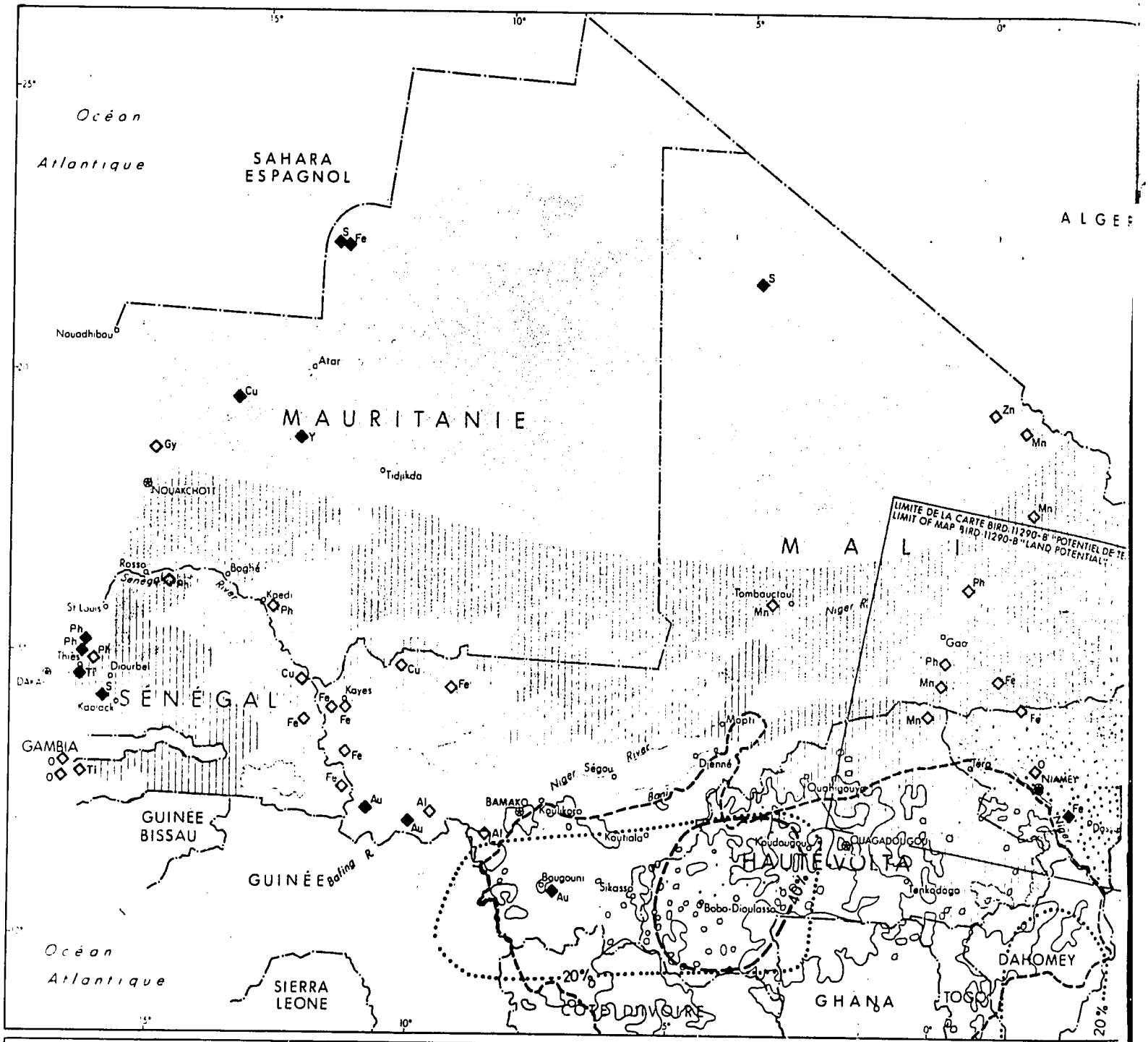
SEDENTARY AND URBAN (ESTIM

RURAL SETTLED DENSITIES
(population / km²)

- 00 - 05
- 05 - 25
- 25 - 50
- 50 - 100
- 100 - 200
- >200

BIRD 11292
FÉVRIER 1975





UTILISATION EFFECTIVE DES SOLS ET LIMITES

Sable[1]

Parc National ou Réserve Nationale[2]
Zone d'élevage[2]
Oasis[2]
Prédominance des cultures vivrières[2]
Predominance de cultures commerciales[2]

Zones d'endémicité d'onchocercose[3]
(Pour plus de détails voir BIRD 11290-A)
Limites de la zone du programme[3]

Puits permanent[1]
Puits temporaire[1]

20 %
40 %
60 %
Terres brûlées, en pourcentage, période decembre 1972 à mars 1973[4]

MINÉRAUX:

◆ Exploités – en cours d'exploitation
◇ Réserves connues

C Charbon	Ti Titane	Gy Gypse
Cu Cuivre	W Tungstène	N Natron
Au Or	U Uranium	O Prospection pétrolière
Fe Fer	Y Yttrium	Ph Phosphates
Mn Manganèse	Zn Zinc	S Sel
Sn Étain	Al Bauxite	

SOURCES

1. Série de cartes au 1:2 000 000e des services cartographiques de l'Armée américaine à Washington dont les données de base ont été établies à partir d'une série de cartes au 1:200 000e de l'Institut géographique national de Paris.

2. Régine Van Chi Bonnardel. Agrégé d'histoire et de géographie. Université de Paris. Atlas du continent africain. 1974.

3. Données communiquées sous les auspices du Programme des Nations Unies pour le développement (PNUD) de l'Organisation des Nations Unies pour l'alimentation et l'agriculture (FAO), de la Banque internationale pour la Reconstruction et le Développement (BIRD) et de l'Organisation mondiale de la santé (OMS). Rapport de la mission préparatoire d'assistance aux gouvernements des pays suivants: Côte d'Ivoire, Dahomey, Ghana, Haute Volta, Mali, Niger, Togo. La lutte contre l'onchocercose dans la zone du Bassin de la Volta. Genève 1973.

4. Walter Dashler. Université du Maryland. An Example of the Extent of Fire in Grassland and Savanna along the Southern Site of the Sahara. Exemple illustrant l'ampleur des feux dans les prairies et la savane longeant le sud du Sahara. Compte rendu du 9e Symposium international sur la photographie aérienne de l'environnement prise à partir de satellites (Volume II). Université du Michigan, Ann Arbor. pp 23 – 30 1974.

ACTUAL LAND USE WITH LIMITING FAC

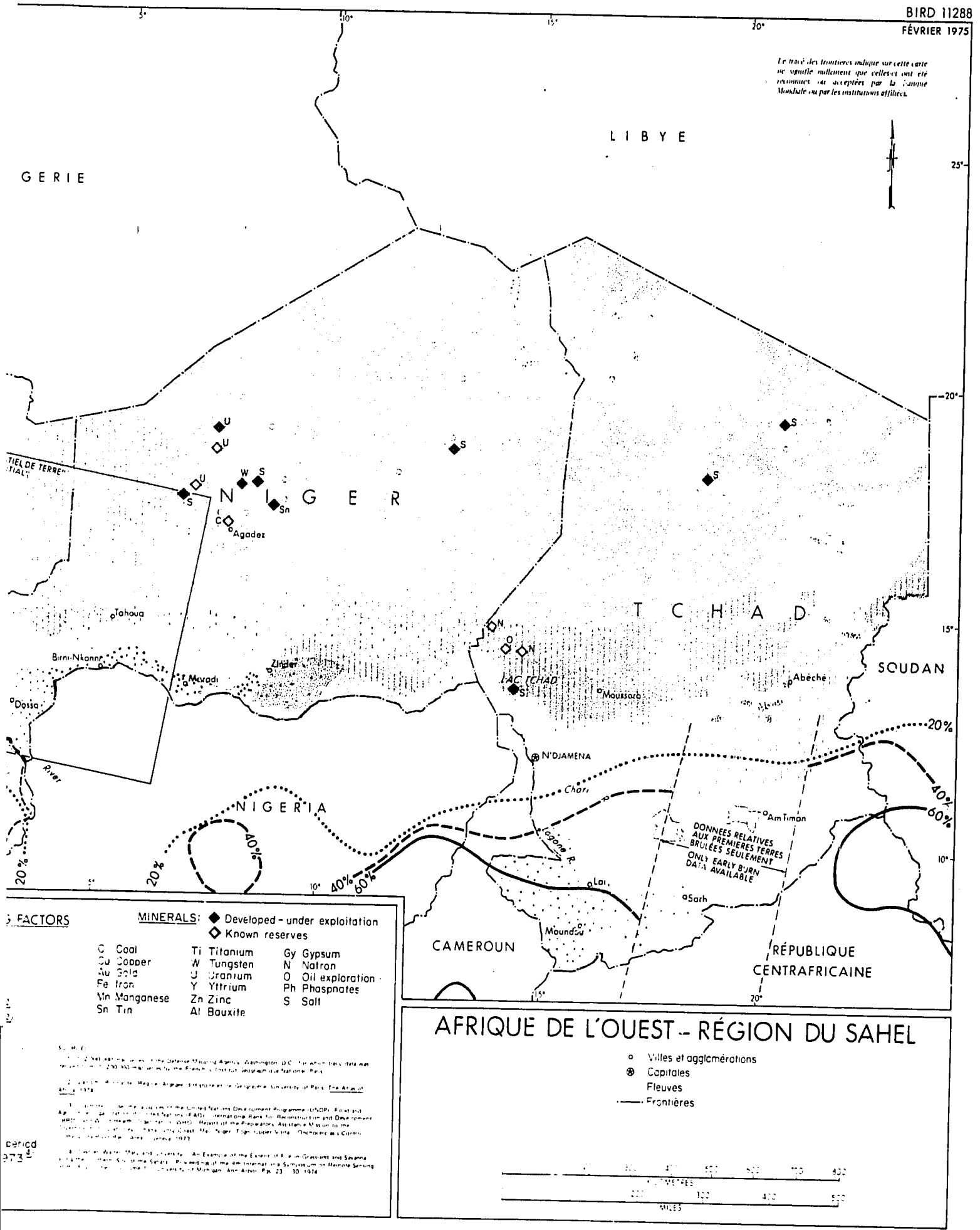
Sand[1]

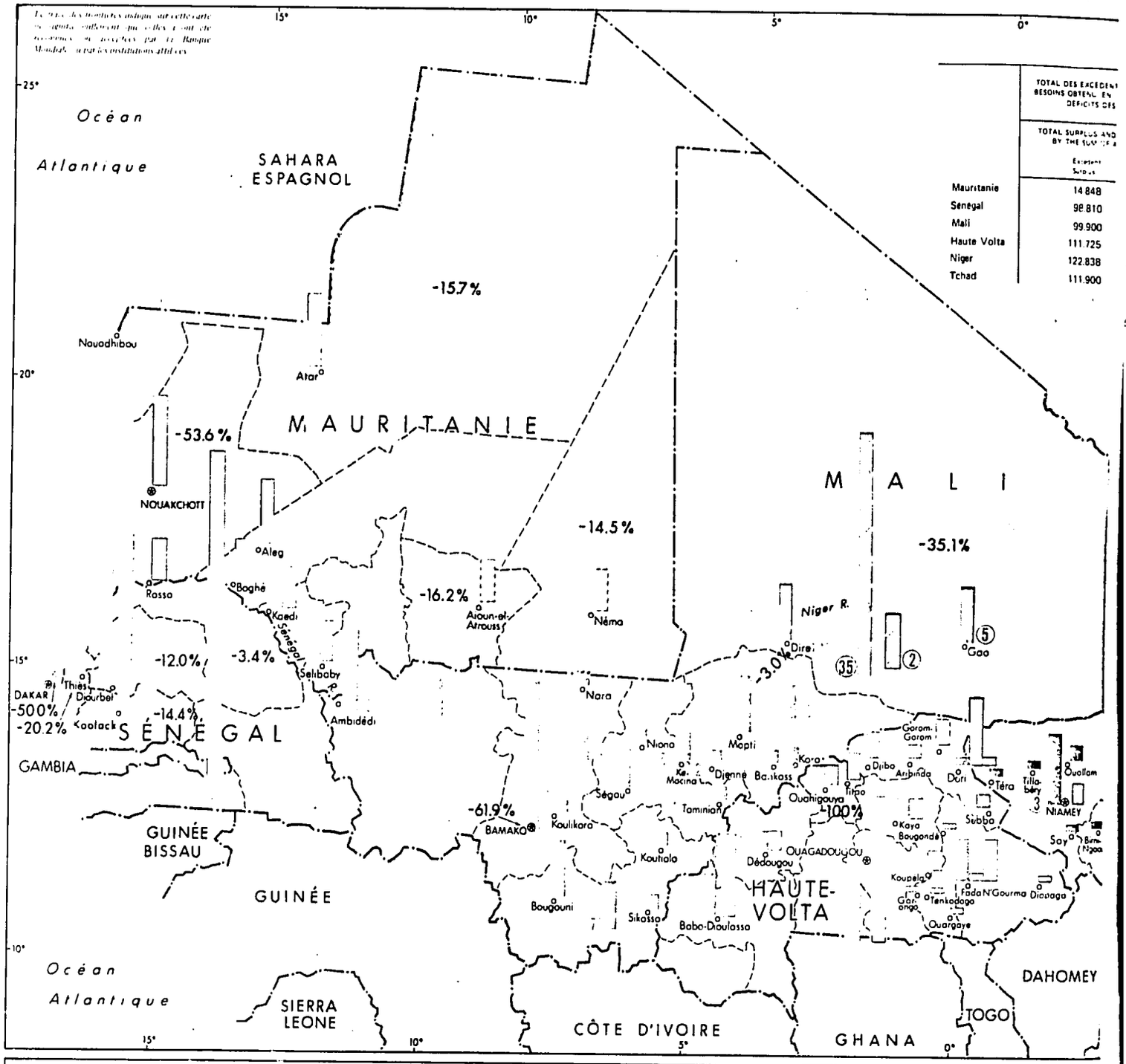
National Park or Reserve[2]
Livestock area[2]
Oasis[2]
Predominantly subsistence crop area[2]
Predominantly commercial crop area[2]

Occurrence of onchocerciasis[3]
(For details see BIRD 11290-A)
Limits of onchocerciasis program[3]

Permonent wells[1]
Temporary wells[1]

20 %
40 %
60 %
Burned areas, in percent, for period December 1972 to March 1973


Le tracé des frontières indique sur cette carte ne signifie nullement que celles-ci ont été reconnues ou acceptées par la Banque Mondiale ou par les institutions affiliées.
LIBYE
GERIE
NIGER
TCHAD
SOUDAN
NIGERIA
CAMEROUN
RÉPUBLIQUE CENTRAFRICAINE
Agadez
Tahoua
Birni-Nkonni
Maradi
Zinder
Dosso
LAC TCHAD
Moussoro
Abéché
N'DJAMENA
Chari
Logone R.
Am Timan
Lai
Sarh
Moundou
DONNEES RELATIVES AUX PREMIERES TERRES BRULÉES SEULEMENT
ONLY EARLY BURN DATA AVAILABLE
20%
40%
60%
MINERALS:
Developed - under exploitation
Known reserves
C Coal
Cu Copper
Au Gold
Fe Iron
Mn Manganese
Sn Tin
Ti Titanium
W Tungsten
U Uranium
Y Yttrium
Zn Zinc
Al Bauxite
Gy Gypsum
N Natron
O Oil exploration
Ph Phosphates
S Salt
AFRIQUE DE L'OUEST - RÉGION DU SAHEL
Villes et agglomérations
Capitales
Fleuves
Frontières
KILOMETRES
MILES



	TOTAL DES EXCÉDENTS BESOINS OBTENUS EN DÉFICITS DES
	TOTAL SURPLUS AND BY THE SUM OF A
	Existent Surplus
Mauritanie	14.848
Sénégal	98.810
Mali	99.900
Haute Volta	111.725
Niger	122.838
Tchad	111.900

REPARTITION GÉOGRAPHIQUE DE L'EXCÉDENT OU DÉFICIT CÉRÉALIER ESTIMÉ POUR UNE ANNÉE NORMALE ET DES INSTALLATIONS D'ENTREPOSAGE ESTIMÉES POUR 1974

ESTIMATIONS, POUR UNE ANNÉE NORMALE, DU POURCENTAGE D'EXCÉDENT OU DE DÉFICIT CÉRÉALIER DE CHAQUE DIVISION ADMINISTRATIVE 1/ PAR RAPPORT A L'EXCÉDENT OU DÉFICIT DE L'ENSEMBLE DU PAYS, EN FONCTION DES BESOINS ET DE LA PRODUCTION CÉRÉALIÈRE DESDITES DIVISIONS

Pourcentage des regions par rapport a l'ensemble du pays (excédent ou deficit)

EXCÉDENT ↑		+20 %
		+10 %
		0 %
DEFICIT ↓	0%-10%	-10%
	10%-20%	-20%
	>20%	

1/ Au Mali la répartition est faite par divisions géographiques et régionales.

RÉPARTITION DES INSTALLATIONS D'ENTREPOSAGE POUR L'ANNÉE 1974 ET CAPACITÉ D'ENTREPOSAGE EXPRIMÉE EN MILLIERS DE TONNES

INSTALLATIONS D'ENTREPOSAGE	Localisée et un point précis	Non localisée (Barre indique total des installations pour l'ensemble de la Division 1/ Administrative)
Existantes		
En cours de construction		
Prévues ou envisagées		

1/ Au Sénégal et au Tchad on trouvera une barre portant le nom du pays représentant le total des installations prévues ou existantes pour l'ensemble du territoire.

CAPACITÉ D'ENTREPOSAGE ECHELLE

TONNES (MILLIERS): 10, 8, 6, 4, 2, 0

Ce chiffre représente le nombre total d'installations quand il en existe plus d'une (dans ce cas il existe 5 installations représentant au total 10,000 tonnes)

ESTIMATED SPATIAL CEREAL AND S

ESTIMATED NORMAL YEAR SURPLUS OR DEFICIT IN PERCENT OF THE COUNTRY'S TOTAL FOR ADMINISTRATIVE DIVISIONS 1/ OF CEREAL/GRAIN REQUIREMENT, CONSIDERING THE AREA'S PRODUCTION

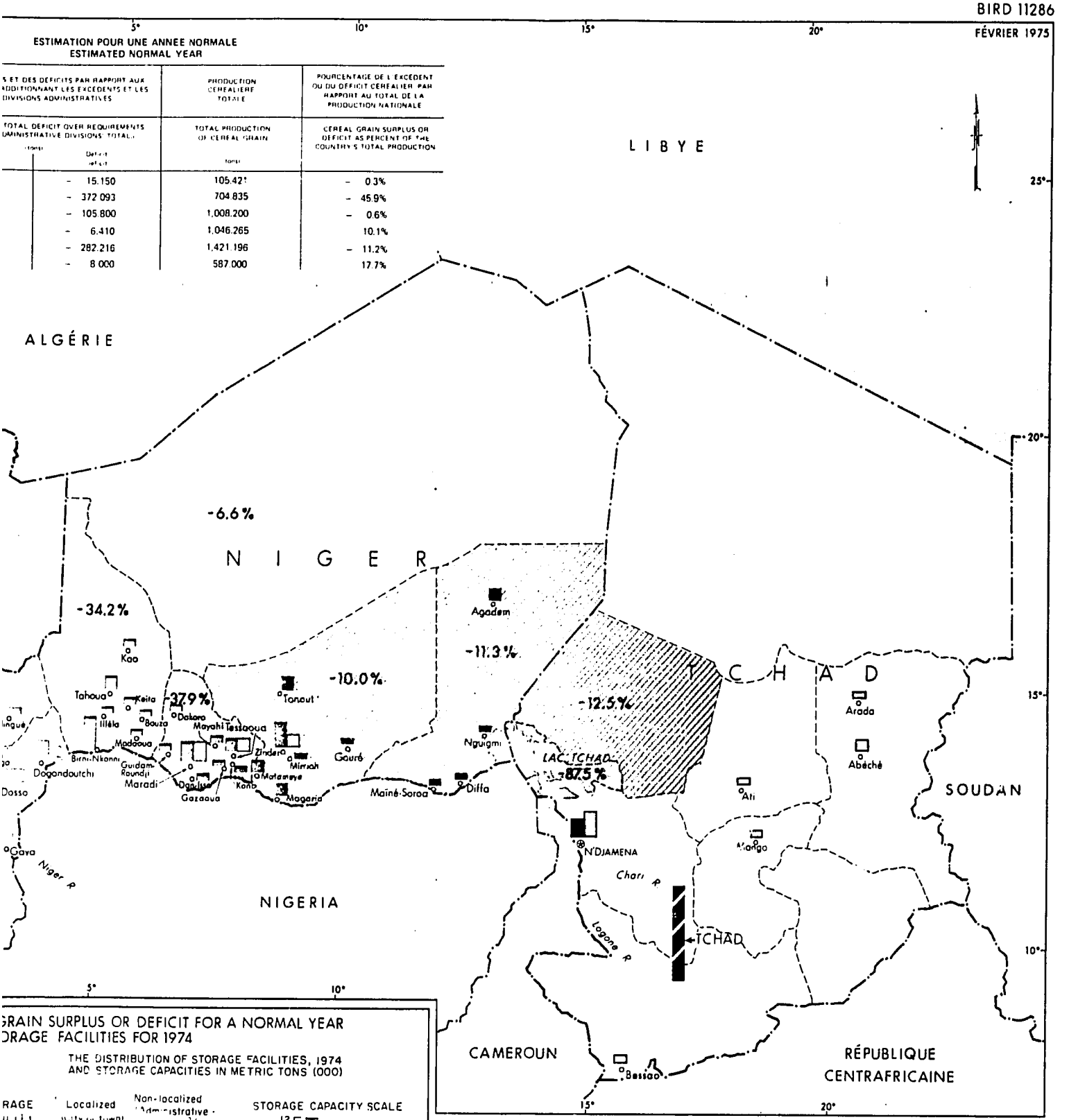
Area's percent of country total (surplus or deficit)

SURPLUS ↑		+20 %
		+10%
		0%
DEFICIT ↓	0%-10%	-10%
	10%-20%	-20%
	> 20%	

1/ Physical and regional divisions were utilized for Mali.

ESTIMATION POUR UNE ANNEE NORMALE
ESTIMATED NORMAL YEAR

S ET DES DEFICITS PAR RAPPORT AUX ADDITIONNANT LES EXCEDENTS ET LES DIVISIONS ADMINISTRATIVES	PRODUCTION CEREALIERE TOTALE	POURCENTAGE DE L'EXCEDENT OU DU DEFICIT CEREALIER PAR RAPPORT AU TOTAL DE LA PRODUCTION NATIONALE
TOTAL DEFICIT OVER REQUIREMENTS DMINISTRATIVE DIVISIONS TOTAL) (tons) Deficit	TOTAL PRODUCTION OF CEREAL GRAIN (tons)	CEREAL GRAIN SURPLUS OR DEFICIT AS PERCENT OF THE COUNTRY'S TOTAL PRODUCTION
- 15.150	105.421	- 0.3%
- 372 093	704.835	- 45.9%
- 105.800	1,008.200	- 0.6%
- 6.410	1,046.265	10.1%
- 282.216	1,421.196	- 11.2%
- 8 000	587.000	17.7%



GRAIN SURPLUS OR DEFICIT FOR A NORMAL YEAR
ORAGE FACILITIES FOR 1974

THE DISTRIBUTION OF STORAGE FACILITIES, 1974
AND STORAGE CAPACITIES IN METRIC TONS (000)

RAGE	Localized (city or town)	Non-localized (administrative division) 2/
isting		
der uction		
nned or oposed		

egal and Chad each have an agglomeration he entire country, which is indicated by the graph with the country name.

STORAGE CAPACITY SCALE

METRIC TONS (000)
12
10
8
6
4
2
0

5

Number indicates total installations when more than one (in this case there are 5 facilities which total 12,000 metric tons.)

AFRIQUE DE L'OUEST-RÉGION DU SAHEL

- Villes ou agglomérations pourvues d'installations d'entreposage
- Capitales pourvues d'installations d'entreposage
- Divisions administratives (Provinces, Régions, Départements et Préfectures)
- Frontières

0 100 200 300 400 500 600 700 800
KILOMETRES

0 100 200 300 400 500
MILES