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THE SAHEL EPIDEMIOLOGICAL AND ENVIRONMENTAL ASSESSMENT STUDIES

VOLUME ONE
of
THREE VOLUMES

International Health Programs Staff
AMERICAN PUBLIC HEALTH ASSOCIATION
Under Contract # AID/Afr-C-1253
for
Office of Development Resources
Bureau for Africa
Agency for International Development
Department of State
Washington, D.C.

FOREWARD

For more than thirty years the United States, through the Agency for International Development and predecessor agencies, has been involved in assisting the Lesser Developed Countries (LDC) of the world to achieve an increasing degree of self sufficiency that will in turn be reflected in an improvement in the quality of life of the residents of these countries. One of the most striking lessons learned in the pursuit of this goal is that a close association exists between poverty and disease. Nowhere is this association more evident than in Africa.

Life expectancy in many African countries is no more than 35 yrs. High prevalences of endemic diseases such as malaria, measles,and gastro-enteritis lead to infant mortality rates of more than 50%. Chronic mal-nutrition contributes to susceptibility to disease and further complicates the picture. Even for those who survive, the chronic disabilities brought about by onchocerciasis and schistosomiasis serve to greatly reduce the quality of their lives.

Experience has shown that development programs themselves can exasperate problems and further depress standards of community health. Irrigation schemes carry the risk of increased schistosomiasis and malaria transmission. Introduction of unfamiliar modern machinery increases the possibility of traumatic injury with which the existing health services are ill prepared to deal. Agricultural chemicals increase productivity but carry risk of serious environmental contamination. Economic development at the cost of human welfare is counter-productive and can be less desirable than no development at all.

In recognition of the desirability for development assistance to contribute to the fulfillment of basic human needs the Agency for International Development (AID) has established guidelines to assure that attending to

these needs will be central to development plans by making health assessments an essential part of program development.

The Sahel Epidemiological and Environmental Assessments Program

In order to plan better its assistance to Less Developed Countries (LDC's) in Africa, the Bureau for Africa, U.S. Agency for International Development issued a request for technical services to which the International Health Programs (IHP) staff of the American Public Health Association (APHA) responded.

In general, the AID request for services called for a core staff team of specialists, including a public health administrator, an environmental health specialist and an epidemiologist, with the help of appropriate consultants, to conduct Epidemiological/Environmental Health Assessments and Health Sector Assessments in the Lake Chad, Niger River and Volta River Basins of Africa. Additionally, Environmental Health Assessments were requested to be performed in Liberia and Swaziland.

The American Public Health Association entered into a contract agreement with the U.S. Agency for International Development (AID/Afr-C-1253) for it's International Health Programs staff to supply these technical services.

In accordance with the terms of the contract, a plan for the execution of the assessments was prepared and submitted to AID for approval. It was then circulated by AID/Washington to the appropriate in-country missions for responses from AID field personnel and host-country representatives.

The responses from the field missions indicated that each country's needs with regard to health assessments tended to be unique and may require significant modification on site of the basic plan if the assessments were to contribute to the overall AID development strategy for each country. The specific country needs identified included assessments of possible

adverse health impacts of existing and identified projects, providing data base for Project Identification Documents (PID), Project Review Papers (PRP), and Project Papers (PP), the updating of information in the country's Development Assistance Program Documents (DAP), provision of professional content for strategy papers and examination and assessment of existing programs for possible replication in new areas.

Closely following the perceived needs of the in-country missions, specific scopes of work were drafted and APHA selected appropriate consultants with proven skills in the required areas of expertise. When available APHA core staff members lead and/or participated in the field assessments. In all, APHA/IHP provided 10 assessment teams and health specialists to 3 developmental teams to conduct assessments in eight different African countries. In one half of these assessments, the team was required to accumulate original data on the prevalence of endemic diseases in the hos country by conducting field surveys. In these cases, personnel were selected who had prior experience in sampling, and identification of specimen materials and data collection. These teams were provided with field/laboratory equipment and charged with the responsibility for conducting limited field surveys.

The report has been prepared in three Volumes. Volume One contains the Description of the Project, the Initial Implementation Plan, Summaries of the Individual Country's Studies with Findings and Recommendations and an appraisal of the overall accomplishments of the project to date.

In preparation for and in support of the field studies, an extensive review of known and available literature pertaining to Schistosomiasis, Onchocerciasis, Malaria, Trypanosomiasis and Filariasis in Benin, Cameroon Chad, Liberia, Mali, Niger, Senegal, Swaziland, Upper Volta and Zaire was undertaken. The information produced constitutes Volume Two of the report.

Volume Three contains the individual team reports as prepared by each of the study teams.

This initial effort of the Health/Nutrition Division of the Office of Development Resources, Bureau for Africa/AID and the International Health Programs staff of the American Public Health Association to develop profiles of the primary endemic diseases in specific countries or regional areas has been an rewarding experience. Much more remains to be done as these studies will indicate.

For the accomplishments to date, we express our deep appreciation to all who assisted, particularly to Edward B. Cross, M.D., Principal Health Advisor for the Bureau for Africa and his staff, the participating consultants and their institutions which generously seconded their services to the project and to the cooperating USAID mission staffs, governments and institutions in the host countries.

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** Each report is a separate document with pages numbered individually for each report.

The Sahel Epidemiological and Environmental Studies

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The Sahel Epidemiological and Environmental Assessments

VOLUME ONE

PART A through Part D

A Study on Prevalence and Incidence of Five Major Endemic Diseases in Eight African States

International Health Programs Staff
American Public Health Association
Washington, D.C.

under

Contract # AID/Afr-C-1253
Office of Development Resources
Bureau for Africa
Agency for International Development
September 30, 1977

CONTENTS

SAHEL ENVIRONMENTAL AND EPIDEMIOLOGICAL ASSESSMENTS PROJECT

Part A - Introduction

A. Project Description

This report has been prepared in accordance with the terms of Contract No. AID/Afr-C-1253 entered into between the Agency for International Development (AID) and the American Public Health Association (APHA). The project is for a one year duration.

Under this contract, APHA provided technical services to AID so that the latter may give assistance to the Lesser Developed Countries (LDC's) in Africa in the development of health delivery systems to reach the poor majority. Specifically, the APHA, in agreement with AID and the host countries, conducted environmental and health sector assessments in an effort to determine current needs for future operational projects. The purpose of the assessments is to support AID plans for applied research projects designed to determine and develop the methodology for alleviating major parasitic endemic diseases such as trypanosomiasis, schistosomiasis, onchocerciasis, filariasis and malaria.

Although greater emphasis was placed on the major disease problems mentioned above, much consideration was given to related topics such as country policies, health manpower, nutrition, population, water resources development and the socio-economic impacts of the problems. The assessment teams also examined other infectious disease problems.

Countries immediately involved under this contract were Liberia, Swaziland, Chad, Upper Volta, Niger, Benin, Mali and Cameroon. Modification of the contract extended its scope to other African states. However, it has continued to be designated "The Sahel Epidemiological and Environmental Assessments."

The assessments were in-depth reviews and analyses of the problems, needs, facilities, and options available in health. Following is the Implementation Plan for the execution of the project. The plan was prepared by a multi-disciplinary team (APHA staff and consultants) assembled by International Health Programs staff/APHA at the Washington, D.C. offices.

B. Purpose

The assessments project is a supportive activity. The long range purpose of the assessments is to provide a basis for decision making for various projects proposed for socio-economic development and improvement of the quality of life in the countries involved. The assessments will help pinpoint problems to be solved, the availability of resources and recommendations for possible additional types of activities in support of proposed projects.

C. Project Objectives

Specific objectives of the project were:

1. to conduct environmental health assessments in Liberia, Swaziland, and selected sites in the Lake Chad and Niger River Basins; and
2. to conduct health sector assessments in selected sites of the Lake Chad and Niger River Basins.

D. Project Sites

Site selections have been based upon the prevalence and known distribution of the five major endemic diseases, population distribution and the location of development projects with direct and/or indirect health impacts. The initial sites were grouped into the following Project Areas, viz:

Project Area I: Liberia

Lofa and Bong Counties

Project Area II: Swaziland

Middle and Lower Velds

Project Area IIIa: Northern (Sazid) Zone, Chad Basin

Chad: N'Djamena-Bol-Moussoro
Niger: Diffa Department Zinder

Project Area IIIb: Southern (Lovid) Zone, Chad Basin

Chad: Bongor-Moundou-Logone Valley
Cameroon: Marova, Logone-Chari Department

Project Area IVa: Upper Niger Basin

Mali: Bamako-Segou
Mopti

Project Area IVb: Middle Niger Basin

Niger: Niamey-Gaya
Upper Volta: Bogande
Kantchari-Diapaga of Eastern Ord

Modification of the initial contract broadened the scope of the studies and extended their geographical coverage to include all African countries. As a result IHP staff were requested to undertake studies in five additional project areas:

Project Area Va - Senegal River Delta

Project Area Vb - Confluence of Senegal and Faleme Rivers Basins

Project Area VIa - Southern and Western Sudan

Project Area VIb - Sudan - National

Project Area VII - Zaire - Equateur Region

II. BACKGROUND INFORMATION

A. Health Significance

The lack of access to health services and the inadequacy of both health planning and management of scarce resources present great barriers to health in the African countries. The old environmental hazards, including poor community sanitation, are still the greatest problems within these developing countries. The principal health problems existing in both urban and rural Africa include:

- inadequate quantity as well as quality of water supplies;
- lack of proper waste disposal systems, leading to pollution of soil and water;
- the presence of flies, mosquitoes, rodents and other vectors of communicable diseases;
- inadequate and unhealthy housing;
- occupational health hazards;
- lack of manpower;
- lack of knowledge in public health practice among general populations; and
- inadequate health infrastructures.

Particularly pronounced in the African region are not only fecal and water-borne diseases, but parasitic diseases such as malaria, schistosomiasis, trypanosomiasis, onchocerciasis, and other filarial diseases which take the heaviest toll in human health.

The major parasitic and endemic tropical diseases such as trypanosomiasis (sleeping sickness), schistosomiasis (snail fever), onchocerciasis (river blindness), filariasis, and malaria cause widespread human suffering in Chad, Niger, Upper Volta, Mali, Cameroon and Benin. These diseases also severely hamper socio-economic programs/schemes, particularly agricultural and livestock development projects. These problems are due largely to the fact that the most fertile lands have become uninhabitable because of the prevalence of parasitic endemic diseases in the areas. Because the vectors or intermediate hosts for most of these diseases require surface water environments during their development stages, i.e. trypanosomiasis - tsetse fly, onchocerciasis - black fly, schistosomiasis - snails, and malaria - mosquitoes, any development of surface water resources and other national development schemes in tropical Africa will suffer severe constraints due to these major endemic diseases.

Prevalence/incidence data on the diseases mentioned above are often outdated or nonexistant. Currently planned comprehensive environmental health assessment studies, with an emphasis on the major endemic parasitic diseases, are badly needed. Such assessments in Liberia, Swaziland, and selected sites in the Lake Chad and Niger River Basin countries could be used to better determine the magnitude of the problem and update epidemiological prevalence/incidence data on the diseases and enhance proposed operational research programs for control of the major endemic diseases in the countries. Some of the lowest life expectancy rates are among the people in Africa. Life expectancy in Africa

is a meager 35-to-40 years, an age at which most healthy people in the developed countries of America and Europe consider themselves at the half-way point in their lives and can look forward to 30, or even 40, more years of active living.

Mortality causes are reliably known only in countries with well-organized registration services and where a high proportion of causes of deaths are established by physicians. For this reason only fragmentary information is available for these areas; unfortunately, it is the most fragmentary in those countries with the shortest life expectancies.

Schistosomiasis

This disease is a chronic debilitating one in which more than 200,000,000 people in the tropical and sub-tropical areas of the world are affected. It has been estimated that in Africa more than 150,000,000 people are at risk from the disease, with approximately fifty to seventy-five million being infected. The haematobium species of the parasite causes urinary schistosomiasis and is the predominant one affecting West Africa south of the Sahara, with Schistosoma mansoni, the causitive agent of intestinal schistosomiasis, being less common but potentially more serious. The disease is associated with still waters, such as lakes, swamps and irrigated areas. The disease must be considered as one of the risks associated with creation of new bodies of water (man-made lakes, etc.) in connection with water resources management and utilization projects such as for irrigation; hydro-electric dams; ponds and lakes for pisciculture and recreation;

and flood plain and swamp irrigation for rice.

From a socio-economic standpoint, schistosomiasis exacts a significant toll on the populations in general. In many African countries the infection rate among school age children may be as high as 60% - 70%.

Trypanosomiasis

Trypanosomiasis is transmitted by tsetse flies (Glossina sp) and is endemic in West, Central and East Africa.

There are two forms of the disease affecting humans, a chronic, debilitating type and an acute, often fatal variety. The chronic type is the most common; however, an outbreak of the acute disease around Lake Victoria during 1902-1905 reportedly killed approximately half of the population. Although actual prevalence of the disease is unknown, it has been estimated that approximately 35 million Africans are at risk from the disease in the 30 out of 58 African countries where the disease nas been reported. From an economic standpoint this disease serves as a serious obstacle to the development of much fertile land, not to mention loss of the use of thousands of square kilometers of grazing areas for livestock.

In as much as there is a type of trypanosomiasis which affects animals, particularly cattle, severe constraints to growing and maintaining herds of cattle are a direct result of the disease. The same vector (the tsetse fly) transmits both human and animal species of the disease, thus eradication of the vector could reduce the prevalence of the disease in both humans and animals.

The continuing migration of African people, some of whom may be infected with the disease, coupled with reinfestation of previously cleared areas by the tsetse fly, increase the possibility of larger outbreaks and pose a potentially serious health hazard.

Malaria

Malaria is the most serious health problem in Africa from a socio-economic standpoint. The disease is hyperendemic in practically all of sub-Sahara Africa, except South Africa and areas above 5,000 feet. It has been reported that malaria affects more than half of the children under five years and virtually the entire population at risk over that age group. It has also been estimated that malaria accounts directly for 10% of the deaths of children under five and a larger number as a secondary or associated cause of death in this age group.

In most of the African countries where malaria is endemic the problem is compounded by the fact that malaria eradication is not feasible because of financial, administrative and technical limitations. In essence, there are presently no satisfactory cost-effective and/or affordable technology or mechanisms to control the disease in Africa, to say nothing about the possiblity of its eradication. In the absence of peripheral health services and adequate health infrastructures, African countries have been unable to effect necessary surveillance and health education programs which are essential for the control of the disease.

The total economic loss, coupled with human misery produced by these diseases, greatly decreases the quality of life for the

population and prevents economic independency of the African countries under discussion.

Onchocerciasis

Onchocerciasis has been estimated to affect one million Africans. Although the disease has been reported in the mountain regions of East Africa and certain parts of the Congo forest, its most severe effects and highest prevalences are found in the Volta River Basin area of West Africa. In this area, out of a total population of ten million, 70,000 individuals suffer economic blindness. This disease is transmitted by the female "black fly" of the genus Simulium. Since the black fly which serves as the vector for the disease must breed and pass through the larval stage in areas associated with flowing streams or rivers, the disease is commonly referred to as "river blindness".

Although onchocerciasis is not a significant cause of mortality, it is a major cause of irreversible eye damage in Africa. In areas of high endemicity it is possible to find more than 10% of rural populations that are blind. Additionally, the infection is relatively refractory to existing chemotherapeutic agents.

From a socio-economic standpoint, the effects of the disease are very serious, particularly in hyperendemic areas. Affected families are more poverty stricken than others due to the inability of adult members to farm effectively. Affected villages are poorer than unaffected villages for similar reasons.

Onchocerciasis causes populations to resettle in upland areas to avoid the fly vector, thus abandoning fertile river areas; as a consequence, there is a marked decrease in agricultural productivity and a decline of economic well being of individuals and families. In addition, overcrowding results and this provides optimum conditions for spread of other communicable and contagious diseases.

Taking a year or more to develop in the human host, adult worms live just beneath the skin where they produce subcutaneous nodules, a characteristic feature of the disease. Though the microfilariae are found mainly in the skin, they may also migrate to the eye where they cause the ocular lesions.

Filariasis

Filariasis is produced in man and other vertebrates by certain filarial worms, eight different species of them in fact, six of which are found in Africa and all but one of which are transmitted by blood-sucking insects. The adult worms, or macrofilariae, live for ten to eighteen years in the lymphatic vessels and lymph nodes, connective tissues, serous membranes or skin. They produce microfilariae, their larvea, which find their way into the blood stream or the skin; from there they develop into the infective larvae. When the insect again feeds on man, the infective larvae are inoculated and grow into adult worms.

In some parts of Africa one of the filarial worms, Wucheraria bancrofti, is transmitted to man by mosquitoes. Frequent reinfection with this worm occasionally results in the debilitating condition known as elephantiasis.

B. Socio-Economic Impacts of the Diseases

There is a vicious circle from poverty to malnutrition and illness to the inability to work and back again to greater poverty. Tropical diseases which afflict such a large proportion of people represent a huge economic loss not only to the countries, but also to the individuals afflicted. It is well known that the lack of access to health services and the inadequacy of health planning and management of the scarce resources in the LDC's present great barriers to health, but the offenders of highest frequency in Africa are malaria, schistosomiasis, filariasis, onchocerciasis, trypanosomiasis, as well as intestinal diseases and leprosy. To date the control measures used against these diseases are yet ineffective and many of them are on the increase. Vector control methods are hampered by increasing cost of pesticides, by insecticide resistance and by the fear of the risk of further environmental pollution. The countries in question do not have the manpower in types of trained personnel, nor numbers required, nor the financial resources to do much, if anything, about the problems.

In some areas in the countries involved in the assessments, the diseases in question are hyperendemic. The hyperendemic states may be associated with or related to seasonal changes, major environmental changes such as drought or flood, massive acute nutritional imbalances, migration of herds or herdsmen, or industrial disturbance of the prevailing ecology. Hyperendemicity of each of these diseases will significantly affect the health of the community in one or more of the following ways:

1) There is an increase in the disability and/or death of the risk group. The risk group refers to those more environmentally exposed because of age, sex and occupation in that culture.
2) Contribute to the retardation of the physical, mental and social growth and development of the growing child, especially academic growth.
3) There is a decrease in physical vigor, industrial effectiveness (on the job) and positive environmental control planning.
4) The complications and sequelae of these diseases contribute to political unrest. This is especially true where physical disabilities and debilities are frequent, such as blindness and elephantiasis.
5) When several of these selected diseases are highly endemic or hyperendemic in the same area at the same time, the economic and industrial development may be virtually paralyzed by such catastrophic effects. When these debilitating conditions combine with the repeated droughts and the environmental expansions of the Sahara desert, the viability of the countries is threatened by their inability to maintain a quality of life.

Other environmentally related diseases such as trachoma, tuberculosis, measles, smallpox, typhoid fever, and cholera are also major problems and should be assessed. Another important group of problems are those which have a close relationship to child

birth and family living.

In the Sahel where a large proportion of the rural population has a close living relationship with animals, consideration given to the various zoonoses is very important.

The basic sanitary conditions of the homes, schools, towns and cities are reflected in the prevalence of many of the above health problems and should be given attention.

Part B. THE PLAN

A. Methodology

Using a system of overlays, the prevalence and distribution of the major endemic diseases as well as population density and distributions were plotted on large scale maps. So were the location of development projects (AID and others) with direct or indirect health impact. These included the agricultural, irrigation, sanitation and infrastructural projects related to the improvement of health delivery systems and the quality of life.

This overlay system was then used to select the sites within the countries of interest in the Niger River and Lake Chad Basins, Liberia and Swaziland.

Team selection for the various sites was then undertaken, based upon the health and related problems of the chosen sites

This information was then assembled in Table I showing the plan for the environmental health and health sector assessments by location in river basin, country and sites, health problems, development projects, assessment team composition and scope of work.

The field study teams for Liberia and Swaziland will be concerned only with the environmental health assessments as required by the Contract. However, it is felt that instead of separate environmental health and health sector teams for the Lake Chad and Niger River Basin countries, combined teams should

TABLE I

ENVIRONMENTAL HEALTH & HEALTH SECTOR ASSESSMENTS

PROJECT AREA I - LIBERIA

Location			Health Problems	Development Projects	Environmental Assessments	
Basin	Country	Sites			Team	Scope
	Liberia	1. Lofa County Kolahun-Voinjama Districts Zorzor District	Schistosomiasis Malaria Onchocerciasis Filariasis Trypanosomiasis Inadequate Sanitation Unsafe drinking water	Upper Lofa County Rural Development Project (ULCRDP) Rural Health	Physician/ Epidemiologist Malacologist/ Parasitologist Environmental/ Sanitary Engineer Vector Biologist	1. To carry out Environmental Health Assessment Studies in accordance with USAID environmental procedures directed primarily to the rural development projects in Lofa and Bong counties. 2. Assess the incidence and prevalence of major endemic diseases and their effects on the socio-economic development. 3. Assess what preventive measures (engineering, technological, biological) may be used to ameliorate the health hazards of those diseases. 4. Render assistance as requested in project development and/or evaluation. See "Appendix A" of Contract attached
		2. Bong County	Schistosomiasis Malaria Onchocerciasis Filariasis Trypanosomiasis Inadequate Sanitation Unsafe drinking water			

PROJECT AREA II - SWAZILAND

Location			Health Problems	Development Projects	Environmental Assessments	
Basin	Country	Sites			Team	Scope
	Swaziland	Middle & Lower Velds Centra ÷ Manzini	Schistosomiasis Malaria Inadequate Sanitation Unsafe drinking water	Schistosomiasis Control in Irrigated Areas Health Care Manpower	Physician/ Epidemiologist Malacologist/ Parasitologist Environmental/ Sanitary Engineer Vector Biologist	1. To carry out Environm Health Studies in accord with USAID environmental health assessment proced directed primarily toward the development of the p jected national schisto maisis control project. 2. Assist in developing t design of the evaluation plans for the project. 3. Assess what preventiv measures (technological, logical, engineering) ma used to ameliorate the h hazards of other major e diseases. See "Appendix A" of Contr attached

PROJECT AREA IIIa - NORTHERN (SAZID) ZONE, CHAD BASIN

Location			Health Problems	Development Projects	Environmental & Health Sector Assessments	
Basin	Country	Sites			Team	Scope
Chad	Chad	N'djamena-Bol -Moussoro	Malaria Trypanosomiasis Filariasis Schistosomiasis Onchocerciasis Inadequate Sanitation Health Resources and Infrastructure Weaknesses Unsafe drinking water	Polder Project (Irr. Agri.) Water Borne Parasites Health Infrastructure Mobile Vaccination Well Construction Integrated Rural Development	Physician/ Epidemiologist Social Anthropologist Malacologist/ Parasitologist Environmental/ Sanitary Engineer Vector Biologist Public Health Veterinarian	To carry out Environment Health and Health Sector Assessment Studies in accordance with USAID Procedures and terms of the contract.
	Niger	1. Diffa Dept.	Malaria Schistosomiasis Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	Basic Health Services Center Epidemiologic Surveillance	AS ABOVE	AS ABOVE
		2. Zinder	Malaria Schistosomiasis Inadequate Sanitation Health Resources and Infrastructure	Public Health School for Sahel Epidemiological Surveillance	AS ABOVE	AS ABOVE See "Appendix A" of Cont attached

PROJECT AREA IIIb - SOUTHERN (LOVID) ZONE, CHAD BASIN

Location			Health Problems	Development Projects	Environmental Health Sector Assessments	
Basin	Country	Sites			Team	Scope
Chad	Chad	Bongor-Moundou Lagone Valley	Malaria Trypanosomiasis Filariasis Schistosomiasis Onchocerciasis Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	Integrated Rural Development	Physician/ Epidemiologist Social Anthropologist Malacologist/ Parasitologist Environmental/ Sanitary Engineer Vector Biologist Public Health Veterinarian	AS ABOVE
	Cameroon	Marova in Lagone-Chari Department	Malaria Trypanosomiasis Filariasis Schistosomiasis Onchocerciasis Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	National Health Sector Support - Surveillance and Nutrition Staff Assistance to University Center for Health Sciences (CUSS) Livestock Development	AS ABOVE	AS ABOVE See "Appendix A" of Con attached

PROJECT AREA IVa - UPPER NIGER BASIN

Location			Health Problems	Development Projects	Environmental & Health Sector Assessments	
asin	Country	Sites			Team	Scope
iger	Mali	1. Bamako-Segou	Malaria Schistosomiasis Onchocerciasis Trypanosomiasis Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	Haute Vallee: Agriculture Nara and Dilli: Livestock Central Veterinary Laboratory Road Construction Rural Health Services Medical School	Physician/ Epidemiologist Social Anthropologist Malacologist/ Parasitologist Environmental/ Sanitary Engineer Vector Biologist Public Health Veterinarian	To carry out Environmental Health and Health Sector Assessment Studies in accordance with USAID Procedures and the terms of the USAID/APHA Contract.
		2. Mopti	Malaria Schistosomiasis Trypanosomiasis Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	Crop Production	AS ABOVE	AS ABOVE See "Appendix A" of Contract attached

PROJECT AREA IVb - MIDDLE NIGER BASIN

Location			Health Problems	Development Projects	Environmental & Health Sector Assessments	
Basin	Country	Sites			Team	Scope
Niger	Niger	Niamey-Gaya	Malaria Schistosomiasis Onchocerciasis Trypanosomiasis Filariasis Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	National Health - Grant Support National School of Public Health	Physician/ Epidemiologist Social Anthropologist Malacologist/ Parasitologist Environmental/ Sanitary Engineer Vector Biologist Public Health Veterinarian	To carry out Environment Health and Health Sector Assessment Studies in accordance with USAID Procedures and the terms the USAID/APIA Contract.
	Upper Volta	Bogande' Kantchari - Diapaga of Eastern Ord	Malaria Schistosomiasis Onchocerciasis Filariasis Trypanosomias Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	Farm Market Centers Engineers Training Center Road Construction Integrated Rural Development Catholic Relief Services Well Construction Language Training Center	AS ABOVE	AS ABOVE

See "Appendix A" of Cont
attached

PROJECT AREA IVb - CONTINUED

Location			Health	Development	Environmental & Health Sector Assessments	
Basin	Country	Sites	Problems	Projects	Team	Scope
Niger	Benin	Malanville (Borgou Dept.)	Malaria Schistosomiasis Onchocerciasis Trypanosomiasis Filariasis Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	Entente: Food Production	AS ABOVE	AS ABOVE See "Appendix A" of Contr attached

ROJECT AREA IVb - CONTINUED

Location			Health Problems	Development Projects	Environmental & Health Sector Assessment	
asin	Country	Sites			Team	Scope
iger	Mali	3. Gao	Schistosomiasis Trypanosomiasis Inadequate Sanitation Unsafe drinking water Health Resources and Infrastructure Weaknesses	Crop Production	AS ABOVE	AS ABOVE See "Appendix A" of Contr attached

TABLE II

FIELD ASSESSMENTS - TIME ALLOTMENTS

Location	Number	Teams Type	Members	Time On Site (Months)	Man Months
1. Liberia	1	Env.	4	1-1/4	5
2. Swaziland	1	Env.	4	1	4
3. Chad Basin					
a. Northern Zone (Sazid)	1	Env/H	6	1-1/4	7-1/2
b. Southern Zone (Lovid)	1	Env/H	6	1-1/4	7-1/2
4. Niger Basin					
a. Upper	1	Env/H	6	1-3/4	10-1/2
b. Middle	1	Env/H	6	1-3/4	10-1/2
TOTAL	6		32		45

quirements. These are shown in the Time Allotment Table, II. It may or may not be necessary for the full teams shown to be in the field at the same time. Also, members of a team may be transferred to another site or country upon completion of an assignment. The schedule of field assessments is shown in Figure I, while the complete performance plan is shown in Figure II.

The Field Assessments Budget Estimates are given in Table III.

Points of Emphasis

1. The primary concern is to conduct the studies in areas where AID has projects in operation and/or planned, yet keeping in mind that the planning team may not necessarily confine the studies only to those sites if major problems dictate the need for studying other sites.

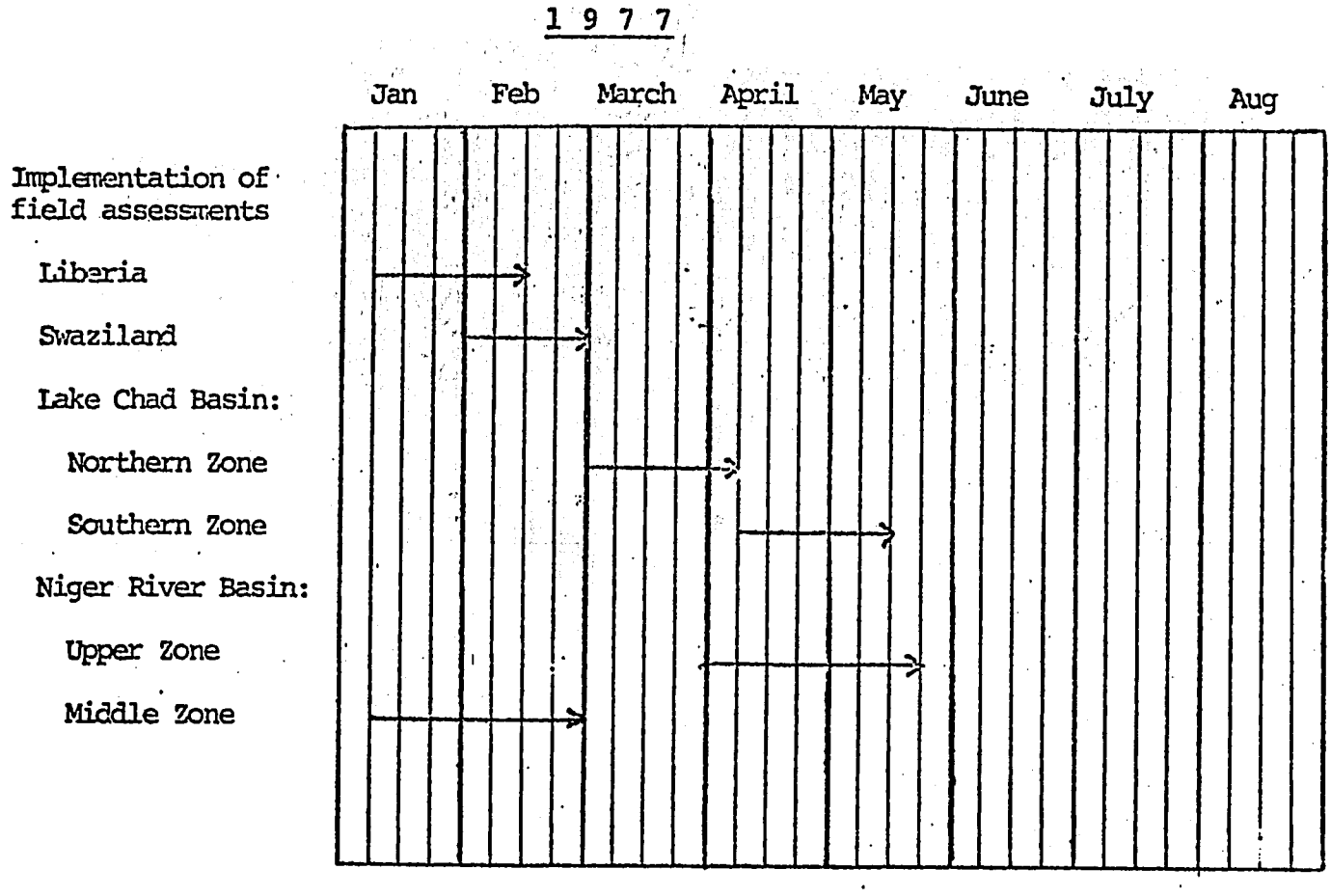
2. Time spent examining the many AID projects, completed, ongoing or planned, should be an important part of the orientation of each member of the team. Any activity that has made the level of becoming a project, whether successful or not, has had a background of important study which should be carefully reviewed.

3. One example is the Chad project (1978, AID, Budget Submission, P. 183) to help develop an improved rural health delivery system in the LOVID and SASID Zones of Chad. This project, as described, has many elements which, besides improving the delivery of health services, should make fundamental contributions to the capacity of the M.O.H. in Chad.

4. Primary emphasis is being placed on the five major endemic diseases given in the project contract, but this does not mean that the study teams will necessarily omit consideration of other infectious disease problems and necessary recommendations for solutions.

FIGURE I

FIELD ASSESSMENTS - IMPLEMENTATION SCHEDULES



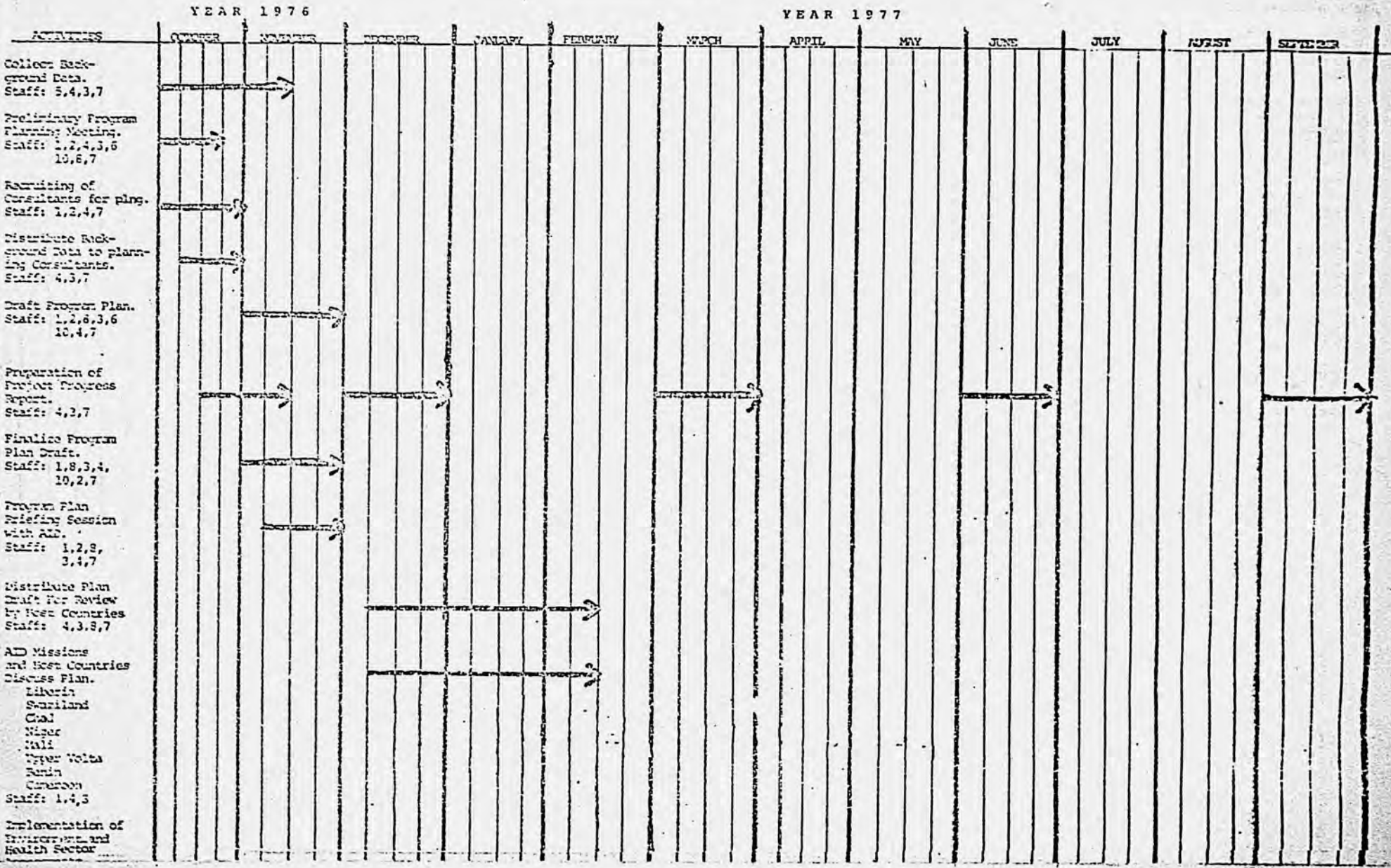
AMERICAN PUBLIC HEALTH ASSOCIATION
PROJECT PERFORMANCE PLAN
ONE YEAR DURATION

Contract No. AID/AFR-C-1253
Contract Title: Sahel Epidemiological and Environmental Assessments

FIGURE II

Project No. 698-11-99-135
Contract Signed: August 9, 1976

Sahel Epidemiological and Environmental Assessments



Liberia
Staff: 8,10,3,6
Swaziland
Staff: 8,10,3,5
Lake Chad Basin
Northern Zone
Staff: 8,6,3,10,12,13
14, Southern Zone
Niger River Basin
Upper Zone
Staff: 8,6,10,3,10,13
14 Middle Zone 11,13,

Progress Reports on Environmental Assessments.
Staff: 1,4,8,3,7

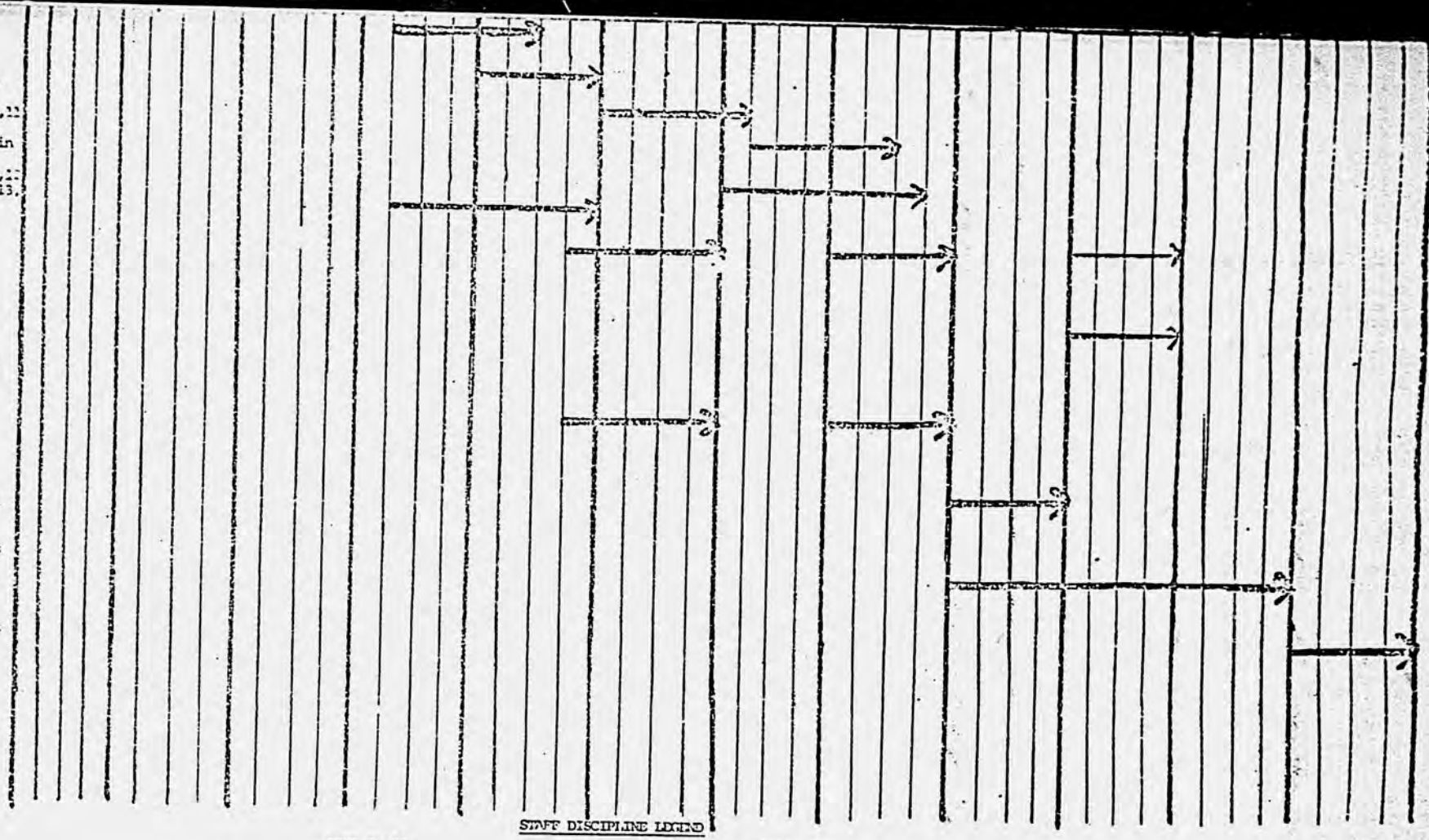
Prepare Combined Environmental Assessments Report
Staff: 1,8,3,4,7

Progress Reports on Health Sector Assessments.
Staff: 1,8,3,4,7

Prepare Combined Health Sector Assessments Report.
Staff: 1,8,3,4,7

Prepare Assessments Report Package.
Staff: 1,2,8,3,4,7

Briefing Session on Finalized Report with AID.
Staff: 1,2,8,3,4,7



STAFF DISCIPLINE LEGEND

AFHA Staff

Project Director——1
Executive Assistant to Associate Director——2
Environmental Health Specialist——3
Public Health Administrator——4
Research and Information Specialist——5
Vector Biologist/Entomologist——6
Secretary——7

Field Teams

Physician/Epidemiologist——8
Social Anthropologist——9
Malacologist/Parasitologist——10
Environmental/Sanitary Engineer——11
Public Health Veterinarian——12
Rural Sanitarian——13
Nutritionist——14
Health Services Manpower Planner——15

TABLE III

FIELD ASSESSMENT BUDGET ESTIMATES

ost Components	Liberia 4 people 5 weeks	Swaziland 4 people 4 weeks	Lake Chad Basin 6 people 5 weeks	Lake Chad Basin 5 people 5 weeks	Niger River Basin 6 people 7 weeks	Niger River Basin 6 people 7 weeks	TOTALS
taff Assessment Teams							
Salaries (6 day week @ $140/day)	16,800	13,440	25,200.	25,200	35,280	35,280	151,200
Per Diem	7,560 ($54)	3,584 ($32)	9,660 ($46)	9,660 ($46)	9,450 ($45)	9,450 ($45)	49,364
ommodities	900	900	1,100	1,100	1,100	1,100	6,000
ther Costs							
In-country travel	3,200	3,000	6,000	6,000	7,200	7,200	32,600
Translation and Secretarial Services	200	200	1,000	1,000	1,500	1,500	5,400
						TOTAL	$244,564

5. Primarily the field teams are concerned with the six countries, Chad, Upper Volta, Niger, Benin, Mali and Cameroon in the Sahel group, but there may be studies recommended to be done in other countries along the basins if problems of sufficient magnitude dictate the need.

6. Special effort is made to plan activities of the project within the given span of time, one year, and within the given budget specified in the contract.

7. The team will bear in mind that studies which are considered of sufficient importance but too long to be carried out at this time should be mentioned in the assessments.

8. Field sampling and laboratory tests of specimens to further determine the magnitude of the disease problems will be undertaken as deemed necessary.

9. Vector densities are expected to be low during the periods of the assessments in sites located in Mali, Niger, Upper Volta, Benin, Chad and Cameroon, due to the dry season. Swaziland will be in its rainy season which will have a greater potential for increased vector densities.

10. There is general agreement throughout the areas where assessments will be carried out that malaria is the most serious of the major endemic diseases. Schistosomiasis, onchocerciasis, filariasis, and trypanosomiasis, are the other major endemic diseases.

11. Information relative to investigative work on vector bionomics, as well as specific malariometric data for the subject

countries and sites of the environmental assessment studies have not been found among reference materials made available to the Planning Team.

12. Cetre Maz at Bobo Dioulassa, Upper Volta, has made significant contributions relative to the bionomics of the primary malaria vector, Anopheles gambiae.

13. In the absence of malariometric data at the country sites, consideration may be given to estimating the malarial prevalence by splenic examination of children between the ages of two and ten. In a malarious area, adults are more or less immune and their spleens are diminished in proportion.

14. When collecting malariometric data from local health records, adequate consideration should be given to the usual diagnostic method for the determination of a malaria case.

15. In the absence of a more complete clinical diagnosis, including blood smear examination and charting the periodicity of the fever, clinics and small health posts in both rural and urban areas often consider the presence of or complaint about fever as a positive sign of malaria. Usually, these health service units have neither the knowledge or skill to carry out a differential diagnosis of malaria. Such a procedure entails a knowledge of all fevers, both tropical and non-tropical.

B. Review of Relevant Reports and Documentation

The Sahel is a semi-arid zone of approximately two million square miles extending in a band between 11 degrees and 24 degrees

north latitude across the African continent extending 2,600 miles eastward from the Atlantic Ocean. It forms the transition zone between the Sahara Desert and the more fertile lands to the south.

It includes large parts of the world's six poorest countries; Mali, Niger, Chad, Upper Volta, Senegal and Mauritania. Similar harsh environmental conditions characterized by frequent, protracted droughts affect the nearby Cape Verde Islands and Gambia which together with the previous six mentioned countries form the Permanent Interstate Committee for Drought Control in the Sahel, (CILSS).

The Sahel spans the three major river basins of the Senegal and Niger Rivers and Lake Chad and the two lesser basins of the Gambia and Volta Rivers. This project is, however, concerned with the environmental and general health conditions in the basins of the Niger River and Lake Chad and particularly the countries of Mali, Niger, Upper Volta, Benin, Cameroon and Chad. Environmental health assessments in two rural counties of Liberia and in Swaziland pertaining mainly to endemic schistosomiasis are also included in this project.

The protracted drought of 1968-1973 throughout the Sahel created very severe human suffering and deprivation which dramatically revealed the basic and unresolved socio-economic development problems of the region.

By 1975 the donor countries had completed initial studies to determine the long-term development needs of the region. The Massachusetts Institute of Technology's "Framework for Evaluating Long-Term Strategies for the Development of the Sahel-Sudan Region",

funded by the United States Agency for International Development, was among the first of these. Several other important studies were published by the World Bank, the FAO, the UNDP, various French agencies and by AID itself (Development Assistance Program, 1976 - 1980, Central and West African Region, revised November 1975). Many of these are listed in the accompanying references.

These initial studies generally agree that:

- it is necessary to plan for the Sahel as a single entity;
- the task is long-term in nature (20-30 years);
- The long-term objective of the region should be as defined by the CILSS: food self-sufficiency in the context of accelerated economic and social development;
- an integrated approach is necessary in which agronomists, river basin engineers, educators, health specialists and others work together.

It is precisely this form of integrated approach that has been adopted by the APHA in planning the assessment of the environmental health and health sector needs of the region. The same approach will be continued through the implementation of the field studies in providing the health inputs to the socio-economic development of the region.

The planning team reviewed the considerable volume of available reports and documents listed in the references with a view to obtaining information pertinent to its planning task.

Of particular importance were AID's Reports to the United States Congress entitled, "Proposal for a Long-Term Comprehensive Development Program for the Sahel." These provided guidance on the role, policy and strategy of AID in the development and execution of long-term plans for the Sahel.

The Syncrisis Series and AID's Development Assistance Programs, FY 1975 for the countries of interest have been important sources of information and planned development health problems and their interactions. So were AID's Annual Budget Submissions, FY 1978.

Another major source of information was the several reports on various specific aspects of health needs in these countries which were undertaken with AID and other donor financing. Particularly significant has been AID's "Health in Africa," a comprehensive strategy proposal to be pursued by the Africa Bureau, USAID.

C. Environmental Health Problems

The environmental health assessments are required to lay emphasis on the major endemic diseases, viz., schistosomiasis, onchocerciasis, trypanosomiasis, malaria and filariasis in the recipient countries.

These diseases do indeed constitute the major health constraints to the socio-economic development of the region. In some areas of the major basins being considered these diseases are hyper-endemic. Hyperendemicity of these diseases results in many very adverse effects on community health, among which are:

- a very significant increase in the disability and/or mortality of those who are environmentally exposed because of age, sex, occupation and cultural factors;
- retardation of the physical, mental and social growth and development of the growing child, especially intellectual growth;
- decrease in physical vigor, industrial effectiveness and positive environmental control planning;

- severe physical disabilities and debilities such as blindness and elephantiasis which in addition to the adverse economic impact may also contribute to political unrest;

- virtual economic paralysis with catastrophic effects where several of these diseases are simultaneously hyperendemic.

When these effects are combined with the repeated, protracted droughts of the area, expansion of the Sahara Desert and other harsh environmental conditions it becomes only too obvious why the viability of the countries is threatened and the quality of life is substandard.

It is paradoxical that economic development of the region can further exacerbate the existing poor health conditions. To achieve the very desirable long-term objective of food self sufficiency, agriculture must be intensified. Concomitant with this is the need for the storage of large bodies of irrigation water, the flooding of lands for the growth of rice, the staple crop. These bodies of water can provide the environment for the proliferation of the insect vectors (flies, mosquitoes) and intermediate hosts (snails) of the major endemic diseases.

Furthermore, the modern practices of intensified agriculture such as the use of insecticides, pesticides and fertilizers will pollute water supplies and introduce additional health problems. So will large scale larviciding and molluscicide for vector and intermediate host control.

It is very important, therefore, that environmental health considerations play a major role in the socio-economic development of these countries. Yet these considerations have generally

received very little attention. Control measures against the endemic diseases have been limited mainly to chemotherapy. The use of environmental engineering measures to sever links in the chain of infection has been virtually non-existent. These measures may include the use of siphons in dams to vary reservoir water levels and thus destroy insect larvae and snail hosts of the disease organisms.

Existing studies indicate that poor sanitation is characteristic of essentially all of the areas. Yet sanitation is perhaps the most important single factor in the prevention and control of these diseases. Sanitary sewage disposal facilities, for instance, will ensure that the eggs of the schistosome organisims do not reach the fresh water habitats of the snail intermediate hosts. The severing of this link prevents infection of snails and consequently subsequent human infection.

Similarly, the provision of adequate water supplies will considerably reduce the need for human contact with the water habitats of the insect vectors and intermediate hosts of the disease-producing organisms.

The environmental health considerations related to schistosomiasis in two of the project areas, Liberia (Lofa County) and Swaziland, have been analysed in studies done, respectively, by the San Juan Laboratories of the Center for Disease Control (CDC) and Drs. Jobin and Jones. Dr. Nebiker's report on his study in the Senegal River basin for AID/APHA appears to have considerable relevance for similar sites within the project areas.

Evident throughout all of the literature is the need for greater emphasis on sanitation and the use of preventive as well as therapeutic measures.

D. Health Sector Problems

Like the environmental health studies, the health sector assessments are required to place emphasis on the major endemic diseases. In this case, however, the approach will be to assess the ability of the existing infrastructure to cope with these diseases as well as with problems of nutrition, population and other major health impediments.

The health infrastructure of each area is taken to include the total resources devoted to improving health and the quality of life. While the major responsibility for these tasks traditionally resides with the Ministry of Health (MOH), there are frequently private and international organizations such as mission clinics, the World Health Organization, Africare, the Peace Corps and the Center for Overseas Pest Research operating within the areas.

Population information from the census bureau produces information which is vital for planning educational institutions devoted to the training of medical and paramedical workers are also an essential part of the health infrastrucutre and as such play a vital role in implementation of planned programs.

The ministry for the development of water resources is rarely considered to be part of the health infrastructure but its policies are crucial to the spread of water and vectorborne diseases.

In short, many agencies, public, private and international, which are conventionally excluded from the decision-making process of the health sector, should be assessed for their potential and active participation. Any opportunity to interrelate these resources should be indentified and assessed as to the benefits that could be derived from expanding cooperative efforts.

On a more direct level, the assessment must include an evaluation of government policies for dealing with problems of medical care delivery, vector control, immunization against internationally important diseases, maternal and child care, zoonoses, nutrition, population dynamics and health manpower needs. This evaluation should include a consideration of how well these policies are being implemented and whether they are designed to meet future as well as present needs. Of particular importance is the evaluation of the extent to which the rural populations benefit from the health sector policies.

Another important aspect of the health sector assessment is the establishment of the extent to which the host country has provided for the manpower needs in terms of training programs and schools.

In order to preserve the interdisciplinary nature of the plan it is considered prudent to bring environmental and sector elements together as closely as possible so that team resources will not be dissipated in isolated considerations. For example, official attitudes toward water resource development, prevailing standards of sanitation and mosquito breeding sites can be considered

in isolation. However, they are so interrelated that if they are assessed by a multidisciplinary team using an integrated approach, considerably more usefulness can be achieved.

A common finding of all the available reports is the inadequacy of relevant health data with which to undertake problem solving. Population census figures are often inaccurate or unavailable. While for some diseases prevalence data are available, the very important incidence and intensity of infection data are non-existent. Generally, systems have not been established for the collection, processing and use of these types of data. The health sector assessments must examine the major health problems to determine basic information needs and the systems required to ensure that those needs are met. Problem solving cannot proceed in the absence of these basic data.

In summary, the health sector assessments must be concerned with the identification of the broad spectrum of health problems and all approaches to, and measures for their solution. Preventive, as well as curative and control, measures must receive their due attention. Administrative structure, human and financial resources are of fundamental importance for the continued implementation of programs.

E. Terms of Reference

On behalf of the American Public Health Association (APHA) and in accordance with Appendix "A of the AID/APHA Contract No. AID/Afr-C-1253 and the AID Environmental procedures, the field teams shall conduct Environmental Health Assessment studies in

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Scope of Work

1. In conducting the environmental field studies the team shall perform the following scope of work:

- Assist in the design of evaluation plans for health projects/programs.
- Assist in collection and analysis of pre-project implementation baseline data, as well as collection of subsequent data for project/program evaluation.
- Assist in conducting program/project evaluations for AID's purposes.
- Conduct epidemiological studies as to the incidence and prevalence of major endemic diseases.
- Assess constraints imposed by endemic diseases on plans for socio-economic development.
- Assess what preventive measures may be undertaken to either prevent worsening of the disease problem or ameliorate the health hazard (engineering, technological, biological, etc.)
- Assess what control measures and/or eradication measures are needed and could be used in a manner to complement development and improve the quality of life for the people.
- Assess what role potable water supply and environmental sanitation may play in controlling or preventing endemic diseases.

- Assess the impact that ecological and environmental changes due to socio-economic development will have on health and quality of life of the people.

- Make appropriate recommendations for pragmatic solutions to the problems.

- Prepare a report on the results of the overall environmental health assessment studies. The report should also include identification of areas and opportunities for relevant endemic disease control projects and recommendations for possible AID intervention in the environmental health area.

The field teams shall also conduct Health Sector Assessments in

_____

_____

_____

2. In conducting the Health Sector field studies the teams shall perform the following scopes of work:

a. Health Structure

- Analyze capability of Ministry of Health (MOH) to plan and project health needs. Evaluate adequacy of MOH staff, both centrally and in the field, to perform assigned tasks.

- Assess MOH capability for management and/or administration of health resources.

- Assess adequacy of health information data system, and determine whether it is appropriately used or capable of being used for planning.

- Assess the adequacy of facilities in terms of equipment, accessibility and whether or not such have been planned on basis of health priorities.

- Analyze linkages between public supported health services/institutions and those supported by non-governmental institutions.

b. Health Problems and Policies

- Analyze major health impediments to improve quality of life and increase productivity of the people.

- Analyze budgetary allocations of MOH, both in terms of curative and preventive health services; assess trends in allocation and use of health related activities, allocations and relevancy of health manpower training programs.

- Carry out financial economic analyses in the health sector; capability of government to carry out planned programs.

c. Health Manpower

- Analyze the levels and types of health manpower available including appropriateness/capability of health personnel to function in plans for rural health manpower, as well as needs for training both existing and newly recruited health manpower needed to implement expanded health program for rural populations particularly.

- Assess alternatives as to mixes of various levels of manpower to develop a total health manpower system.

- Assess and rank alternatives for health manpower systems to reach rural populations.

- Assess cost-benefits of various health manpower development alternatives including in-country training vs. out-of-country training; field training vs. training in urban centers, etc.

- Assess health manpower training capabilities in-country and determine what additional resources are needed to strengthen or improve training capabilities of host government.

d. Nutrition

- Assess the level of nutrition and major nutrition problems in-country.

- Assess the impact of inadequate nutrition on health and quality of life of the people.

- Review and assess plans or programs to improve nutrition of population, particularly for women and children.

- Assess and make recommendations as to how problems of malnutrition may be ameliorated, particularly at rural or community levels.

e. Population

- Assess the policy and/or lack of policy in the area of population/family planning.

- Assess the population and quality of life of the people.

- Assess the existence and the effects of migration or mobility of the population, i.e., rural to urban migration, nomadic practices, etc.

- Assess the adequacy of demographic and/or population dynamics data.

The team will prepare a report on overall problems in the health sector of the Sahel, based upon the completed health sector assessments. The report should also identify opportunities for project developments in the areas, as well as recommendations on possible assistance strategy in the health sector of the Sahel area.

- The team leader is responsible for management of the country visit.

- Upon arrival in the country of assignment the team leader must report to the USAID mission official who will serve as the principal first contact.

- The assessments should be conducted in collaboration and with participation of the host country (ies).

- The team shall cooperate with the relevant USAID mission (s) in the country/region and through the mission (s) wi the recipient nation.

- The team shall inform the mission (s) and the relevant national governments of the nature of its findings prior to its departure from the recipient country (ies).

- The team shall prepare and submit a draft copy of its report to the AID mission official prior to its departure from the host country and provide a copy for the American Public Health Association within ten days of its return to the United States.

IV. REFERENCE REVIEW

The following list of publications is of particular value in relation to the Sahel Epidemiological and Environmental Assessments Project.

1. APHA/USAID - Regional Public Health Training in Central Africa - OCEAC, 1971-1976

2. WHO - Field Visit Report: Upper Volta, December 1973

3. Jobin, W.R. and Jones, C.R. - Report of a joint consultation bilharzia control in Swaziland, USAID/WHO, February 1976. Describes bilharzia situation in Swaziland and offers recommendations on various aspects of ways in which disease can be combated.

4. American Universities Field Staff, West Africa Series

   a) DuBois, Victor D. - The Drought in West Africa, Part I: Evolutionary Causes and Physical Consequences, Vol XV, No. 1, November 1973

   b) DuBois, Victor D. - African Development Planning, Vol XV, No. 3, June 1972

   c) DuBois, Victor D. - The Drought in West Africa, Part II: Perception, Evaluation and Response, May 1974

   d) DuBois, Victor D. - The Drought in West Africa, Part III: The Logistics of Relief Operations, May 1975

   e) DuBois, Victor D. - The Drought in Niger, Part I: The Physical and Economic Consequences, July 1974

   f) DuBois, Victor D. - The Drought in Niger, Part II: The Overthrow of President Hamani Diori, December 1974

   g) DuBois, Victor D. - The Drought in Niger, Part III: The Flight of the Malian Tuareg, December 1974

   h) DuBois, Victor D. - The Drought in Niger, Part IV: The New Refugee Camp of Lazaret, December 1974

   i) DuBois, Victor D. - Food Supply in Mali, April 1975

5. Tropical Health, A report on a study of needs and resources. Division of Medical Sciences Publication 996. National Academy of Sciences, National Reserach Council, Washington, D.C. 1962

6. Manual on Practical Entomology in Malaria, Parts I & I, WHO 1975

7. Newell, Kenneth W. - Health by the People, ed. WHO 1975

8. USAID - Capital Assistance Papers. Background Notes, Department of State: Cameroon, Niger, Mali, Upper Volta, Swaziland, Liberia, Chad, Dahomey (Benin)

9. U.S. Government Post Report - Dahomey (Benin)

10. Service, M.W. - Survey of Relative Prevalence of Potential Yellow Fever Vectors in Northwest Nigeria. Bull, WHO Vol 50, No. 6, pp. 475-576

11. Natural Resources by Developing Countries; Investigation Development and Rational Utilization - United Nations, Official Records of the Economic and Social Council, 39th session

12. Food and Nutrition Strategies in National Development - Ninth Report of the Joint FAO/WHO Expert Committee on Nutrition, WHO, Geneva 1976

13. WHO Expert Committee on Filariasis - Third Report WHO Techn. Report Series, No. 542, 1974

14. African Trypanosomiasis - Report of a Joint FAO/WHO Expert Committee. WHO Techn. Report Series, No. 434, 1969. Distribution, impact, methodology for dealing with it, including treatment, vector control, planning.

15. Comparative Studies of American and African Trypanosomiasis - Report of a WHO Scientific Group. WHO Techn. Report Series, No. 411, 1969

16. WHO Expert Committee on Yellow Fever - Third Report, WHO Techn. Report Series, No. 479, 1971

17. Manson-Bahr, Sir Philip H. - Manson's Tropical Diseases, 16th Edition, The Williams & Wilkins Co., Baltimore

18. Health Sector Policy Paper - World Bank, March 1975. Assesses health situation in developing countries. Examines the impact of poverty on health, and ill health on economic development. Analyzes trends in health policy in member countries and offers suggestions for reform.

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APPENDIX I

Equipment and Supplies

Because the final composition and numbers of the assessment teams have not been established, the various participants could not be consulted as to their specific equipment needs. However the following list is considered to be fairly comprehensive and should not depart substantially from the final form.

Equipment required by each team:

1. Binocular compound microscope (1) mirror type equipped with ocular micrometer.
2. Binocular stereo microscope preferably with mirror and zoom capability.
3. Hand lens 10 x (1 per team member)
4. Heavy duty rubber hip boots (1 per team member)
5. Heavy duty flashlight 6-9volt. (floatable) with extra batteries (3)
6. White enamel pans 6" x 12" (4)
7. Dissecting instrument sets including straight and curved forceps and needles dropper pipettes, plastic ruler.
8. Mosquito net - standard double size (1)
9. Scoop net - insect collection (2)
10. Wire mesh dip net - snail collection (2)
11. Metal dipper with curned handle; about 4" diameter (2)
12. Large straight forceps 8" (2)
13. Entomological forceps (2)
14. Hand operated centrifuge (1)
15. Wire Test Tube Rack (3)

Non Expendable (reusable) Supplies

1. Conical flasks - urine sedimentation - 3 dozen
2. Small plastic salve boxes - insect storage - 1 gross
3. Flat bottom screw capped vials 1" x 3" - snail storage - ½ gross
4. Graduated centrifuge tubes 15 ml. - ½ gross
5. Glass microscope slides - 2" x 3" - 1 gross
6. Glass microscope slides standard size - 2 gross
7. Glass dropper pipettes with rubber teat - 4 dozen
8. Plastic Petridishes - standard size - 1 gross
9. Plastic Petridishes - small ½ gross
10. Plastic bottles - 1 qt. size - 1 dozen
11. Plastic bottles - 1 pt. size - 1 dozen
12. Plastic bottles - 4 oz. size - 1 dozen
13. Glass dropping bottles - 4 oz. size - ½ dozen
14. Test tubes Pyrex - 100mm x 10mm - 1 gross

Expendable Supplies (Hardware)

1. Disposable sterile lancets - finger stick blood collect.
2. Cotton (absorbent) - 2 boxes
3. Applicator sticks - wooden - 1 box
4. Plastic stool containers - 2 gross
5. Self adhesive labels - 2 packages
6. Dupont cellophane (for kato stool exam) Available on request.
7. Glass coverslips - 22 x 22mm - 3 gross
8. Plastic Slide Storage Boxes - (5)
9. Rubber bands - 1 box
10. Magic markers - 5 red, 5 black - (Alcohol base)

Expendable Supplies (Reagents)

1. Glycerine
2. Malachite green stain
3. Giemsa stain
4. Ethyl Alcohol
5. Formaldehyde 40%
6. Lugol's Iodine (Saturated)
7. Physiological saline

APPENDIX II

Contract No. AID/afr-C-1253

APPENDIX "A"

I. General

The Contractor shall provide technical services to A.I.D. so that the latter may provide assistance to LDC's in Africa in development of health delivery systems to reach the poor majority. Given the large number of African countries requiring such assistance, the specific objective of this contract will be to provide technical services in the following areas of activities in selected areas/countries in Africa:

A. Environmental Health Assessments in the major Basin Areas (Lake Chad, Niger River, and Senegal plus Liberia, Swaziland, and Zaire) with emphasis on major endemic diseases (Schistosomiasis, Onchocerciasis, Trypanosomiasis and Malaria).

B. Health Sector Assessments in the Lake Chad and Niger River Basin Areas.

II. Specific

The majority of the technical services will be provided in Africa, in multidisciplinary team settings and consisting of varying mixes of categories of health professionals. The location, timing and composition of the teams will be along the following general lines and will under all circumstances be initiated with the Contracting Officer's prior written approval.

A. Environmental Health Assessment Studies

In the initial planning for the studies the Contractor will carry out the following efforts for the Major Basin Areas:

--Review available reports and documentation on the magnitude of the problems from endemic diseases in the countries/areas to be studied in the Sahel;

--Plan environmental health assessment studies in the Sahel;

--Select and/or identify the team members and/or technical expert composition of teams; and

--Develop Scopes of Work and Terms of Reference for the study teams.

The following field studies will be conducted:

1. Liberia (Lofa and Bong Counties) - The contractor will provide technical services to carry out environmental health assessments studies in connection with rural development projects.

2. Swaziland - The contractor will conduct environmental assessment studies and/or pre-project implementation studies/planning, with emphasis on schistosomiasis control.

3. Lake Chad Basin - The contractor will conduct environmental health assessment studies in selected sites in the Lake Chad Basin area.

4. Niger River Basin - The contractor will conduct environmental health assessment studies in selected sites within the Niger River Basin Area.

In conducting the field studies the Contractor shall perform the following scope of work:

--Assist in the design of evaluation plans for health projects/programs.

--Assist in collection and analysis of pre-project implementation baseline data, as well as collection of subsequent data for project/program evaluation.

--Assist in conducting program/project evaluations for AID's purposes.

--Conduct epidemiological studies as to the incidence and prevalence of major endemic diseases.

--Assess constraints imposed by endemic diseases on plans for socio-economic development.

--Assess what preventive measures may be undertaken to either prevent worsening of the disease problem, or ameliorate the health hazard (engineering, technological, biological, etc.).

--Assess what control measures and/or eradication measures are needed and could be used in a manner to complement development and improve the quality of life for the people.

--Assess what role potable water supply and environmental sanitation may play in controlling or preventing endemic diseases.

--Assess the impact of ecological and environmental changes due to socio-economic development will have on health and quality of life of the people.

--Make appropriate recommendations for pragmatic solutions to the problems.

--Prepare a final report on the results of the overall environmental health assessment studies. The report should also include identification of areas and opportunities for relevant endemic disease control projects and recommendations for possible AID intervention in the environmental health area.

B. Health Sector Assessment Studies in the Sahel (Lake Chad and Niger River Basin Areas)

In the initial planning for the studies the contractor will carry out the following efforts for planning for the field studies for Health Sector Assessments in selected sites of the Sahel:

--Review available reports, data and documentation on health sector problems in the Sahel.

--Plan the actual health sector assessments to be done in selected sites in the Sahel.

--Select and/or identify the team members to carry out the health sector assessments.

--Develop Scopes of Work and Terms of Reference for the studies.

e following field studies will be conducted:

Lake Chad Basin Area and Niger River Basin Area - The contractor will provide technical services to carry out health sector assessments in selected sites.

In conducting the field studies the Contractor shall perform the following scopes of work:

Health Structure

--Analyze capability of Ministry of Health (MOH) to plan

and project health needs. Evaluate adequacy of MOH staff, both centrally and in the field, to perform assigned tasks.

--Assess MOH capability for management and/or administration of health resources.

--Assess adequacy of health information data system, and determine whether it is appropriately used or capable of being used for planning.

--Assess the adequacy of facilities in terms of equipment, accessibility and whether or not such have been planned on basis of health priorities.

--Analyze linkages between public supported health services/institutions and those supported by non-governmental institutions.

Health Problems and Policies

--Analyze major health impediments to improve quality of life and increase productivity of the people.

--Analyze budgetary allocations of MOH, both in terms of curative vs. and preventive health services; assess trends in allocation and use of health related activities, allocations and relevancy of health manpower training programs.

--Carry out financial economic analyses in the health sector; capability of government to carry out planned programs.

Health Manpower

--Analyze the levels and types of health manpower available including appropriateness/capability of health personnel to function in plans for rural health manpower, as well as needs for training both existing and newly recruited health manpower needed to implement expanded health program for rural populations particularly.

--Assess alternatives as to mixes of various levels of manpower to develop a total health manpower system.

--Assess and rank alternatives for health manpower systems to reach rural populations.

--Assess cost-benefits of various health manpower development alternatives including in-country training versus out of country training; field training versus training in urban centers, etc.

--Assess health manpower training capabilities in-country and determine what additional resources are needed to strengthen or improve training capabilities of host government.

Nutrition

--Assess the level of nutrition and major nutrition problems in-country.

--Assess the impact of inadequate nutrition on health and quality of life of the people.

--Review and assess plans or programs to improve nutrition of population particularly for women and children.

--Assess and make recommendations as to how problems of malnutrition may be ameliorated, particularly at rural or community levels.

Population

--Assess the policy and/or lack of policy in the area of population/family planning.

--Assess the population and quality of life of the people.

--Assess the existence and the effects of migration or mobility of the population, i.e., rural to urban migration, nomadic practices, etc.

--Assess the adequacy of demographic and/or population dynamics data.

Contractor will collate, edit, prepare and publish a final report on overall problems in the health sector of the Sahel, based upon the completed health sector assessments. The report should also identify opportunities for project developments in the areas, as well as recommendations on possible assistance strategy in the health sector of the Sahel area.

III. Reports

The Contractor shall submit the following reports (20 copies) to AFR/DR:

A. Draft report of implementation plans for field studies on or about October 1, 1976.

B. Draft Health Sector Assessment for each such study conducted within 30 days after completion of study.

C. Draft Environmental Health Assessment Report for each such study within 30 days after completion of study.

D. Technical Team report for each team assignment within 30 days after completion of assignment.

E. Technical reports on the magnitude of the problems in the health sector and endemic disease problems in the areas studied within 30 days after completion of study.

F. Quarterly Review and Progress Report.

G. Final report of overall results of all studies, including pertinent recommendations within 60 days after completion of all studies.

Part C - Findings and Recommendations

TABLE OF CONTENTS

CHAD - Northern Zone

1. Objectives

A four-member team visited the Northern Zone of Chad from March 16 through April 22, 1977 with the following objectives:

- To identify the major endemic disease problems in the Bol, Moussoro and N'Djamena areas of the Republic of Chad.
- To identify the relevant environmental factors responsible for disease transmission.
- To assess any existing programs or plans with environmental health significance.
- To make recommendations and develop alternative proposals for any further surveys, projects or control programs complimentary to those planned or in existence, including essential health infrastructural requirements for maintaining and improving the health status of the communities particularly those within the rural development project areas.

Upon AID/Chad's request and with AID/Washington's agreement, the areas of Moussoro and N'Djamena were deleted from the scope of work.

2. Team Composition

The team was comprised as follows:

Roy Mark Malan, M.D. - Epidemiologist, Team Leader

Joe Haratani, M.S. - Sanitary Engineer

Curt Schneider, PhD. - Malacologist

Andrew Spielman, Sc.D- Malariologist

3. Background Information

The Bol-Polder Project represents the principal focus of economic

development in that vast region of central and northern Chad lying between the capital city (N'Djamena) and the Lybian border. The Project represents an extension of traditional attempts at agricultural exploitation of peripheral bottomland of Lake Chad. Eventually, sufficient land may be developed near the town of Bol to constitute a significant contribution to the Chadian economy and to employ numbers of local farmers. Many other Chadians will benefit from secondary employment generated by the Project.

"Polder" is adopted from a Dutch word coined to describe diked farmland claimed from the sea. Land-form in the Bol region presents certain unique advantages for construction of polders in that numerous elongated islands project into a large shallow lake. Thus, a few short dikes serve to isolate large polder areas. Once isolated, the impounded region is pumped dry in order to expose the extraordinarily fertile soil that covers the botton of Lake Chad. Although rainfall is minimal, water for irrigation is readily available from the Lake. These advantages are offset by the difficulty of maintaining the polder, once constructed. Problems of drainage and salinization have made useless all but a small portion of land already empoldered. The objective of the Project is to apply modern techniques to prevent such loss of land, to permit reclamation of lost land and to facilitate construction of new polders. Particular care is taken to insure the well-being of local residents.

Millet, the basic crop of the region, is grown on the sand dunes typical of the Sahel. It is planted in May and harvested in October after the periodic rains have ended. Supplementary crops, as vegetables and corn, are grown at receding borders of the Lake and in the numerous small wadis of the regions. When the water table is within 2 meters of the surface, small parcels of land may be irrigated manually using the counter-weighted bucket known as the "shadoof". Cattle are pastured

in the narrow transition zone between the dunes and the Lake and in wadis. Goats are raised on the dunes and fish harvested from the Lake. Polders are a natural development of this system, representing conversion of receding lake line into large permanent wadis.

More than 50 polders have been constructed in the Bol region beginning before the present century. Originally, local authorities organized groups of prospective farmers into teams for the building of dikes, and such participation was rewarded by assignment of parcels of land in the new polder. Dikes were constructed of parallel wicker walls filled with sand and polders were pumped dry by means of shadoof. Various technical and social factors eventually forced abandonment of most of these farms and the land reverted to rearing of cattle.

The modern era began in July 1950 when the new Postmaster of Bol recommended that the central colonial authorities supervise construction of dikes to empolder 3000 additional hectares. Tchingam Polder near N'guela was the first constructed. The general plan followed the traditional idea that those who constructed the dike would be repayed with shares in the farmland that resulted. Generally about 200 men would work for about a month using the simplest of hand tools. Because wicker supporting walls rapidly failed, the dikes soon dissolved. Steel reinforcement was, therefore, incorporated into some of the new structures. Guini, No, Baga-Sola, Djiboulboul and Berim polders appeared during the next few years, and by 1954, there was great optimism for the 6 extant polders incorporating nearly 400 hectares of productive land.

Unfortunately, the entire system of dikes was virtually destroyed between 1954 and 1957 by flooding due to unusually high levels of the Lake. The system of rewards that sufficed for initial construction of polders failed to insure maintenance. Brief experiments

with hired labor and tenant associations were no more successful due to lack of capital. At the time of independence, in 1960, the system remained in disarray.

During the post-colonial decade of the 1960's, central authorities provided capital for hired labor on the polders using the proceeds of a flour mill constructed in the capital city. Flour was sold on the open market and revenue was converted into foodstuff to pay the dike workers. In this manner, about 6000 hectares were reclaimed by 1970.

The entire polder system was reconsidered in 1972 and a comprehensive report made available recommending that the "California System" of irrigation should be instituted. The principal of this system requires that irrigation water enter the polder by gravity and be removed by pumping. Water is distributed in concrete lined channels and pipes and drained by a series of ditches and earth-lined canals. The traditional system of small peasant farms would be augmented by hired labor and directed by skilled agriculturalist. The system is intended to produce two cash-crops each year; wheat and cotton will alternately be grown on the same land.

This basic system of peasant farming is labor intensive and requires that large human populations reside close to their polder farms. People who provide secondary services, as mechanics, merchants and administrative personnel, will concentrate in communities nearby. Accordingly, many thousands of people will become vulnerable to any hazards to the public health that may be generated by the system. The objective of the present study is to begin to assess these dangers and to recommend measures for surveillance, prevention and control of such problems that appear.

4. Summary of Findings

Negative Aspect

There is reason to believe that immigration to the Lake area is going to increase with the development of the polders project. Statistical figures supplied by the local authorities indicate movement of some 600 temporary and 400 permanent immigrants into Bol each year. On the other hand emigration is limited to some 150 persons, most of whom eventually return to the Lake area.

Immigration of larger numbers of people, especially from southern areas of Chad threatens to introduce intestinal schistosomiasis. In addition, the overcrowding may cause a worsening of diseases such as tuberculosis, cerebro spinal meningitis, hepatitis and venereal diseases. Cholera is also an ever-present threat. There was a recent epidemic in Chad in 1971 with 8,000 cases and 2,300 deaths reported in the country. Again, in 1973 there were 75 cases and 21 deaths in Kingeria (Lake Province) and 104 cases and eight deaths in N'Djamena.

Positive Impact

The positive impact of the polders agricultural projects should not be disregarded. The economic benefits of the operation are expected to improve the level of well-being of the people of this area and to have a favorable influence on housing and nutrition. Ultimately,it could positively affect the general level of education and personal hygiene. Equally, the economic development of the area should have a positive impact on public services, transport facilities and recreational opportunities, thus offsetting to some degree the negative impacts of urbanization.

5. Status of Major Endemic Diseases

Schistosomiasis Haematobia in the Bol Area - Schistosomiasis

Barkhuus (1976) stated that urinary schistosomiasis, due to Schistosoma haematobium, occurs in 100% of people in the Bol area and 85 - 90% of people in the coastal areas of Lake Chad. He

referred to this area as a focus of hyper-endemicity and noted that "nowhere are less than 10% of children found infected and prevalence in this age-group is usually higher -- between 20%and 50%". He noted that "transmission occurs all the year round in Lake Chad but that elsewhere infection takes place mainly in the dry season from November to May, reaching a maximum in February and March. During this period there is snail-man contact wherever infected water occur -- marshes, springs, lake shores, residual pools, etc. Lake and river fishermen and their families, living in constant contact with the water, are more or less permanently exposed to infection risk. It is practically impossible, even for parents knowing the risk to their children, to prevent them from bathing and playing in the water".

In the present study, efforts were made to detect cases of urinary schistosomiasis in children of the Bol area between the ages of 4 and 15. Single urine specimens were obtained at the same time that anthropometric measurements were made and blood samples taken. The fact that the urines were taken usually late in the morning and that only single specimens were obtained means that the results must be viewed conservatively and the figures might be augmented by improved collection methods. Specimens were taken only from boys. Most were of normal appearance, straw or yellow in color. Only one of the 118 was grossly bloody. All specimens contained sand (the boys normally squat to urinate, the prepuce touching the ground). Specimens were not centrifuged but were allowed to settle for 3 or more hours. Co-operation was almost 100% (only one boy became frightened, threw away his specimen tube and ran off).

The results showed prevalence rates of 35% in four Polder villages, zero percent in two Tala villages in the inland region, 7% in two Lake Islands villages and 16% in Bol.

It was concluded that transmission of schistosomiasis in the Bol Polders

area was taking place on the polders. All of the people questioned in these villages admitted to visiting the water of the drainage ditches on the polder, with one exception (Moun, where the barrage is leaky and where a good-sized swamp has appeared on the polder side of the barrage). Although no Bulinus truncatus were found, as the ditches were mostly dry during our visit, it is believed that the indirect evidence appears to suggest that the ditches may be an important source of infection when irrigation is underway and standing water is present.

The data from the island villages (Yakoua and Mamdi) were adequate only for purposes of inference. Of the 15 children who presented themselves to us, only four were above the age of ten; the ages of the others ranged from four to seven, not good ages for detecting schistosomiasis. Thus, the lake village examinations would have to be much more extensive before a definite statement could be made about the status of schistosomiasis in them. Nevertheless, we were impressed by the contrast between the actual figures and those that published reports led us to expect ("100 % infection on the islands").

The failure to find evidence of urinary infection in the two Tala villages was not surprising, but again the samples were too small to use for anything more than inference.

b. Malaria

Malaria has frequently been reported from Chad. Most recently, Cano and Marcos (1971) reported rainy season parasite rate of 15.7% in children (2-9 yrs) and 11.6% overall in residents of N'Djamena. Plasmodium falciparum predominates. Sporozoites were present in one out of 50 A. gambiae collected in the Chagoua region of that city.

The clinical records of the hospital at Bol list numerous cases of malaria diagnosed through the year. However, these include diagnoses made

by nurses working without laboratory facilities in outlying areas. No proven malaria case was called to the team's attention during its 2 week stay in Bol. The hospital physician, Dr. J.P. Dompnier, reports that malaria is frequently diagnosed during and after the July and August rainy season. Questions relating to malaria were posed in each of the nine locations studied. Local residents claim to know about malaria ("Kango" in Kanembou) and report that the period September through November is the season during which such disease most commonly occurs. The question of the prevalence of malaria remains unanswered.

5. Existing Health Infrastructure

The health services of the prefecture of Bol includes a medical center, located in Bol, and six dispensaries located in major villages in the prefecture. The medical center consists of the following:

a. concrete structures: a 27-bed hospital pavilion. A small surgery, a delivery room, a laboratory, an X-ray room, a treatment room, and an isolation department for tuberculosis patients.

b. mud brick structure: a doctor's office; a pharmacy store room.

c. straw hut: a kitchen for the patients.

The Center is presently staffed by a French doctor on a one-year contract as an alternative to French military service, one registered nurse, one technician, seven licensed male nurses, a traditional midwife, three orderlies, a male secretary and a cook.

The six dispensaries located in major villages of the prefecture are each staffed by one or two licensed nurses and an orderly.

As reported in the chief medical officer's annual report, 11,421 persons were seen at the Bol medical center in 1976, and 33,057 at the six dispensaries.

Four Protestant missions contribute to these services at Tatveron, Aikoulou, Magui and Kingeria.

In addition to regular curative services, the medical center has weekly neonatal clinics and a monthly well-baby clinic.

The shortcomings of the system

The medical system in Bol experiences the same problems that affect the entire national system: lack of proper drugs and medicines for treatment, lack of basic equipment; almost complete lack of preventive health education.

The use of a helicopter for the evacuation of emergency cases to N'Djamena hospital has been discontinued. The inadequacy of transport facilities hinders the doctor's visits out into the province.

There is only one microscope in the whole province. The work of the laboratory is limited by lack of adequate facilities and personnel to perform the following tests:

- sputum examination (detection of tuberculosis)
- stools examination (ascaris, amoeba)
- urine schistosomiasis
- blood (malaria)

The dispensaries, none of which has a microscope, send sputum from suspected tuberculosis cases to the Bol laboratory for analysis. Urinary schistosomiasis is diagnosed without microscopic examination and is based on evidence of blood in the urine.

No serological tests are used for the diagnosis of syphilis which is claimed to be a growing public health problem in Chad (12,348 cases reported for the year 1975). Diagnosis is symptomatic as is that for diagnosis of malaria.

The mobile team of "Grandes Endemies", the backbone of preventive medicine activities which was established by the French administration i

1925 for the control of trypanosomiasis, has not visited Bol for the last 11 months. Under the circumstances, despite the remarkable disgnostic ability of the health staff, a considerable number of diseases are missed and the magnitude of public health problems cannot be adequately assessed. It is not surprising that the Ministry of Health lists under the category "other diseases", 143,213 of its reported 324,546 patients ("Releve annuel des symptomes et maladies des hospitalises, cas constates et enregistres dans les centres medicaux et infirmeries au Tchad en 1975").

Since there is neither a surgeon nor a dentist in the province of Bol, patients requiring such service must procure a place on the six-seat plane which comes from N'Djamena twice a week, or must travel the 300 km. of bumpy dirt road which connect Bol with the capital of Chad.

7. Summary of Recommendations

a. Medical Recommendations

The following action aimed at the prevention and control of prevalent diseases and the promotion of the health of the population of the Lake region is recommended.

- The opening of a rural dispensary in a locality close to the polders.
- The assignment of a second laboratory man at the medical center of Bol.
- The supply of microscopes to the six dispensaries of Bol province after trained personnel are provided to make adequate use of them.
- The building of a wing or separate pavilion at Bol hospital to be used for preventive medicine. This new section, which would complement the activities of the "Grandes Endemies" service, would expand the maternal and child health work already carried on by the center and develop an extramural program of health education. The personnel to staff the section, possibly to be recruited locally and trained in N'Djamena, should be given the opportunity to spend some time at a demonstration center abroad. Under the direction of the chief medical officer, he should be instrumental in the setting up of a local committee to help in the identification of needs and methods to raise the level of hygiene of the community. The showing of education health films, easily available from embassies, international organizations, etc. located in N'Djamena, would be of value.

- The routine flights of the helicopters to evacuate emergency cases to N'Djamena should be resumed.

- Adequate means of transport should be made available to the chief medical officer of Bol so that he can inspect his area of responsibility.

- A pharmacist's aid should be assigned to the Bol hospital.

- The medical center should be rehabilitated and supplied with much needed additional equipment.

- The possibility of monthly visits to the medical center by a surgeon, dentist, and other specialists should be considered.

- Clinical services available in the polder region should be improved. These measures should include efforts to upgrade local diagnostic facilities through training of personnel, provision of appropriate equipment and supplies. The physical plant of the Bol clinic should be improved and construction of satellite clinics should be considered. Measures to improve nursing care as well as surgical and dental services are indicated. These improvements should be implemented as part of an integrated plan and require further study by specialized personnel.

b. Environmental Sanitation Recommendations

It is recommended that the Peace Corps pump maintenance program be expanded to include two additional activities.

- The first would be to find some method to solve the problem of ponding around the hand pumps. It is realized that there is no easy solution to this problem and it may be that future wells should be located only where the ground slopes enough to provide for natural run-off away from the well. Several of the existing wells in Bol are located on sloping ground and existing ponds could be drained quite readily. An ideal approach toward providing continual maintenance to the pumps and their immediate surroundings would be to hire and train local residents to perform preventive maintenance, minor pump repairs, and upkeep of the drainage system.

- The second additional activity would be a water sampling and analysis program coordinated with the maintenance visit. Samples from each well should be analyzed for E. coli and salinity using compact field kits available from suppliers such as Hach Chemical Company of Ames, Iowa. These field

kits are self-contained and can be used by anyone who is able to carefully follow the instructions accompanying each kit. No laboratory equipment is required. It is understood that the long-range objective of the well installation and maintenance program is to transfer total responsibility for operation to FDAR at the national level.

- As suggested above, serious consideration should be given toward delegating some maintenance responsibilities to local authorities and their constituents. Perhaps the Peace Corps drilling and/or maintenance training at the FDAR warehouse compound in N'Djamena could be a source for upgrading local staff.

- It is further recommended that planning be initiated now to study the feasibility of installing and operating a piped water system in Bol.

- A practical activity sponsored under the Bol medical center should be initiated to make the people more aware of health problems related to poor personal hygiene and food handling and to demonstrate acceptable techniques.

c. Malaria Recommendations

The present preliminary study should be broadened by additional surveys performed during different seasons. Each additional visit would require about two weeks of field work and can be performed by a physician-epidemiologist and an entomologist - malariologist preferably cooperating with a malacologist-helminthologist. In particular, one such visit should take place early in September at the end of the rainy season, and another in December after the water table has risen to maximum levels. Ideally, both visits would be repeated the following year.

- Each visit should include a general survey of Anopheles mosquitos. This would include collection of mosquitoes biting man at specified times of day; collection of mosquitoes resting in houses, both individually and

with the aid of insecticidal spray; standard sampling by means of portable lighttrap, and manual collection of immature Anopheles from aquatic breeding sites. This survey should cover the entire geographical area covered by the present survey. Salivary glands should be dissected from a sample of each anopheline species collected and tissues examined microscopically for the presence of sporozoites.

- The precise identity of the A. gambiae fauna of the Bol region should be established. Living material might be transported to the WHO Anopheles Reference Center in London. Alternatively, preserved ovaries might be retained for later cytological study.

- Blood samples should be obtained from persons residing in villages throughout the study area. Children are readily available for such study and both thick and thin films should be prepared. A spleen-survey would be an essential supplement to this parasite-survey.

- If an interested local person can be identified, he should be encouraged to conduct weekly light-trap samples of mosquitoes in one location throughout the year. These samples could be stored and transported and mosquitoes identified by qualified taxonomists elsewhere. Such local personnel might also collect and store blood-films from fever patients seen at the Bol clinic.

- Any shallow holes in the ground made during the manufacture of adobe bricks should be treated with insecticide once each week. Only the brick-works near Bol need be treated. A standard formulation of abate is recommended.

- All drainage ditches should be designed to provide minimum opportunity for puddle-formation. Vegetation should periodically be removed from these ditches.

d. Schistosomiasis Recommendations

Schistosomiasis control should be approached through snail control. Because of the failure to identify susceptible snails in April in Bol and surrounding regions, certain further studies are indicated:

- Baseline data should be collected regarding the population dynamics of Bulinus truncatus rohlfsi in the region of the Bol Polders, including adjacent lake waters. The field work should be pursued at favorable times of the year, emphasizing the period between the onset of rains (July) to the beginnings of the ensuing dry season (November). During periods of snail abundance, some attempt should be made to determine the rate of infection, if any, in snails in different localities on the polders and in the lake. Localities on the polders where man snail contact is optimal should be identified and such places should be subject to snail control measures.

- In view of the abundance of Bulinus forskali in ponds, ditches and the lake in April, coupled with the failure to find B. forskali to miracidia S. haematobium.

- Snail control can be done by application of molluscicides but these chemicals have the disadvantage of being dangerous to handle, expensive, or both. It is unlikely that, as a first measure, the use of molluscicides will be considered environmentally acceptable by the agencies concerned. A more practical approach and more suitable to the Bol Polders region would be the employment of naturalistic methods. One of these could involve clearing vegatation from the drainage ditches. Snails are found on plant stems but they are either eating dead plant material or are grazing on microscopic organisms using the plant stems as a substrate. In any case, snails cannot exist where there is not food. The drainage ditches of the Guini and Berim polders were found to be uniformly choked with dense growths of reeds (Phragmites) and cattails (Typha). It can be guessed that these

plants provide considerable protection and substrate for Bulinus snails when the ditches are full of water. A regular program to clear out these plants from the ditches would do much to discourage snails on the polders. Likewise, in the lake, Bulinus has been reported to live in close contact with the mats of submerged water weeds (Ceratophyllum) which fringe the borders of the lake particularly near the boat landing at Bol. Removal en masse of these mats would deprive the snails of a necessary niche in this local area.

- It may also be speculated that a biological control measure involving the use of predators might have a positive effect on snail control in the polders. One such measure might employ herds of ducks, which eat snails with avidity. Such measures have been observed to be effective in clearing ponds in Northeast Thailand of the snail Indoplanorbis exustus (a transmitter of paddy field itch).

- In all snail control work, some provision must be made to assay the situation in the field before, during and after the completion of the work. There is no other yardstick by which success can be measured. Considering the apparent seasonality of Bulinus on the polders, follow-up studies on snail abundance should be pursued at several times during the year, preferably during and after the rains, and should not be abandoned because of apparent success in control. Snails have a way of sneaking back.

- Apart from snail control, human schistosomiasis can be controlled by: (i) specific treatment, (ii) waste disposal, and (iii) health education.

Treatment of cases

Children suffering from schistosomiasis haematobia can be treated with niridazole. Such cases should be actively sought and treated in villages ringing the polders. Bad side effects such as psychiatric changes which have often been attributed to niridazole (Ambilhar) are not often seen in

young patients who have just contracted the disease and whose livers are still healthy and able to detoxify the drug. In the present study, boys began to be seriously affected from about the age of 8 to 10 yrs. This observation agrees in general with others with regard to the age of onset.

- Waste disposal - There is not much chance that this approach will be useful. Eggs of S. haematobium are passed in the urine and the micturitional habits of little boys are not easily controlled.

- Health education - Some sort of program to acquaint the villagers of the polders with the nature and seriousness of the disease schistosomiasis is owed them. In other countries this has often taken the form of popular talks in an informal atmosphere, in local dialect, and using educational demonstrations and aids such as photographs, blackboards, flannelographs, and even cinematography.

- In order to measure a reduction in transmission of urinary schistosomiasis, a diminution in incidence (i.e., the rate of new cases) must be recorded. In practice this will require semi-annual or annual surveys of urine samples from the same population, keeping careful records of names of individuals, in order to prove that new cases are not occurring in non-transient people.

- These recommendations have thus far all dealt with urinary schistosomiasis, caused by Schistosoma haematobium and transmitted by snails of the genus Bulinus. The other form of the disease, intestinal schistosomiasis, caused by Schistosoma mansoni and transmitted by snails of the genus Biomphalaria, is also reported from Chad. However, it is concentrated in the south. The number of cases reported from the region of the lake is negligible. However, it should be recognized that potential vector snails exist in Lake Chad. We had no difficulty in collecting Biomphalaria in the

lake and in ponds on the polders in April at a time when Bulinus unaccountably absent. Thus the Bol Polders area would seem to be ready for an environment accident of major proportions in the event that significant numbers of southern Chadians moved northwards and settled in the lake area or the region of the Bol Polders. Intestinal schistosomiasis is much more pathogenic than is the urinary form, and is more difficult to treat. It would be preferable to avoid the problem by preventing introduction of the infestation.

CHAD - SOUTHERN ZONE

1. Objectives

A five member team visited Chad between May 5 and June 10, 1977 with the following objectives.

- To identify the major endemic disease problems in the: Koumi area, north of Pongor (Logone Dike Project) Laguidereissia, Lai area (USAID Irrigation Project), Goulengdeng area (Multi-Donor Irrigated Perimeters Project), all in the Republic of Chad;
- To identify the relevant environmental factors responsible for disease transmission;
- To assess any existing programs or plans with environmental health significance;
- To make recommendations and develop alternative proposals for any further surveys, projects or control programs complimentary to those planned or in existence, including essential health infrastructural requirements for maintaining and improving the health status of the communities, particularly those within the rural development project areas.
- Upon the request of USAID/Chad, the Guelengdeng area was deleted from the scope of work.

2. Team Composition

The team was comprised as follows:

Curt R. Schneider, Ph.D. Parasitologist and Team Leader

Frank P. Carroll, M.S. Environmental Engineer

Henry M. Gelfand, M.D., M.P.H. Epidemiologist

Roger C. Grenier, M.S. Malariologist

Robert L. Northrop, D.V.M., Ph.D. Epidemiologist

3. Background Information

Logone Dike Project

The Logone Dike Project envisages the repair or new construction of a retaining wall or dike along a 60 km stretch of the Logone River in Mayo-Kebbi Prefecture between the towns of Ogal and Kotao, north of Bonfor. The purpose will be to prevent or control flooding of the natural "yaere" or flood plain, thus increasing cultivation time and freeing much needed farm land for productive use. A draft PRP exists. In the PRP the work to be pursued is divided into two parts, each with a different impact assessment.

The first stage of the work will repair the pre-existing, torn-down dike along a 35 km interval between the villages of Ogal and Mogodi. In the PRP certain conceptual impacts were discussed:

- population growth would not be significantly accelerated;
- it was thought that vector mosquitoes would not increase but, with controlled flooding, might decrease, (The problem of vector snails is not tackled in the PRP);
- if indeed the use of pesticides and herbicides increase, this will learn (sic!) precautions;
- if rat populations increase as the result of increased food supplies, the villagers know how or will learn to cope.

In the PRP, a negative threshold decision was recommended for this component of the project, since it represents essentially a repair job rather than a new departure.

The other component of the project proposes the construction of a new dike to run the 25 km between Mogodi and Kotoa. According to the PRP, the impacts will be magnified because this will be altered. The effect on the ecosystem behind the dike may be beneficial but this remains to be determined. In the PRP, a positive threshold decision

was recommended for this component of the project.

Sategui-Deressia Project

The Sategui-Deressia Project consists of a plan to control flood waters and concurrently increase and improve traditional wet rice cultivation over a 5,700 hectare area (=14,079 acres or about the equivalent of 22 square miles). This is a project of the Republic of Chad, with funding secured by loans from the International Bank for Reconstruction and Development (IBRD) and the International Development Association (DA). The project is administered by the Organization pour le Mise en Valeur de Sategui-Deressia (OMVSD), with a Chadian office in N'Djamena. OMVSD has, in turn, contracted with the Italian firm of Carlo Lottie Associati for hydroagricultural development and construction, and with a firm of French agricultural consultants (SATEC) for improvement of culture techniques.

The flood-control project plans to prolong the local high-water periods in the Sategui-Deressia flood plain without permitting an increase in the inundated surface area. This will be mediated by a large canal (7,800 meters long, 20 meters wide) and a large reservoir. The canal will accept water directly from the Logone River by gravity flow and will feed to rice-growing sectors: (1) a 2,500 hectare area (6,175 acres) and: (ii) a 3,200 ha area (7,904 acres). A set of dikes connecting with the main canal will enclose the reservoir. The main road from Sategui to Deressia will run along one of the dikes.

Lastly, about 12 kilometers north of Sategui, a small irrigation canal drawing water from the Logone will irrigate some 200 ha (=494 acres) at the Experimental Station at Boumo, where activities will be devoted to the development of rice seeds.

The work began with local labor in December, 1975. In 1976, work on a contractural basis commenced during the dry season.

Structural modifications are expected to be finished in another two years. There is a plan to seek a second World Bank Loan to permit an additional 7,000 ha development in a "second phase".

4. Summary of Findings

- There is little danger that any substantial change in the disease situation is a result of the projects.
- Greater emphasis needs to be placed on the prevention of disease rather than curative medicine.
- Research studies are needed to provide reliable basic information on the disease situation.
- Existing drinking water supply and sanitation conditions remain the primary public health problem in the rural areas investigated.
- Agricultural development schemes based on increasing local food supplies at reasonable production levels will not by themselves exacerbate already severe environmental health problems.
- Pesticide and fertilizer usage at current rates does not pose a significant public health problem, except for possible acute exposures to pesticides.
- The Plant Protection Service, as a nascent infrastructure, is approaching the question of pesticide use in a rational and logical manner.
- The Logone River provides an adequate quantity of water year-round for increased agricultural development initiatives in the basin.
- The Logone River and selected groundwaters are acceptable irrigation quality. They are undesirable for domestic use without disinfection as a minimum treatment. A high nitrate level found

in one well is cause for some concern. The low buffering capacity of river water might allow pH swings hazardous to fish life should algal production be further stimulated at low flow.

The current status of all traditional wells in the areas investigated is unacceptable.

Although central water supply systems provide high quality water, other intermediate options remain to be investigated and compared for cost-effectiveness in rural areas.

Although rural health infrastructures are not strong, it is possible to identify key individuals with motivation and initiative to design programs and implement them at the community level. Villagers themselves are cognizant of their environmental health problems and actively supportive of relief activities. The primary constraints of rural health programs are adequate supplies, and transport and direction.

5. Status of Major Endemic Diseases

Data on the occurrence of diseases in Chad are derived from the four urban hospitals (N'Djamena, Moundou, Sarh, and Abeche) 41 Medical Centers, approximately 112 government and 25 private Mission Dispensaries reporting through S.G.E., and from S.G.E. itself. They are of vastly varying quality and are based largely on the clinical impressions of modestly trained and poorly supervised infirmiers unsupported by laboratory studies. The data collected must therefore be interpreted with great caution, and cannot be used to calculate incidence rates because of massive underreporting. Also these medical services are available to only a limited part of the population.

The reported information does, however, provide some clues to the diseases of importance in Chad, and to temporal changes. Table 1 is a record of the reports of certain selected diseases, nationwide, from

1969 through 1975.

To provide some comparative information for the areas of greatest interest to the Assessment Team (Mayo-Kebbi and Tandjilé Prefecture), Table 2 is presented. Data from Prospection Teams of the S.G.E. nationwide are shown separatively because they may be as reliable as any available, and from the largest hospital (N'Djamena) to reflect the diseases encountered in an urban area.

A somewhat different impression is provided by Table 3, which is a compilation of the 10 leading causes of morbidity and mortality as reported f[illegible] the large urban centers in Chad and the rural Dispensaries in 197[illegible]

Current Statu[illegible] of the Major Diseases in Mayo-[illegible]i Prefecture

a) Malaria

Twenty-eight thousand two hundred a[illegible] sixteen (28,216) cases of malaria were reported in Mayo-Kebbi in 1975, but this figure is stated to be meaningless. Most people with the disease do not seek treatment, and the diagnosis in the vast majority of cases is based only on the occurrence of fever and headache not otherwise explained. The S.G.E. does not make microscopic examinations for this disease. It is believed to be heavily endemic everywhere, throughout the year. National figures show some seasonal increase at the end of the rainy season (with a modest peak in October), but this may underestimate the seasonality of the disease since travel to medical facilities is most difficult at this time of the year. There have apparently been no authenic studies of this disease in Chad in recent years.

b) Schistosomiasis

Five thousand four hundred seventy nine (5,479) cases of urinary bilharziasis were reported in Mayo-Kebbi in 1975, and 561 cases of the intestinal form. These figures give no true indication

of the incidence or prevalence of this disease since diagnosis is based usually on the appearance of gross urinary or intestinal bleeding, sometimes "confirmed" by hepato-and spleno-megaly, and infrequently confirmed by microscopic examination. Limited microscopic surveys in various localities indicate the prevalence of S. hematobium to be between 20% and [illegible]. Dr. Le Moal believes that it is heavily endemic throughout Mayo-Kebbi, but least important along the banks of the Logone River which does not provide a a good breeding area for snails. Everyone agrees that the urinary parasite is much less frequent than S. Mansoni.

c) Onchocerciasis

Occurs in two very [illegible] areas in Mayo-Kebbi, in a larger focus on the Mayo-K[illegible]ver, between Fianga and Lere in the western part of the [illegible]cture and a smaller focus at the extreme southeastern border [illegible]h Cameroon. Four hundred twenty-two (422) cases were diagnosed by nodule detection in 1976. A special prospection undertaken in five villages near the Mayo-Kebbi River rapids in 1973 revealed a prevalence rate of 33.9%. Seven hundred thirty six (736) of 2,168, (34.9%), persons examined had nodules, 306 had ocular lesions, 14%, and 632 (49.7%) of 1,271 skin biopsies were positive. An insecticide campaign in the area during 1955-1963 had been effective in reducing Simulium flies by 90% but it was terminated because of lack of funds.

d) Trypanosomiasis

This disease had all but disappeared in Chad, only two new cases having been reported in the entire country in 1975, giving a total of 1,811 known living cases in that year. The last known case in Mayo-Kebbi died in 1976. However, focus of over 200 cases was discovered this year southeast of Lai on the Logone River in the Tandjilé Prefecture. Dr. Le Moal fears its return in Mayo-Kebbi

also, and it is a priority prospection activity of the S.G.E. Teams, principally by examination for and aspiration of lymph nodes for microscopic examination.

6. Existing Health Infrastructure

a) Mayo-Kebbi Prefecture

The five medical centers in Mayo-Kebbi are located in Bongor, Léré, Pinanga, Pala and Gounou-Gaya (although the latter has no physician, it is headed by an Infirmier d'Etat, and is sometimes referred to as an Infermery).

Only the Medical Center at Bonfor was visited. It has three physicians Dr. Ramadan, a Chadian educated in the Soviet Union, his Russian wife, and a Russian surgeon. There are 100 beds, although many additional patients sleep on palets outside the buildings, which are divided into Medical, Surgical, Obstetric and Pediatric Services. The iron beds are cemented into matresses, bedcovers, mosquito nets or screening; surgical patients were not adequately protected from filth and flies. There is no electricity, there is an adequate municipal water supply. Surgery is performed b using light from pressure lanterns. The present X-ray machine and a electricity generator to operate it are expected soon from N'Djamena Laboratory services are limited to microscopic examinations, includi stains for blood parasites and tubercle bacilli in sputum smears, and simple chemical tests for sugar and albumin in urine. It is reported that the medical center is always very low on supplies of essential medications. The hospital provides one meal per day to its patients; other food is provided by relatives. The Bongor Medical Center reports directly to the Ministry of Public Health in N'Djamena, and is not considered to be within the Formation Sanitaire of the Prefecture for purpose of reporting in Sector 2 of Services des Grandes Endemies (S.G.E.).

There are 23 Dispensaries in the Prefecture, 12 government supported and 11 private (operated by religious missions), distributed as follows:

Sub-Prefecture Bongor

Kim

N'Gam

Guelengdeng

Biliam Oursi

Kogoni (Pvt.)

Moulkou (Pvt.)

Sub-Prefecture Pala

Torrock

Dari

Gagal (Pub. & Pvt.)

Keuni (Pvt.)

Moursala Bambiá (Pvt.)

Baje (Pvt.)

Sub-Prefecture Fianga

Lallé

Tickem

[illegible] (Pvt.)

[illegible] Dawa (Pvt.)

Sub-Prefecture Léré

Binder

Bissi Mafou (Pvt.)

Sub-Prefecture Gounou-Gaya

Djodo Gassa

Berem

Gaya [illegible]bi (Pvt.)

Tagal (Pvt.)

Each dispensary is headed by an Infirmier Breveté, and is under the nominal supervision of the Medicine Chef of the S.G.E. The welding of the Dispensaries and the S.G.E. has worked out very badly, and is bitterly criticized by everyone. The S.G.E., with a long and proud tradition, is run by a specialized service of French Military Surgeons. It has always been an independent, disciplined, well-trained, well-supplied corps, directed toward the detection and control of specific diseases with the ultimate aim of prevention. It provides general curative services principally as an operational technique permitting it to reach the maximum possible proportion of the population for surveillance (dépistage) of trypanosomiasis, leprosy, tuberculosis, onchocerciasis, the trepanematoses; for the detection of epidemic out-

breaks of meningitis and measles; and for mass immunizations against smallpox, yellow fever, measles, and tuberculosis. The humanitarian provision of curative services during the course of its tournees des dépistage is secondary.

With this background and orientation, responsibility for fixed dispensary services seems alien, made worse by the fact that the S.G.E. appears not to be given additional medications for supply to the dispensaries, therefore it is unwilling to share its supplies with the latter. Presumably the rationale for the welding of the two services was so that the dispensaries could serve to enlarge greatly the surveillance operations of S.G.E., and in turn, the S.G.E. being mobile could readily get to the dispensaries. Yet the weld is defective, with mutual complaints and recriminations.

In Mayo-Kebbi, Dr. Le Moal, or his adjunct visits each dispensary one to three times per year (according to Dr. Le Moal's tour record). Drugs are provided for no more than about three months use, supplied from the World Health Organization agency. The Infirmiers have limited training, and do not receive refresher training. The S.G.E. is interested principally in detecting diseases clinically rather than using laboratory diagnosis which Dr. Le Moal believes that they are competent to do. However, the reports on diseases, which form a large part of the national morbidity statistics, are said to be inaccurate.

Sector two of the S.G.E. serves only Mayo-Kebbi Prefecture. At the present time its Equipes Mobiles are organized as follows. One large, "polyvalent" team, staffed by twelve persons and carrying a mobile laboratory which includes a capacity for spinal fluid and skin biopsy examinations, is responsible for intensive surveillance by physical examination of all persons, rendering curative care as needed, and immunization against the four diseases for all age groups. It does not visit dispensaries. Mayo-Kebbi is divided into four zones.

and the schedule for this team is so planned that it will cover the entire population in four years. However, during its last cycle, coverage was almost completed in three years.

The polyvalent team is supplemented by an Equipe Mobile Legére, composed of three persons, for childhood immunizations (ages 6 to 30 months only). It also covers one zone per year, therefore, the administration of vaccines to children is repeated on a cycle of two years.

Three light mobile teams are reserved exclusively for follow-up and only used for some detection of leprosy and tuberculosis cases for treatment. They check on the continued use of the prescribed medications and the clinical state of the patients. They are expected to visit and resupply each case every six months.

One light team is kept in reserve for emergency, epidemic control. It is prepared to move within 24 hours, the state of the roads (most difficult in July and August) and the supply of gasoline permitting. In the event of serious need, other teams could be diverted to epidemic control.

The schedule of routine mass immunization is as follows:
Children (6-30 months) - simultaneously administered smallpox vaccination by scarification on left lower arm, B.C.G. scarification on the inner aspect of left lower arm, and measles and yellow fever (17D strain) together, by Ped-O-Jet.

Smallpox - scarification repeated every four years throughout life.

BCG - repeated at about age 10, and once again at about age 20.

Yellow fever - Dakar strain, by scarification, repeated every four years beginning at age 15. No individual records are kept; smallpox vaccine and BCG scars are used as evidence of childhood vaccination, and children who are missed on one visit by this criterion are given the four-agent course on the next.

Prospection Team (including immunization) coverage averages 75-80% based on an S.G.E. census of 469,908. Note that the national

census gives Mayo-Kebbi a population of 592,000, which, if correct, would reduce coverage to 59-64%. Reported coverage is poorest in Bongor Canton - as low as 63%.

The impressive extent of this program is indicated in the following table:

Vaccinations Performed by S.G.E., 1973-1976

Year	Smallpox	Yellow fever	Meas[illegible]	BCG
1973	123,743	102,261	16,0[illegible]	63,952
1974	109,560	41,800	16,9[illegible]	16,120
1975	113,738	39,190	25,614	25,554
1976	127,027	51,510	35,772	80,551

b) There are two Medical Centers in Tandjilé located at Lai and Kelo, and 15 dispensaries distributed as follows:

Sub-Prefecture Lai	Sub-Prefecture Kelo
Buomo	Kolon
Doumongou	Batchoro
Dona Manga (1 Pub. 1 Pvt.)	Bologo
	Sub-Prefecture Bere
Marou Touloum	Dalle
Gabri N'Golo	Bere (1 Pub., 2 Pvt.)
Deressia (Pvt.)	
Guidari (Pvt.)	

Summary of Recommendation

There is every reason to urge that real medical and sanitary services be brought to a people that lack them now. If populations are moved, and if the population in the project areas increases, the people will transfer their old diseases to the new places. Development projects must assume an obligation for the provision of at least minimum local health facilities and maximum health services.

a. Malaria

A malaria control program should not be initiated in Chad unless there is prospect for protection of non-immunes who may be stricken later in epidemic form should the control program fail. A detailed planning must be completed before any effort even a demonstration project is undertaken. Classical malaria surveys during the wet season need to be conducted in the Logone River flood plain area and in the other different ecological areas of the country before a control program can be planned.

In malaria control programs much attention must be devoted to such matters as larval and to the ecology and to the vector mosquitoes. It will also involve other sections (such as drainage) which may be conducted on a community or self-help basis rather than with the rigid central direction required for a malaria eradication program. The Chad rural health infrastructure is not in the position to support a malaria control or eradication program. Serious attempts should be made by the Health Services to develop within the project areas (and all of Chad) a strong health education program initiating preventive medicine (including malaria) in order to institute a type of self-help malaria control program. It should be emphasized that any progress in malaria control must be coupled to the improvement in rural health services.

The characteristics of malaria in Chad depend on the characteristics of the main vectors A. gambiae and A. funestus, particularly the former. Anopheles gambiae are perhaps the most efficient vectors in the world; highly anthropophilic, long-lived and capable of reaching high population levels in a wide variety of temporary water collections. It is easier to list the habitats where the larvae of A. gambiae will not be found rather than list the positive sites. Much additional research on Anopheles gambiae

is needed, including the perplexing question of where the species passes the dry season, particularly in the more arid portion of its range.

In the southern part of Chad, malaria is described as being "stable". That is, it is characterized by high infant and child mortality, high levels of immunity beginning in late childhood, and with little obvious adult disease. This is not particularly the case in the Sategui-Dembo area as the adults appear to suffer from fever and chills. It is extremely difficult to truly assess the impact of the disease in adults. Further research is needed.

b. Schistosomiasis

Snail Studies at Lai

Nothing has been written about the population dynamics of pulmonate snails on the flood plain at Lai and the following is entirely inferential.

Because of road conditions, visitors to the flood plain region have come during the dry season. This permits easy circulation, but the fields are dry, there is little surface water in evidence apart from permanent rivers, and no snails are to be found. This was the experience of Dr. Degremont (1976) and also that of the present team. Nobody visits Lai during flood periods because the road is under water. However, Lai is accessible at all times of the year, either by air or by road from Kelo. Until a year-round study of local pulmonate snails is done with field work carried out during flood times, only guesswork is possible and snail control cannot be planned intelligently.

The local villagers say that snails survive the dry season buried in the mud. This is a good guess and the idea conforms with what is known of the biology of Bulinus and Biomphalaris

in the Nile Delta of Egypt during periods of winter closure.

It would seem only logical to expect some changes in transmission patterns to accompany the construction of a major system of canals and permanent reservoirs on the Sategui-Deressia plain. However, it is not clear, in the absence of knowledge of the snails, what form the changes will assume. It can be guessed that the presence of perennial water will permit the existence of snails on a year round basis. But this idea is contradicted by the finding that some of the largest collections of water, (the marigots at Djoguo) when examined in [illegible], appeared to contain no pulmonates. These ponds looked as if they were ideal for Bulinus jousseaumei, B. forskalii, and Biomphalaria ssp; their absence was unaccountable.

It seems likely that something intrinsic in the life-cycles of the snails in nature remains unknown. Perhaps the requirement for aestivation is intrinsic. Perhaps the natural life span of these snails is shorter than it appears under laboratory conditions. If so, construction of canals will not change it. It is not clear that the incidence of schistosomiasis would be affected, although conventional wisdom accedes to the possibility if not the probability. The effect of canal construction on the prevalence and incidence of other waterborne diseases would have to be judged on an individual basis.

The present principal need is for ecological studies of snails during and immediately after the rainy season at Lai.

- Peace Corps Proposal

The pending Peace Corps well drilling proposal should be approved in a timely manner. Consideration should be given to expansion of the program, as it is one of the few successful US technical support activities in Chad to date. The town of Deressia

should be included in the package. This might be initiated as a pilot project in a town such as Deressia.

Plant Protection Service

Continued support should be given to the Plant Protection Service in its control of pesticide usage in particular and in the development of integrated pest management programs in general.

Health of Field Workers

Agricultural development projects should include as health sector components, among other things, provision for an adequate supply of drinking water for field workers and first aid services for injuries and acute exposures to insecticides.

Fish Breeding

Proposed hydraulic manipulations of river flow for irrigation purposes must not interfere with the breeding of fish, a most important aspect of local economies.

Nitrogen

Any additional water quality studies in the project areas should investigate in more detail various forms of nitrogen in drainage and groundwaters. Algal production should also be studied in the Logone River at minimum flow from the point of view of pH effect on fish life.

Health Extension Acitivities:

Support should be given to the Ministry of Health for the propagation of comprehensive rural health extension activities such as those proposed by Mr. Tatala above. By the encouragement of community self-sufficiency, environmental health education, and the provision of essential goods and services, investment programs will approach maximum cost-effectiveness. At the very least, basic supplies and adequate transport for reaching a wide service area and conducting evacuations should be assured.

LIBERIA

1. Objectives

A five-member team visited Liberia between February 11, 1977 and March 4, 1977 with the following objectives:

a. To carry out an Environmental Health Assessment of Liberia with an emphasis on the major endemic parasitic diseases - schistosomiasis, malaria, onchocerciasis, filariasis and trypanosomiasis.

b. To carry out an Environmental Health Assessment of the proposed Upper Bong County Integrated Rural Development Project in accordance with the AID Environmental Procedures and Guidelines.

2. Team Composition

The Team was comprised as follows:

Ulric P. Gibson, Ph.D.,
Environmental Specialist
American Public Health Association - Team Leader

Margaret E. Grigsby, M.D.,
Professor, Howard University
Physician Epidemiologist

Ernesto Ruiz-Tiben, M.S.,
Sanitarian/Epidemiologist,
Center for Disease Control, Puerto Rico
Schistosomalogist

Henry van der Schalie, Ph.D.
Professor, University of Michigan
Ann Arbor - Malacologist

Emmet Dennis, Ph.D.,
Director, Liberian Institute of Bio-medical Research
Parasitologist

3. Background Information

The Liberian Government has adopted "integrated rural development" as its major development strategy for its rural areas. The first of these integrated rural development projects has begun in Lofa County as the prototype. It involves 14,000 families (90,000 people) in a swamp rice development of 16,000 hectares that includes some of the traditional up-land rice. Simultaneous improvements in education, main and feeder roads, telecommunications, airfields and health facilities are also included. A Schistosomiasis Surveillance Unit has been established to monitor any likely adverse effects of the swamp rice development with respect to schistosomiasis.

Upper Bong Rural Development Project

A similar project has been planned for Upper Bong County. In contrast to Lofa County, the project area of Bong County represents a more difficult challenge, in some respects, to agricultural development efforts. Although the region is closer to product markets than Lofa (the capital of Upper Bong, Gbarga, is only 125 miles from the port of Monrovia, while Voinjama, central town of Lofa, is 247 miles), the rural residents of Upper Bong are more poorly serviced by farm-to-market roads. In Lofa, all but 20% of the rural population live on or within a mile of a road. In Bong, about 45% do not have easy road access.

Climatically, both rainfall and river water resources are less abundant in Bong, where a protracted dry season prevents double-cropping of swamp rice as is possible in Lofa. Furthermore, Upper Bong is a much larger project area than Upper Lofa, with population more widely scattered. But finally, and this is perhaps the most critical difference, agricultural cooperatives, three in all, have been operating successfully in Lofa for

several years. They have trained managers and bookkeepers, established marketing services to farmers, built huge produce storage facilities and have large and growing memberships. In Bong County, on the other hand, this institutional innovation for channeling development service to small farmers is still to be attempted.

Project Goal - To improve the welfare of the rural population in Upper Bong County.

Project Purpose - To increase and maintain agricultural productivity and income of small farmers in Upper Bong County.

The project strategy hypothesizes that since only 3% of farmers in the project area are currently using improved seeds and fertilizers, the income of project participants will be considerably increased through the provision of improved inputs together with supervised credit, agricultural extension, and improved marketing channels.

The project would be implemented over a five-year investment period from 1977 to 1982. It is designed to increase the productivity and income of 9,000 farm families (48% of the farm holdings in Upper Bong County).

Farm and Crop Development - Long-term (development) and seasonal credit would be provided to finance increased productivity of the following crops on the targeted acreages:

Upland Rice	5,750 hectares
Swamp Rice	2,050 "
Coffee	1,500 "
Cocoa	3,000 "
Cassava	1,350 "

Swamp Rice - There are already 1,500 hectares of traditional and 200 hectares of improved swamp rice in the project area. By promoting the clearing and leveling of swamp plots and the construction of water control structures (development costs are estimated at circa $500 per hectare) the project expects to create permanent agricultural properties of great value. Development operations will be spread over a three-year period, with the

variety Gissi 27 used in the first two years because of its resistance to iron toxicity, and IR 5 used thereafter. Direct seeding, combined with chemical weed control, will be recommended over transplanting, with seed application rates ranging from 60 to 100 kilograms per hectare depending on the roughness of the field. Using the Gissi 27 initial yields will increase from 1,000 kg to 2,500 kg per hectare. Recurrent cash expenditures (excluding development costs) are estimated at $130 per hectare and family labor inputs at 264 man/days. With a 3,000 kg yield, an average net return of $458 per hectare or $1.71 per man/day anticipated (after the development loan has been repaid).

The project would reclaim 1,650 hectares of new swamps and improve about 400 hectares of existing swamps. Out of this approximately 300 hectares would be developed as pilot schemes for double cropping of rice. Small earthen barrages and other rudimentary structures would be constructed for storing rainwater and run-offs from upstream catchment areas for use during the rain season. Land clearing on virgin swamps would be done manually with the help of small hand equipment; flood protection and water control would be through peripheral drains, field bunds and leveling. The project would provide assistance in making simple topographical surveys and soil analyses for selecting swamps for development. The main focus on the on-farm measures would be on proper swamp management, timely planting and fertilization, and use of varieties that are resistant to iron toxicity.

4. Summary of Findings

Environmental Health Impact of Upper Bong County Integrated Rural Development Project

The areas of potential negative health impacts of the Project are those related to the transmission of schistosomiasis and malaria.

a. Schistosomiasis

This disease is endemic in the area. All of the ingredients (including the definitive host, poor sanitation and personal hygiene, and frequently used waterways infested with the intermediate hosts) for the transmission of the disease are present. The potential, therefore, exists for increased transmission to result from an increase of snail infested waterways and increased human contact with those waterways.

A more definitive statement is presented in the final assessment team's report.

b. Malaria

Malaria is mesoendemic in the project area during the dry season. The survey shows that transmission occurs in the dry season. The endemicity during the rainy season is not known and would require a survey. It is, however, known from the Phebe Hospital records that the number of malaria infections increases during the rainy season. How much of this increase is attributable to swamp rice cultivation is not known. A survey would be needed to confirm that swamp rice fields contribute to the increase in vector density. Experiences in Gezira, Sudan have, however, shown that rice irrigation has resulted in increased Anopheles gambiae density and increased malaria.

The project will, in effect, only increase the water area by the acreage cultivated for a second crop during the dry season, i.e., by 750 acres or about one percent (1%) of the total swamp area of 73,500 acres in the Project Area. The Project will also develop an additional 4,000 acres of existing swamp for rice cultivation. This transformation of the swamps may possibly result in the development of conditions more conducive to the breeding of malaria vectors as well as increased human exposure to

the vectors.

A long-term entomological and epidemiological survey would be needed to determine the potential for increased transmission.

Vector control of mosquitoes by larviciding breeding places and the spraying of huts should be undertaken in the Project Area.

Consideration should be given to the provision of malaria chemoprophylaxis for the Project Area population. Continuing surveillance of malaria throughout the year should be instituted.

Nothing stated within this assessment should be construed as a reason for delaying the implementation of this Project pending further study or the implementation of the recommendations. Nor is it intended that the health needs be neglected. The required studies and other recommendations should properly be implemented simultaneously with and as a part of the Project.

Status of Major Endemic Diseases

Hospital records constituted the major source of available data. Examination of these records indicated definite evidence of under-reporting of endemic diseases. The available parasitological statistics from the Phebe Hospital and the C.B. Dunbar Clinic revealed the most prevalent endemic parasitic diseases in Bong County to be malaria, schistosomiasis, onchocerciasis and hookworm. Of significance also were diarrhea, dysentery and leprosy.

a. Malaria

Malaria has the highest endemicity among communicable diseases in Liberia and constitutes a severe problem. This is shown by hospital and clinic records and by limited malariometric surveys carried out a few years ago in the counties of Lofa, Nimba, Bong, Grand Bassa, and Grand Gedeh.

In some rural areas of Liberia, the parasite rate in children is stated to be as high as 80-100%. According to the Annual Report of the National Public Health Service for 1969, 73.6% of 743 blood samples from employees and their families were positive for malaria parasites.

At present, few, if any, control measures are being carried out in Bong County. Malariometric surveys and control measures are applied mainly in Monrovia and its environs (within a 25 mile radius).

No recent data are available on vectors or vector density with regard to malaria and Anopheline mosquitoes in Bong County. Vector species collected in the Monrovia survey revealed A. gambiae, A. funestus, A. hancocki and A. coustani. A. gambiae was the predominant species collected.

A feasibility test on weekly chemoprophylaxis, at Bentol, as a measure of malaria control, showed a significant reduction in endemicity. The parasite rate fell from 76% before chemoprophylaxis to 38% afterward.

Review of Past Activities and Epidemiological Data

i) The first results of malaria survey in Liberia published by the Harvard African Expedition (1926-27) showed that out of 150 children and adults examined, 34.6% were positive for malaria.

ii) GOL and WHO, Malaria Control Programme (Liberia-5), 1951. Residual insecticide spraying in Bong and Nimba counties (9,000 square miles). By second half of 1957, a widespread resistance of A. gambiae to Dieldrin and BHC was established.

iii) In 1958, a Malaria Eradication Pilot Project (MEPP-Liberia-16) was superimposed on the previous one. DDT was sprayed at one year cycles, last spray - 1961.

iv) 1954-57 - A. funestus was predominant at 57%, next came A. gambiae 32% and A. hancocki at 10%. By 1958, A. gambiae represented 98% and A. funestus only 1.5% of the Anopheline population.

v) 1961 - Parasite rate - 18.5%. 85% was P. falciparum, P. talariae - 12.5%, P. ovale - 2.5%, mixed infections 10.6%.

vi) Malaria Pre-Eradication Project (MPEP Liberia 20), 1963. Malariometric surveys in Nimba, Bong, Grand Gedeh, Since, Lofa and Grand Bassa revealed parasite rates for all age groups ranging from 57-88%.

vii) Entomological surveys in 1965 were done in the sprayed and unsprayed areas of former project Liberia - 16. Seven species of Anopheles were recorded of which A. gambiae was the only one found infected.

No subsequent data on Bong County, with regard to malaria surveys, were available.

An assessment of malaria prevalence in two villages in Bong County was done by the team. The villages selected were within the Bong County Rural Development Project area. One village, Gbatala, was in a non-swamp rice area and the other village, Palala, was in a swamp rice area. Both villages were in Gbarnga District.

Gbatala - The survey sample of 172 persons from the population of approximately 679 showed a parasite rate of 48%, spleen rate of 14%, gametocyte rate of 10%, and an infant parasite rate of 25%. Plasmodium falciparum 61.4%, and Plasmedium malariae 36.2% accounted for almost all of the parasites. The 2-9 age group (65%) showed the highest rate of infection which tended to decrease with increase in age. The infant parasite rate and gametocyte rate indicated dry-season transmission of the disease.

Palala - In a sample of 71 from a population of approximately 455, the survey found a parasite rate of 55%, spleen rate of 21%, a gametocyte rate of zero (0) and an infant parasite rate of 66% (only 3 infants, all under 1 yr. old, examined). Plasmodium falciparum 71.8% and Plasmodium malariae

20.5% again represented almost all of the parasites. The highest rates of infection were found in the 30-39 (71%) and 10-19 (67%) age groups with only the 20-24 age group showing less than 33% infection.

b. Schistosomiasis

Several studies have been undertaken by various researchers including Miller (1954-57), Vagel (1958-59), Haas (1969), Sademan (1973), and Hiatt and Ruiz-Tiben (1976). These studies have reported the presence of both S. haematobium and S. mansoni with the former being more prevalent. No transmission has been reported from a 70 mile wide coastal strip or from the large eastern and western forest regions. The highest prevalences are in the Central provinces, extending up to the border with the Ivory Coast. Infection has also been documented in the western provinces to the borders of Sierra Leone and Guinea.

A brief review of Phebe Hospital records for the six-month period of July 1, 1976 through December 31, 1976 revealed that 22 persons were hospitalized with schistosomiasis as the primary or secondary diagnosis. Six of the cases were in children less than ten years of age. The remainder were described as adults. Thirteen cases were S. mansoni (one double infection) and 10 cases were S. haematobium infections (one double infection). These findings indicate that as a primary or secondary cause of hospitalization for schistosomiasis, S. mansoni is quite significant. This may also suggest that S. mansoni occurs more frequently than routine stool examinations may indicate.

The APHA Team undertook field surveys in Velezela (Lofa County), and Gbatala and Palala (Bong County). Prevalence rates for S. haematobium were found to be 9.2% in Velezela, 24.8% in Gbatala, and 52.5% in Palala. The corresponding intensities of infection (geometric means of egg counts per 10 mile of urine) were 4.5 in Velezela, 8.6 in Gbatala and 11.8 in

Palala. Egg counts of up to 1200 per 10 mile were found in Gbatala and 543 per 100 mile in Palala.

The Team found prevalence rates of S. mansoni to be 25% in Velezela, 16.3% in Gbatala, and 50.4% in Palala. The intensities of infection were 8.9 eggs per gram of feces in Velezela, 20.1 eggs per gram in Gbatala and 26.1 eggs per gram in Palala with corresponding ranges up to 1855, 1164, and 2054 eggs per gram in the three villages.

c. Onchocerciasis

The most dramatic form of filariasis is onchocerciasis or river blindness caused by the worm Onchocerca volvula, which is transmitted by the black fly, Simulium damnosum.

In 1926 the Harvard Expedition gave the first evidence of the occurrence of onchocerciasis in Liberia (Strong 1930). Burch, et al. (1955), Miller and Frang (1958), Rebe and Hoeppli (1964) and Gratama (1966) determined the prevalence in the population of several clinical lesions, as well as the regional occurrence of endemic foci in rural areas. Burch, et al. found the highest prevalence of skin nodules and positive skin snips was among people from Western Liberia, while there were fewer microfilaria carriers from the coastal belt.

Data on parasitological and clinical findings from a homogeneous rural population at Bong Range were evaluated by Frentzel-Beyme. He found that from a sample of 1,252 persons from a total popualtion of about 15,000 of the Kpelleh tribe, 783 (63.2%) were carriers of microfilariae of O. volvulus Age-specific prevalence rates revealed that at an age of 16-18 years more than 50% of the population had detectable larvae in the gluteal skin. Among the adult population, the male sex showed a significant predominance of positive results.

The rate of blindness of 1.18% found in the Bong Range was more than twice as high as in onchocerciasis free regions of Liberia. Blindness appeared related to onchocerciasis in the majority of cases. The average age of onset of blindness was 48 years. In the unilaterally blind, the average age was 40 years and the blindness seemed less related to onchocerciasis.

The study by Frentzel-Beyme on blindness in Liberia with relation to onchocerciasis suggested that 50% more blindness occurred than would be expected without exposure to onchocerciasis sometime in life.

Studies on the epidemiology of onchocerciasis in Liberia included a survey on the breeding places of the vector Simulium dammosum, which was found to be distributed throughout the country. The species appeared to be more common in regions where the original tropical rain forest had been destroyed and replaced by farmland, rubber plantations, low-bush or savanna.

Garms and Vajime studied the ecology and distribution of the Simulium dammosum complex in Liberia and Guinea. S. dammosum Theobald and S. sirbanum Vajime and Dunbar were found breeding in rivers and irrigation systems.

Brinkman studied quantitative measurements on skin snips in onchocerciasis. He found that the largest proportion of microfilariae in skin snips emerged within the first 30 minutes after immersion in Normal saline.

Laboratory records of the Phebe Hospital and C.B. Dunbar Clinic on skin snips show a positivity range from 33% to 51% over the period of 1973-1976.

d. Trypanosomiasis

This disease is not widespread in Liberia. However, in many parts of the country there are several species of tsetse fly capable of transmitting

trypanosomiasis. In the mid-60's surveys indicated that the disease seemed to be limited to northern Liberia. The small number of cases found there indicated that trypanosomiasis is not now a major health problem. Review of records at Phebe Hospital for the period of 1967-77 revealed only 13 cases; most were residents of the proposed area.

At present, it does not appear that trypanosomiasis is a major health problem in Bong County. However, Sekou Toure Hospital reported 5 positive slides for trypanosomes in May 1976.

Again, a brief review of hospital records on all persons hospitalized at Phebe Hospital over the 10 year period, 1967-1977, revealed only 13 cases. The species of parasite was identified only twice and that was T. gambiense. The two most recent cases seen in February 1977 were suspected as being due to T. rhodesiense. The hospital does not routinely do studies on blood for trypanosomes. However, because of its acute nature, patients with Rhodesian sleeping sickness will usually seek medical aid.

e. Filariasis

There were no reports on filariasis from hospital data or the MHSW. However, filariasis is known to occur in Liberia but does not appear to be a major health problem at this time. One report from Sekou Toure Hospital for April 1976 revealed eight out of eight positive coverslip examinations for microfilariae. It was not clear whether this was for W. bancrofti or O. volvulus as nothing was reported under skin snips. No accurate figures exist from the records of the Phebe Hospital and the C.B. Dunbar Clinic as to the incidence of this infection.

f. Other Parasites

Intestinal parasites were quite prevalent, especially hookworm in laboratory summaries from Phebe and C.B. Dunbar Clinic. Hookworm and ascaris

were the most prevalent. The results of the APHA Team's analysis of stool samples for 13 parasites showed the following major prevalences:

Parasite	Velezela	Gbatala	Palala
Hookworm	76.3%	65.3%	54.8%
Entamoeba coli	57.9%	36.7%	39.5%
Ascaris lumbricoides	19.7%	32.7%	16.1%
Trichuris trichiura	19.7%	40.7%	20.2%

6. Existing Health Infrastructure

a. National

Health infrastructure is based upon the Ministry of Health and Social Welfare (MHSW) which is headed by a Minister of cabinet rank. The three main Bureaus are: the Bureau of Medical Services, the Bureau of Preventive Services and the Bureau of Planning and Development. The organizational chart of the MHSW is shown on page 151. The Ministry is assisted by various advisory bodies.

The Ministry has, over the years, also received assistance from foreign sources such as USAID, WHO and UNICEF.

Below the national level, the Ministry has a weak infrastructure. This deficiency is emphasized in the report: A Preliminary and Comprehensive Analysis of the Health Situation in Liberia -- 1976, Bureau of Planning and Development.

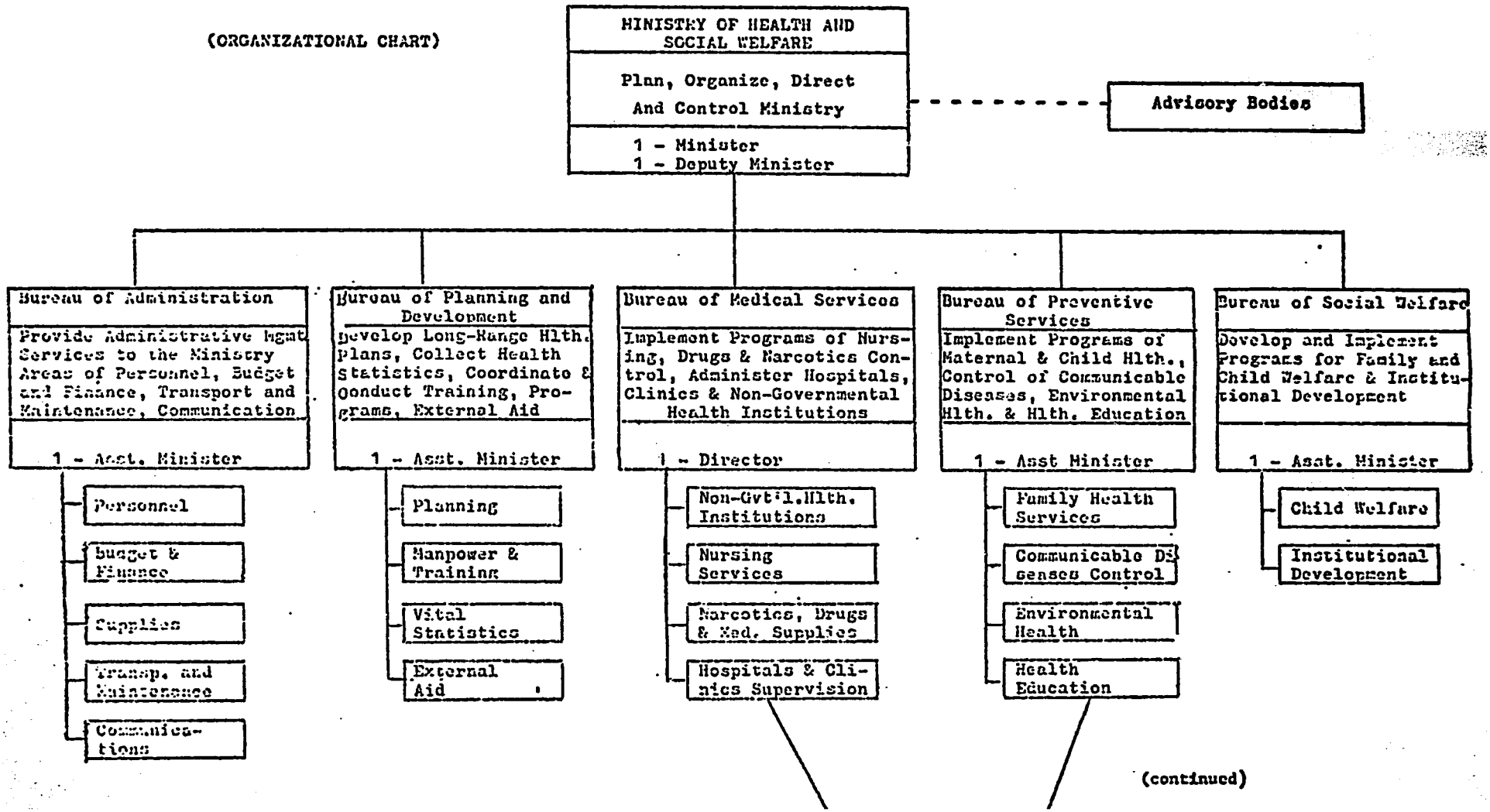
The immediate administration of hospitals and clinics is the responsibility of local administrators. A medical director is in charge of each region except in Montserrado County which has a Medical Director of Public Health Clinics in charge of 25 clinics.

Liberian government agencies have taken increasingly active roles in health care and there are a number of programs in public health. However, medical missionaries, Bong Mines and Firestone Plantations Co. play major roles in health care delivery in Liberia. It is estimated that

MINISTRY OF HEALTH AND SOCIAL WELFARE

ORGANIZATIONAL CHART

(ORGANIZATIONAL CHART)



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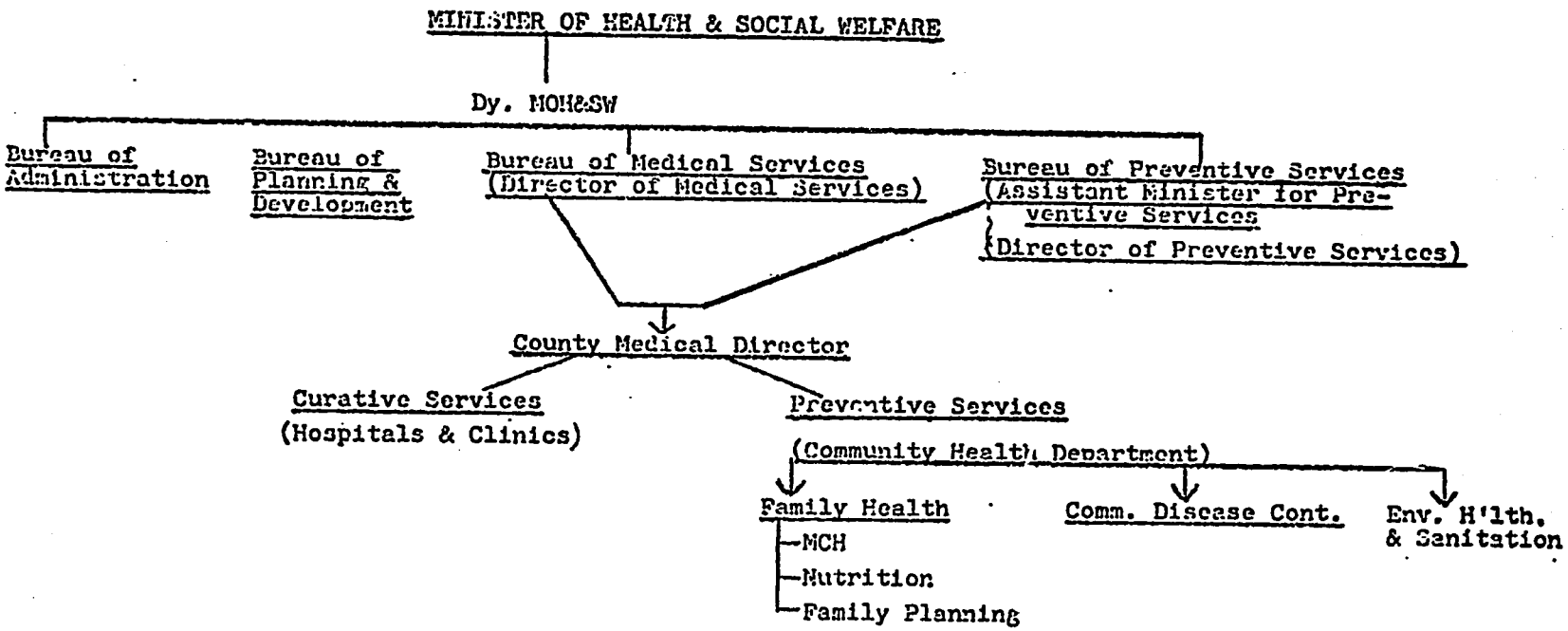
(Organizational Chart continued)



missions and concessions supply as much as 50% of the total of health care in the country.

The publication, Syncrisis: Liberia VII, gives a good breakdown on the disparity in the distribution of hospital beds between Monrovia (Montserrado County) and other counties in Liberia. The ratio is decidedly in favor of Montserrado.

b. Bong County

- Population 1976 - 194,191
- County population with direct access to health facilities - 14,138
- Number of health facilities - 36 (government clinics - 31)
- Number of hospitals - 2
  - Phebe
  - Sekou Toure
- Government physicians - 5
- Dentists - 1
- Other physicians - 8
- Doctor/population - 1/22,830
- Professional Nurses - 27

Only 7.3% of the Bong County population has direct access to health facilities. The facilities were built in relationship to existing roads. This is the situation in most of Liberia; for only 33% of the total population is being served. The situation is more acute in rural areas.

The Annual Report - 1976 of the MHSW contains statistical data on the various health facilities, personnel and on reportable diseases.

7. Summary of Recommendations

The following recommendations are proposed:

a. Schistosomiasis

The control of schistosomiasis in Liberia and the Bong Project Area in particular would require the use of a combination of measures including:

i) Improved environmental sanitation (potable water supplies and sanitary waste disposal) to prevent viable organisms from reaching waterways and reduce human contact with polluted waters. (See later recommendations on sanitation.)

ii) The location of focal areas of the snail intermediate hosts (Bulinus globsus, host of Schistosoma haematobium and Biamphalaria pfeifferi, host of Schistosoma mansoni) and the rendering of these areas free of infestation bymollusciciding, maintaining waterways free of weeds and canal banks relatively steep.

iii) The use of chemotherapy.

iv) The use of a sustained health education program to familiarize residents with the details and need for the implemented control measures.

v) The Liberian Institute for Biomedical Research and the Schistosomiasis Surveillance Unit (SSU) presently becoming operative in Lofa County should be responsible for the implementation of the required research, surveillance and control programs. This would require the expansion of the SSU's functions as presently defined to include the immediate pursuit of a control program. The estimated requirements for such an expansion are to be found in Appendix 3.

A snail culture facility is needed to maintain stocks of at least three intermediate snail hosts: - Bulinus globosus, Biomphalaria pfeifferi and Pyrgophysa forskalii. A useful paper on culture methods is:

Cultivation of Bulinus (Physopsis) globosus (Morelet) and Biomphalaria pfeifferi pfeifferi (Krauss), Snail Hosts of Schistosomiasis, by Yung-san Liang (Sterkiana, 53: 1-75, 1973)

With prospects of having fascioliasis appear where cattle are maintained, it would be important to culture Lymnaea natalensis. Also there should be a field program of studies similar to that carried out by Dr. Harold Walter as reported in the LITM Report for 1960. The year-round survey would provide snail population information needed to determine both prevalence of disease and effectiveness of control procedures.

Since field programs are dependent on a good deal of mobility, adequate transportation facilities will remain at the center of the program.

Personnel selected for the program must be properly trained.

The medical aspects of the work require a physician with expertise both in diagnoses and in drug therapy.

It would seem worthwhile to use the area for a pilot project to test the feasibility of using increased ambient temperatures to eliminate snails in focal areas, such as a pond, pool, rice paddy, etc. Evidence is at hand to indicate snails (pulmonates) are not present where temperatures are maintained in the field at 30°C or higher. Heat would be applied only at the season when the gonads of the snails are producing eggs.

b. Malaria

i) Entomological survey for A. gambiae and other Anophelines, e.g., A. funestus and A. hancocki during both wet and dry seasons.

ii) Larviciding of breeding places, spraying of huts, varying of water levels and the use of predator minnows.

iii) Consideration of Chemoprophylaxis of the population in the Project Area. A study (pilot project) in Bentol townships in 1975, of weekly Chemoprophylaxis with Chloroquine, reduced the parasite rate from 76% to 37.9%. Encourage the population to use mosquito nets and repellents where practical.

c. Onchocerciasis

Continuing surveillance of onchocerciasis for evidences of clinical disease (blindness dermatitis).

d. Trypanosomiasis

A survey for trypanosomiasis in the Project Area (random sampling).

e. Filariasis

A survey for filariasis in the Project Area (random sampling).

f. Environmental Sanitation

i) Environmental sanitation is generally poor throughout Liberia with the exception of a section of Monrovia, the capitol, and the private concessions such as the Bong Mines and the Firestone Rubber Company.

ii) This poor sanitation is a (perhaps the) major contributor to the highly endemic schistosomiasis, and other water-borne, helminthic and parasitic diseases of the country

iii) Current efforts to improve the situation are very inadequate.

iv) The resources allocated to the improvement of environmental sanitation are grossly inadequate.

v) A massive environmental sanitation program must be at the core of any plans for significantly reducing and controlling the major endemic diseases of the country, particularly schistosomiasis, malaria, and the various enteric, helminthic and parasitic diseases.

vi) Top priority should be given to the provision of potable water supplies on a country-wide basis. This would considerably reduce the need for human contact with polluted, schistosome-bearing surface waters and thus significantly reduce the incidence of schistosomiasis. It will also significantly reduce and control the other water-borne and gastro-enteric diseases.

vii) Towards this end, a long-term water supply improvement program should be developed by the government with the necessary bilateral and international aid.

viii) Simple systems should be adopted to keep costs to a minimum and to ensure that the systems can be properly operated and maintained by local personnel.

ix) In the villages and small towns the programs should be aimed at providing water of adequate quantity and quality at road-side stand pipes within easy reach of residents(say at intervals of 100 yds.) in the initial phases. These systems may be later expanded to provide for individual house connections.

x) Wells, when used, should preferably be properly sealed tube wells fitted with suitable pumps. Hand-pump equipped tube wells would be much more efficient than hand-dug wells just tapping the top of water-bearing formations. In addition, they will not be subject to the pollution of the currently used improperly sealed hand-dug wells with rope and bucket operation. The use of hand-pump equipped wells would be indicated for small isolated communities with relatively few, perhaps widely separated, houses.

xi) A similar long-term sewage disposal program should be developed and implemented. It would combine the use of well designed sanitary septic tanks and pit latrines in the rural towns and villages with the expansion of the sewerage system in Monrovia.

xii) These long-term programs must provide for the training of the necessary local staff at all levels and the required logistic support.

NIGER

1. Objectives

A three member team visited Niger between October 6 and November 27, 1976 with the following objectives:

- To carry out a Health Sector Analysis of Niger to be used in revising AID's Development Assistance Plan (DAP) for the country;
- To develop a specific project proposal in the form of a Project Review Paper (PRP) for AID assistance to increasing the Government of Niger's capacity for conducting public health programs. This PRP was to be based on a Project Identification Document (PID) and preliminary report developed by Dr. Poulsen which was in turn based upon MOH and WHO documents, MOH recommendations, discussions with RDO/Niamey personnel and on field observations.

2. Team Composition

Eugene R. Boostrom M.D., Ph.D.
Team Leader

Gladstone Fairweather
Human Resources Specialist

James Neal
Health Economist

3. Background Information

General Information

Niger is an inland Sahelian country of 1.25 million km^2, stretching from the loop of the Niger River in the West to Lake Chad in the East and sharing northern borders with Mali, Algeria and Libya. The country is three-quarters desert, and 75% of the population of approximately five million (mid-1976 estimate) live in the Niger River Valley and in an narrow band extending eastward from the Niger River along the southern

border; this band normally receives about 600 mm of rainfall during the 3-4 month rainy season. Most of the people live in the country's 9,000 villages, with an average village population of 300-500. It has been estimated (1970) that per capita income in rural areas is less than one-fourth of the national mean per capita income (WHO Brazzaville).

The nearest ocean port is 600 miles away from the southern border, and the country is fully dependent upon a marginal road and rail system for imports and exports. Within the country, economic, social and administrative integration are hindered by long distances between major population centers, inadequate transportation and communication networks, and the presence of several major tribal groups (including 500,000 nomads and semi-nomads) and several indigenous languages.

The following statistics indicate the general socioeconomic conditions of the country:

Per capita GNP (1973, from 1975 IBRD Annual Report)	$90
Percent of labor force in agriculture	91%
Percent urban (1975)	9%
Literacy rate	5%
Students as % of 5-19 age group	7%
Annual population growth rate	2.8%

Niger was severely affected by the 1968-1974 Sahelian drought, from which the agricultural sector has not yet recovered, in spite of increased rainfall in 1975 and 1976.

The GON bases its economic development plans primarily on improved exploitation of the nation's agricultural potential, with main emphasis on increased production of cereal grains and livestock; in recent years however, mineral exports (especially uranium) have become increasingly important.

The Council of Ministers has adopted a Triennial Program for 1976-78, prepared by the Ministry of Planning. The Program has three main goals:

-- to free the national economy from limitation currently imposed by natural conditions such as climate and terrain (e.g., increase food production through irrigation and water projects and improved livestock productivity)

-- to institute a truly "developing" society (emphasizing human resources development through public health and education activities and sensitization and literacy campaigns, encouraging mass participation)

-- to promote economic independence (through development of transportation, infrastructure, primary food processing industries, mining and tourism)

A financial program supports the capital investment program: 88 billion CFA during the three year period, distributed as follows, in accordance with national priorities:

Rural Productivity - 33.6%

Infrastructures (including transportation and water projects) - 46.8%

Human resources - 15.3%

Industry, mines and commerce 4.3%

Health Conditions and Disease Problems

Niger's people suffer from all of the health problems associated with poverty, with the addition of several widespread diseases which afflict unprotected populations in poor "tropical" lands. Health statistics reflect the severity of national health problems:

Birth rate (WHO 1976 Country Profile)	50-55/1,000
Crude death rate (WHO 1976 Country Profile)	25-30/1,000
Infant mortality (PMI 1975 Annual Report)	314/1,000
Age 1-4 mortality (PMI 1975 Annual Report)	327/1,000

Perhaps the most striking health statistic, derived from those above, is the fact that for every 10 births in Niger, less than four children survive to their fifth birthday. In 1974, a study done in Niamey, the capital city, showed the following causes of death for children under the age of 10:

Malaria	26.0%
Measles	10.5%
Diarrheas	13.0%

While the good harvest in 1975 brought some relief to the population which suffered under the 1968-1974 drought, the health sector of Niger is still characterized by the vicious cycle of malnutrition and high incidence of communicable and parasitic diseases which together are the main causative factors in the high infant and child mortality rates. Furthermore, experience in other developing countries shows that high infant mortality rates are inducive to high birth rates, in order to secure the wanted number of surviving children. This results in narrow spacing of births, which has devastating effects on the mother's health and deprives the "displaced" infant of sufficient breast feeding - thus contributing further to the state of infant malnutrition - and the vicious cycle goes on.

Project Description

The GON has increased the national health budget by about 75% over the three year period 1974 through 1976. Even with this major monetary increase, the percentage of the total GON budget allocated to the health sector has declined during the same period from 7.84% in 1974 to 6.90% in 1976.

The cost of operating the existing health care system is rapidly increasing, primarily because of inflation in the cost of material and logistical support. Of the 549 million CFA francs (US $2.231.707) increase

(75%) in the MOH budget during the period 1974-1976, 409 million CFA francs (US $1,662,401) (74.5%) was due to increases in the cost of materials and transportation. 155.5 million CFA francs (US $631,114) (15%) of the total cost of materials and logistical support has been for maintenance of vehicles and other operating cost, of transportation. These factors, the general influence of inflation, and the paucity of infrastructure have severely limited the increased health services which the MOH was able to provide with the increased funds made available by the GON.

The five years of health sector support proposed in the PRP document will increase the MOH capacity to support the existing Three Year Plan 1976-1978 and enable the MOH to plan a more effective program for the 1979-1982 period and beyond. These support funds will be used as a direct supplement to the GON budget allocations for health during the 1978-1982 period rather than for specific project support. This will enable the MOH to implement its program of expanded and improved basic health services more rapidly than would otherwise be possible.

In summary, there are two general objectives:

1. To help the MOH strengthen its existing organization.
2. To provide resources to help the Ministry to extend health services to more people in more villages.

Achievement of these objectives will depend upon previous attainments in overcoming obstacles which currently constitute bottlenecks limiting both coverage and quality of services.

The MOH has identified several areas in which such obstacles exist and has outlined key programs intended to overcome them:

1. A permanent program of training, retraining and regular control and supervision of health personnel at all levels.
2. The retraining or re-orientation of existing health personnel towards public health, preventive medicine, health education, maternal and child health (including nutrition education).
3. Capability to maintain vehicles and medical equipment to enable health workers to function.
4. Improved systems for gathering, analyzing, interpreting and using

information (including epidemiological surveillance, health statistics, and a responsive management information system capable of identifying management problems).

4. Summary of Findings

Findings Relevant to Health Sector Assessment

Niger is far ahead of many developing African countries in terms of developing and implementing a rural health system appropriate to national health conditions and in the context of overall socioeconomic development. In some areas, Niger has already used available information and experience, as in the adaptation of elements of the CUSS program in developing a medical curriculum suited to national needs. In other areas of health services, encouragement of direct exchange of information and direct observation of other programs and projects would be mutually beneficial, especially within Francophone West Africa.

The GON's emphasis in health services development is on the provision of low cost basic health services to as much of the population as possible, using well-trained and supervised basic level personnel (including traditional practitioners), with primary focus on the village level. In keeping with this emphasis, the initial criterion of progress in development of a global medicine including prevention, education and cure for both rural and urban communities on a participatory basis should be measurement of cumulative coverage of villages by adequate basic health services. The secondary criterion of progress to be developed should evaluate the adequacy of the services provided in terms of relevance to the population served and adequacy of the amount and variety of facilities and services. The tertiary criterion of progress to be developed should enable the MOH to evaluate the quality of services provided according to pre-determined standards of health services and care provided.

Findings Relevant to Proposed AID Program (PRP)

The extension of health services to additional villages will require that additional paid workers be hired to supervise and support the village level volunteer workers. This will directly provide employment to a limited number of persons.

Improved and expanded health services are expected to lead to improved health for the rural people. Better health will increase their potential productivity (one of the objectives of the Ministry's overall program). If other conditions make it possible for this potential increase in productivity to be realized, incomes should also increase.

The Ministry of Health is now successfully providing basic health services using Village Health Teams in approximately 1,500 of Niger's 9,000 villages. The services are developed in each place with the participation and cooperation of the village's people, using techniques of motivation and community organization developed and used during the past 15 years by another national agency, Animation Rural, which cooperates fully at all levels with the MOH and which assists the villages to prepare for participation in the village health program and to select the village health team members.

RDO Niamey and consultants and WHO workers agree that the MOH focus on rural health, the use of basic level health workers, and emphasis on low cost basic services are a realistic and feasible approach to the health problems of Niger's people. These policies and the Ministry's program are also in complete agreement with WHO and USAID policies regarding health services development.

The health services which the MOH is developing are designed to provide adequate basic services (preventive, educative and curative) at the lowest possible per capita cost. Part of the cost is paid by villagers

who purchase selected drugs, with the money being used to replenish the local drug supply through a local revolving fund controlled by a village committee. Villagers also continue their traditional practice of in-kind payments to matrones for deliveries. The services offered by the MOH could be used by villagers without substantially increasing the amounts the villagers spend for health care at present.

Full development of the MOH program of rural health services will not be accomplished within the five years of project activities (See Project Description for project objectives). However, the Ministry expects funds to be available from the national budget and other sources which will permit development and operation of the full system. The services provided in rural areas are designed to have per capita costs (excluding villagers' payments for some medications) which will not exceed the nationwide per capita availability of funds for MOH operations.

Given the basic congruence of GON and USAID policies and objectives in the health sector, and MOH progress to date in developing and implementing plans to attain those objectives, health sector support seems to be a desirable and workable approach to improving the productivity and quality of life of the people of Niger. RDO/Niamey and the consultants involved in project development have been aware of the need to assure that the MOH absorptive capacity be adequate for successful utilization of such support.

The MOH emphasizes the importance of coordinating the numerous health sector projects which it is carrying out with the assistance of a large number of different bilateral and multilateral international donors. The Ministry correctly accepts this responsibility as its own and assures that all donors' contributions will be used in ways which will contribute

to the MOH's own policies and program without distorting or shifting MOH priorities.

5. Status of Major Endemic Diseases

Malaria

A 1968 WHO study showed that malaria is present throughout the country in holo and hyperendemic form. During the rainy season - April to October - malaria is by far the most common and serious communicable disease problem. In the last two years, the Government has intensified its malaria control program of free distribution of Nivaquin to pregnant women through health centers and dispensaries and sale of Nivaquin tablets (mostly for curative purposes) by the village health workers("secouristes"). The GON found, however, that the program was poorly accepted, poorly controlled and only reached a small percentage of the vulnerable population, few of whom were fully protected. In 1976 the MOH started a new, innovative and better controlled program of "flavoquinization" of the population. The program is carried out by para-medical personnel of all health centers and dispensaries through regularly scheduled visits every two weeks to all villages in the cantons covered by a health center or dispensary. The Flavoquin is sold for 5 CFA per tablet (actual cost to the Government is 7 CFA). At the beginning of the malaria season the nurse visiting the village lists the names of all members of each household accepting the program and determines the total cost of providing Flavoquin tablets to be taken every 15 days for the whole household throughout the malaria season. The head of the household then pays the total amount for the entire season in one payment, but receives only sufficient pills to cover the first 15-day period. After two weeks the nurse returns, checks the household list, and distributes the pills for the next two weeks, and so on. This program has been well accepted. The population has shown more

confidence in the Flavoquine which they purchase than they had in the Nivaquine received by free distribution, and para-medical personnel report a significant decrease in the number of patients seeking malaria treatment in the centers.

Schistosomiasis

Schistosomiasis is rapidly spreading into new areas of Niger in the wake of new dams and agricultural irrigation projects. The Director of "Grandes Endemies" feels that increased cooperation between agricultural development agencies and the MOH might help limit the problem, but there is as yet no adequate answer to the problem of schistosomiasis in Niger or elsewhere. Efforts of the "Grandes Endemies" in this area have thus far been limited to a few surveys, which showed infection rates of up to 90% in children in irrigated areas along the Niger River.

Onchocerciasis

Onchocerciasis is found only in the South-Western part of the country. Prevalence surveys have been done in the cantons of Tamou and Torodi. Niger is participating in the regional onchocerciasis control program, which will use larvacides over the next 18-20 yrs. to control the disease vector (simulidae fly). After adequate vector control during that length of time, the disease agent should no longer be present in the population of the region.

Leprosy

Leprosy is still a major problem in Niger, with over 20,000 known cases in the country. The majority of cases are concentrated in a belt from Dosso to Maradi and Zinder along the Nigerian border. The "Grandes Endemies" (see later discussion) is charged with the treatment and control of leprosy and provides distribution of DDS and other sulphone drugs through special mobile units visiting the patients in the villages. However, the program

seems to suffer from "benign neglect". Leprosy patients are still outcasts from the society, and leprosy ranks rather low on the list of priorities of the "Grandes Endemies". According to local health officials in the leprosy belt, the schedule of the leprosy units is irregular and the coverage poor. One sustained effort in leprosy control and treatment is carried out by the Sudan Mission Leprosarium in Maradi. This institution provides hospital and outpatient service to some 700 patients through a highly experienced American nurse, a visiting surgeon and a small local staff. The institution also provides some vocational training in agriculture and in leather work for former patients in Maradi, and supervises a leprosy village for outpatients and their families. The program has suffered from lack of coordination with the "Grandes Endemies", but attempts are being made to remedy this situation and the leprosy nurse was recently, for the first time in her long experience, invited to a departmental conference with the "Grandes Endemies"to discuss leprosy problems.

Tuberculosis

Tuberculosis is another serious and difficult to manage problem in Niger. The only attempt made to control TB is the BCG vaccination program initiated in 1965 and carried out by the "Grandes Endemies". While this vaccination program has a high priority in the "Grandes Endemies", it probably does not reach a sufficiently high percentage of newborn children (or children 0-14 yrs. of age) and its effectiveness is therefore doubtful. Casefinding is limited to occasional sputum examinations, sent from health centers and dispensaries which happen to be near enough to one of the only three "Grandes Endemies" laboratories in Niamey, Zinder and Maradi, and to occasional X-ray examinations in the few hospitals and health centers which have functioning X-ray equipment. Treatment is provided mainly

by the three TB clinics in Niamey, Tahoua and Zinder, but ambulatory treatment is also given through some health centers and dispensaries. No organized TB control and casefinding program exists in Niger, and there is little hope of controlling TB until (1) the nutrition status of the population is improved, (2) BCG vaccination can be carried out by all health centers and dispensaries and reach the majority of newborn children, and (3) the health services can provide treatment and isolation (as necessary) of all new cases and follow-up of their contacts. Unfortunately, these conditions seem as far away in Niger as in other West African countries. No reliable statistics exist on the incidence of TB in Niger, but most health workers who look for it find that it is rampant.

Venereal Disease

Syphilis and gonorrhea are widespread in both urban and rural areas. Extremely high prevalence rates have been found among prostitutes and "free women", and contact tracing is virtually impossible in many cases and probably seldom seriously attempted. Incomplete treatment is also a major problem, with patients often not returning to complete a series of injections; this is especially true among the nomads. Several Departmental Directors of Health have had limited success with periodic examinations of prostitutes.

Meningitis (meningococcal)

Meningitis has produced major epidemics in Niger in the past (13,964 cases and 1,419 deaths in 1962; 11,242 cases and 1,184 deaths in 1970), but not in recent years (1,603 cases and 68 deaths in 1973; 1,723 cases and 145 deaths in 1974).

Cholera

No clinical cases of cholera have been reported since 1974, although bacteriological cases were reintroduced into the country in 1975 by pilgrims

returning from Mecca.

Infantile diarrheas, dysentery, salmonella infections, amoebiasis, hepatitis, etc., are all frequent in the Niger population. The control of these disease is a question of environmental sanitation aimed at controlling fecal-oral infections. This involves provision of potable water, construction of latrines at sufficient distances from village wells, and health education of the rural population. The same is true of the common intestinal parasitic diseases (ascariasis, taeniasis, etc.) According to small surveys carried out by the departmental laboratory in Maradi, eggs of these parasites are found in the stools of 80% of the children examined. While not serious by themselves, the parasitic infections contribute to the malnutrition of children and thus accelerate the vicious cycle. The GON policy of extending basic sanitation and health education services to the villages through the village health workers (secouristes) is a good beginning in controlling these conditions and may succeed as these basic health services penetrate a larger part of the population.

6. Existing Health Infrastructure

Physical Facilities *

Type of Facility	Number	Number of beds
National Hospitals	Niamey Zinder	794 681
Departmental Hospitals	5	459
Medical Centers (Hospital-Dispensaries)	38	781 hospitalization 421 maternity
Rural Dispensaries	143	---
Antituberculosis Centers	3	161
Private Hospitals	1	200
Armed Forces	---	72

* Information from the WHO Country Profile of 30 September 76.

Utilization of Services

The following data indicate levels of utilization of the health services:

Number of outpatients seen	(1974)	1,880,692
Number of outpatient visits	(1974)	4,883,437
Hospital patient-days	(1974)	131,303
Deliveries in Maternities	(1975)	26,671

There is also one "Grandes Endemies" mobile team in each of the seven departments. There are Social Security Dispensaries in Niamey, Zinder, Tahoua and Maradi. A small number of private dispensaries and medical centers are operated by medical missionaries and others, with little formal coordination with government services. Mining consortia operating dispensaries and hospitals for their workers and workers' dependents in the Arlit area of Agadez Department have a closer relationship with local MOH facilities; they accept referred emergency cases and sometime provide medicines unavailable in the local MOH facilities. In Niamey there is a private "French"clinic (with about 25 inpatient beds, one surgeon and one general physician), and a smaller private clinic, with fewer beds, operated by an African physician.

Organization of the Health Services System

The Ministry of Health and Social Affairs is highly centralized, with a vertical line of command. All major policy decisions are made by the Minister with the advice of the Cabinet. The Secretary General is responsible for the administration, coordination and supervision of the different technical divisions and their operations, and the division directors report directly to him. All contact with health officials - on central and peripheral levels - must be cleared with the Secretary General or through the Secretary General with the Minister. The Cabinet appears to play an active role in all administrative decisions. According to the Director of the Zinder Nursing School all assignments of graduate nurses and social assistants from the school are, for example, determined by the Cabinet or at the Cabinet

level. The Secretary General is responsible for all professional decisions and the Assistant Secretary General works as his administrative assistant (both are MD's).

Divisions of the MOH

Division of Infrastructure

The establishment of a Division of Infrastructure (DIS, which is to begin functioning in early 1977) should help strengthen the administration of the Ministry. The division will have three sections:

(a) Section for Health Statistics - to collect and record data on major disease prevalence

(b) Section for Maintenance - repair of vehicles and medical equipment

(c) Section for Logistics - undefined responsibility

Division of Administration and Finance

The Division of Administration and Finance has the following responsibilities:

Bureau of Orders
Personnel
Accounting and Supplies
Pharmacy
Planning and Programming

Division of Hospitals (Curative Medicine)

This Division has the following sections:

National Hospitals
Departmental Hospital Centers
Tuberculosis Centers
Arrondissement Health Centers (Dispensary Hospitals)
Statistics and Documentation

The Division's aim is to provide modern hospital care - with surgery, internal medicine, obstetrics and gynecology, etc. in order for the hospitals to serve as backstop in the chain of references going from the village health workers, to the dispensary, health center and finally to the hospital where medical services are available.

The Division of Social Affairs and MCH (PMI)

Functionally, this division is charged with Social Affairs, Maternal and Child Health Services (MCH) (Protection Maternelle Infantile; PMI), Education of Women, and with coordinating the efforts of the private sector (mission and PVO MCH centers, etc.) within the framework of governmental policies and efforts.

The Division of Training and Health and Nutrition Education

The division is to deal with education and related research, paramedical and social assistance training, health and nutrition education, and coordination ("des aides" - ?donor assistance for training?)

The division is responsible for the training and retraining of all paramedical personnel and social assistants, and shares with the Ministry of Education the responsibility for the School of Medical Sciences. Training institutions and programs are discussed under health manpower. The division also coordinates training of Nigerian MOH health personnel in other countries as required in order to fill specific MOH needs.

Emphasis in the program for retraining (recyclage) of paramedical personnel is on short-term seminars at the Central, Departmental and Arrondissement levels. The numbers of seminars and their general content and participants are included in the Three Year Plan, which is followed as closely as possible.

The Division of Hygiene and Mobile Medicine

The Division of Hygiene and Mobile Medicine inherited its basic patterns of organization and operation from the French system of "Grandes Endemies" out of which it developed. As in most other Francophone African countries, the system consists of mobile teams (concerned primarily with immunizations) and stationary clinics, all directed from a

central division of the MOH.

Organization of Peripheral Health Services

On the peripheral level the health services are organized in the usual pyramidic fashion with the Departmental Health and Hospital Center at the top, the Arrondissement Health Centers and small hospital and maternity wards at the second level, followed by the dispensaries or rural health posts on the canton level and finally reaching down to the village level with its small teams of village health workers - secouristes and matrones.

7. Summary of Recommendations

The consultant team's main recommendations and evaluations regarding health services in Niger and the development of the Improving Rural Health Project are contained in the PRP and its appendices. The rural health services delivery system in Niger, as described in the PRP, is already a good example for other countries attempting to develop rural health services and has great potential for expansion and improvement. It deserves the support which AID is preparing to provide. Few programs and projects already actually providing rural health services, including even limited demonstration projects, coincide so well with AID's aims in health and development and with AID's congressional mandates. Continued attention needs to be given to the coordination of AID-sponsored health sector activities in Niger (i.e., the proposed Improving Rural Health Project, Africare, and Strengthening Health Service Delivery Systems). This is especially important because the Mission is seeking ways to help the MOH improve its coordination of donor activities, and Ministry officials feel that AID's own project development activities are uncoordinated.

Information flow from AID/W to RDO/Niamey should be improved with regard to health sector activities. It might have been helpful to RDO/

Niamey if, during the course of revision of the Africare proposal and the negotiation of the Africare contract, more information had been sent to the Mission. It would also have been useful for the Mission and the APHA team to have had copies of the Africare contract soon after it was signed in late September. At the time of the team's departure, the Mission had still not been given copies of the Africare proposal.

The number of teams contacting the Ministry of Health in Niger should be kept as small as possible to reduce what MOH officials perceive to be needless duplication of efforts and unnecessary demands on their own time. The teams should probably also be small.

The PP team should have copies of the reports to be provided by the AID/W contract nutrition consultants who were in Niger during the latter part of the PRP team's stay there.

Contraception is the fifth of the eight items listed in the GON National Three Year Plan (see Appendix J of PRP) as action to be supported in the health sector. RDO/Niamey should discreetly attempt to determine how and by whom this item came to be listed, and what it represents in terms of GON attitudes toward contraception and the delivery of contraception information, supplies and services. This is a very sensitive area in Niger, but the listing of contraception in the Three Year Plan warrants careful attention.

The eighth and last item listed in the National Three Year Plan as a health sector action to be supported states, under the title "Social Security", that "a system of health insurance will be developed for salaried workers." RDO/Niamey and the PP team should attempt to determine what is meant by this and what implementation actions the GON may be contemplating. Health Insurance for salaried workers would tend to increase their proportional share of health services, and development

of such a system therefore has implications as to distribution of health services to rural people, most of whom, of course, are not "salaried workers". Also, if consideration is being given to developing a separate system for providing services to salaried workers, rather than developing a system for paying for MOH services provided to this special group, there is a high risk of wasteful duplication of efforts and services at all levels, eventually at the expense of MOH services.

SENEGAL

I. Objective

A five-member team visited Senegal between April 11 and May 6, 1977 with the following objective:

To make an environmental assessment (EA) of the Bakel Irrigated Perimeter Project, focussing on Public Health related aspects. This assessment will also produce a recommended design for the incorporation of an appropriate health component in the project to protect villagers in the activity area from any potential adverse health effects of a new water impoundment and provide cost estimates for such a program. The EA team should study as many possible alternatives and/or internal modifications of the project as possible and make recommendations to USAID and the Government of Senegal (GOS) concerning the various options weighed.

II. Team Composition

The team was comprised as follows:

Ulric P. Gibson, Ph.D.
Environmental Specialist-Team Leader

Swailen S. Hennein, Ph.D.
Sociologist

Kevin L. Palmer, M.S., M.P.H.
Malariologist

Sheldon A. Miller, M.H.A.
Health Administrator/Planner

Frank P. Carroll, M.S.
Environmental Health Engin

III. Background Information

Previous Environmental Examinations

A preliminary environmental examination was conducted during the development of the AID Project Paper (PP) and forms a part of it. The Executive Committee for Project Review (ECPR), however, found that examination to have dealt inadequately with the potential negative health impacts.

Subsequently, another environmental assessment was undertaken by Dr. John H. Nebiker during October/November 1976. That assessment concluded that an increased period (year round instead of the rainy season only) of high malaria incidence is the most serious and immediate negative impact. It recommended free prophylaxis for all residents of the project area as the main controlling measure. The ECPR, however, disapproved

That assessment also pointed to much less significant potential impacts of increased schistosomiasis and ecological changes due to the use of fertilizers and pesticides. These, it pointed out, should not be totally ignored but should be carefully and regularly assessed in the future.

Project Description

The project is located in the far eastern region of Senegal around Bakel on the Senegal River and the lower reaches of its tributary, the Faleme River. It proposes to introduce farmer managed irrigated crop production in an area previously characterized by dry land and flood recession farming.

The irrigated perimeters will be worked on a village level cooperative basis in 23 villages with a total population of about 31,000. The Project is concerned only with the first of the proposed three-phased development

plan which will consist of small perimeters varying is size from 20 to 300 hectares with most being in the range of 30 to 50 hectares each. The total area of the perimeters will be 1896 ha. Small pumps of 15 hp and 32 hp and of 150 and 300 m^3/hr., capacity, respectively, will be used to pump water mainly from the Senegal and Faleme Rivers, and from marigots (swamps) in a few cases, for irrigation.

The Project will introduce farmers to double cropping consisting of a first crop of rice during the rainy season of July to October followed by a crop of maize, sorghum and cowpeas during the dry season of November to June. It is also intended to demonstrate to the farmers the benefits of irrigated agriculture such as protection against periodic droughts.

This Project is not to be confused with the larger irrigation development projects planned in relation to the construction of 2 major dams on the Senegal River and for which another environmental assessment is in progress.

The total cost of the Project is estimated at $8.556 million with AID providing $6.149 million for pumps, equipment etc., and the Government of Senegal (GOS) providing the remaining $2.407 million. The Project period is planned for FY 1977 through FY 1982.

The Project is already in progress with the harvesting of the first year's crops currently being completed.

Summary of Findings

The issues of concern relate to the potential adverse impacts of the project with respect to:

1. The transmission of the water related diseases of malaria and schistosomiasis.
2. The ecology of the area resulting from the use of agricultural chemicals, mainly pesticides and, to a much lesser extent, fertilizers.

IV. Water Related Diseases

The findings confirm that, as far as potential adverse health impacts of the project are concerned, consideration need only be given to malaria and schistosomiasis.

Malaria

-- Ponding of water in the perimeters during the dry season will be very short-lived and not attain the 4 to 7 day interval required for the complete cycle of mosquito development.

-- Spot checks made in a number of perimeters and repeated intensive search in one perimeter have failed to produce a single anopheline larva.

-- The extent of ponded water in these small perimeters during the rainy season will be minimal in comparision with the existing sum total of naturally occuring bodies of standing water, particularly in the marigots. The contribution of the perimeters to the proliferation of mosquito vectors is therefore expected to be minimal.

-- Since the primary vectors in the area are A. gambiae which bite only at night, workers will not be at increased risk as no work takes place in the fields at night.

-- Perimeters are generally located at distances from villages approximating the reported limit of the effective flight range of A. gambiae. Very few mosquitoes from the perimeters are therefore expected to reach the villages. The effects on the disease problem will be minimal.

-- For the above reasons the effect on the project area is likely to be insignificant.

Schistosomiasis

-- The available existing information points to the Senegal and Faleme rivers as the main source of S. haematobium in the region.

-- This being the case, essentially all of the villagers in the project area are continually being exposed to the disease because of their customary extensive use of the river on a daily basis for bathing, washing, fishing and other human contact functions.

-- The statement made by the Department of Health, Education and Welfare's Principal Environmental Officer/H in his memorandum of March 30, 1977 to the Director, Office of Environmental Affairs/ DHEW that "because of increased irrigation, exposure of previously unexposed workers may be markedly increased by the project" is therefore without foundation.

-- The repeated drying out of the fields at short intervals because of the intermittent irrigation practices (see the Project Paper) and the nature of the soils will discourage the proliferation of the intermediate host snails of schistosomiasis. These snails require about forty (40) days of favorable water conditions for the development of a colony and sixty (60) days for transmission of the disease.

-- Repeated weeding of the irrigation ditches and the lining of the walls of these ditches with burnt clay bricks, as is already

in progress in one perimeter, should further discourage the proliferation of snails.

-- It is therefore expected that the potential of the project for increasing the incidence and prevalence of schistosomiasis will not be significant enough to justify delaying the implementation of this project.

V. Agricultural Chemicals

Pesticides

A somewhat confusing situation with respect to the use of pesticides on the project has recently been clarified. The original Project Paper dated July 30, 1976 made many references to the likely use of pesticides on the project. Dr. Nebiker in his assessment specifically referred to the use of hexachloracyclohexane in the rice fields against locust and spanish fly infestations.

Officials of the Societe d'Amenagement et d'Exploitation du Delta (SAED) managing the project have, however, adamantly insisted that no pesticides have been used on the project and it is not intended to use any. They stress that the project's objective is not the achievement of optimum crop production rates but mainly subsistence farming. Thus they are prepared to accept some losses due to crop pests without resorting to the use of pesticides.

The revised Project Paper of May 15, 1977 confirms this position. It goes on further to state:

> "If a serious insect or pest outbreak occurs, SAED will consult with the Crop Protection Service which is being supported through the AID financed Sahel Crop Protection Project (629-0916). Two AID entomologists are based in Dakar for that project and would be available for consultation".

It is therefore concluded that the project will not normally contribute

to pesticide-related adverse environmental impacts. Adequate precautions have been proposed for unusual circumstances necessitating the use of pesticides.

Fertilizers

The opinion of Dr. Nebiker is supported that the level of fertilizer use is unlikely to produce measurable increases of algae and plankton growth because of the considerably greater fertilization from livestock manure.

Conclusion

It is concluded that the implementation of the project will result in no foreseeable significant adverse impacts. It is recommended that the project proceed in the manner planned.

VI. Status of Major Endemic Diseases

Very little morbidity and mortality data were available. Hospital records indicated malaria to be the main disease problem, followed by schistosomiasis. Onchocerciasis is a problem outside of the project area. Other diseases of importance have been Asian flu, measles, and cholera of which there was an outbreak in 1971.

Malaria

A malaria survey of 1-9 year olds undertaken in June 1968 by the Service de Lutte Antipaludique (SLA), the government malaria control service, found the disease to be approaching hyperendemicity. Parasite rates of 60% and 75%, respectively, were found among children of ages 1-9 in Golmi and Kounghani with corresponding spleen rates of 46% and 62.5%, respectively.

The APHA Team's epidemiological survey in April 1977 found parasite rates of 18.6% and 39.4% among all age groups in Golmi and Kounghani respectively, and 22.4% and 52.8%, respectively among 1-9 year olds. The

survey found a spleen rate of 16.7% in Golmi.

Schistosomiasis

Indications are that only urinary schistosomiasis (S. haematobium) exists in Senegal. Dr. Watson in a WHO report (1970) stated the prevalence rate to be 22% in the Bakel area.

A survey of school children currently being undertaken by the Government's Services des Grandes Endemies found a prevalence rate of 34.9% for S. haematobium in Tambacounda.

The APHA Team's survey of April 1977 found prevalence rates for S. haematobium of 12.8% and 11.6% in Golmi and Kounghani, respectively. The intensities of infection were low, ranging from 1-61 with a mean of 3 eggs per 10 ml. in Golmi, and from 1-27 with a mean of 6 eggs per 10 ml. in Kounghani. These indicate that transmission is perhaps intermittent without much evidence of morbidity.

Onchocerciasis

Past clinical and entomological studies have indicated that the northern limit of the occurence of the disease is Neyes on the Falémé River, about 30 km. south of the Bakel Project area. The vector is Simulium dammosum.

VII. Existing Health Infrastructure

The Ministry of Public Health and Social Affairs is organized at Regional, Departmental, and Rural Community levels.

At the Regional level, the center of service is the Regional Hospital, one of which is found in all regions except Senegal Oriental and the new Louga Region. These hospitals serve as the referral centers for serious cases from rural areas. The regions' Chief Medical Officer heads the hospital.

Each region is also shown as having a Communicable Disease Control Service (Services des Grandes Endemies). These are, however, very poorly staffed and provide little service.

At the Department Level, each "Circonscription" Medicale has a Health Center, usually a small hospital with 20 to 30 beds including about 10 maternity beds. A physician heads the staff of one or two midwives and nursing personnel.

At the Rural Community Level, health posts or rural dispensaries are located. Most are staffed by only one nurse but plans include the provision of an auxilary nurse and a laborer for cleaning purposes.

Severe shortages of manpower and facilities exist throughout the system. Distribution of the resources is heavily weighted in favor of the capital city and urban areas. Training programs are inadequate as are drugs and supplies.

VIII. Summary of Recommendations

The Bakel Project's Health Component which provides for disease surveillance and village health services programs should be strengthened by the inclusion of two-way radios for better communications and by the provision of malaria prophylaxis (chloroquine tablets or medicated salt) for all residents during the 3-month malaria transmission season.

SENEGAL

1. Objective

Provision of an Environmental Health Specialist to participate with a design team from the International Bank for Reconstruction and Development (IBRD) in the preparation of an environmental health assessment and make recommendations for the Lampsar/Diagambal Irrigated Perimeters in the Delta area of Senegal.

2. Team Composition

APHA:

Charles C. Johnson, Jr., P.E.
Environmental Health Specialist

IBRD:

Jean-Louis Ginnsz, Group Leader
Gois, Irrigation Engineer
Weinberg, Agronomist
Brown, Loan Officer
Dialanas, Hydraulic Engineer
Dubois, Agronomist
Daher, Economist

AID:

Jay M. Bagley, Ph.D.
Irrigation Engineer

Peter B. Hammond, Ph.D.,
Anthropologist

Charles C. Johnson, Jr.
Environmental Engineer

AID/Dakar:

Glenn Slocum,
Coordinator

3. Background Information

The Lampsar-Diagambal perimeters are located northeast of St. Louis, Senegal, along the St. Louis-Rosso Road, between the townships of Lampsar

and Rosa-Bethio. The Lampsar perimeter, located on the north side of this road, is traversed by the Lampsar river or marigot. It includes approximately 1500 ha to be developed at this time. The Diagambal perimeter is south of the road and includes 1,000 ha to be developed.

As designed, the Lampsar perimeter will be irrigated by surface flooding and controlled drainage. The Diagambal perimeter will use sprinkler irrigation. The project is the further implementation of the plan by SAED to develop approximately 44,000 ha in the delta area by 1985.

4. Summary of Findings

- No need for the relocation of villages is anticipated.
- There will not be any noticeable change in land-use. Farming will continue to be dominant.
- The existing quality of water resources in the Delta will not be significantly affected by either the Lampsar or the Diagambal project.
- The use of sprinkler irrigation in the Diagambal Project will result in little or no surplus water for surface run-off or percolation into the ground.
- The shallow groundwater in the area is already unfit for domestic use and will continue to be so.
- The ecology and biology of the river region are unlikely to be influenced in any measurable degree by the projects.
- Snails of the Bulinus species, the intermediate hosts of schistosomiasis, do not seem to be prevalent in the area.
- Depending on the duration of water ponding in depressions, the mosquito breeding season and malaria transmission may be extended by the growing of a second crop in the Lampsar perimeter. This is not the case with the Diagambla perimeter where sprinkler irrigation will be practiced.
- The environmental impact of all the pesticides in use, with the exception

of DDT and HCH should not be significant.

- The Diagambal project will not cause further deterioration in the health of the villagers. The possibility exists that the Lampsar project may cause some adverse effects regarding malaria and schistosomiasis if double cropping is practiced.

5. Status of Major Endemic Diseases

The following is a discussion of the disease situation within the Senegal Delta from St. Louis to Dagana. The statistics given do not represent levels of infections existing in the total population, but rates of infections found in patients visiting the several medical facilities existing in the region or special studies conducted in the area. Also, the infection rates indicated are not necessarily specific for the disease entity cited as no laboratory confirmation was undertaken in some instances, i.e., most fevers are reported as malaria. It can be expected that true prevalence rates will be higher as many villagers become ill and recover or die without seeing a physician or visiting a dispensary.

Malaria

Clinical statistics based on 277,000 visits to 10 dispensaries in 1973 (end of drought) indicated 15% of the patients had malaria. When the rain started again in 1974 this percentage increased to 20% and in 1975 to 30%. These increases indicate a relationship in the region between suspected malaria cases and rainfall (water for mosquito breeding).

Prevalence rates of 56% have been reported in the river region and 48% in the Ferlo. Generally speaking, 76% of all the population below 30 years provide positive findings for malaria. Several species of A. Gambiae are found in the region - Melas A & B. A. Gambiae Melas B. is suspected of being DDT resistant. A. Gambiae is believed to be the primary vector for malaria transmission although other Anopheles mos-

quitos common to the area are capable of its transmission.

Intestinal parasites

Five thousand stool examinations in 1971, 1973, and 1975 indicated 1% positives for strongyloidiasis and 3% positives for Amoeba (Entamoeba histolytica) with a peak in 1973 of 8.8%. Ancylostomiasis (hookworm disease) indicated 1% in 1971, 1.3% in 1973, and 2.9% in 1975.

Bacterial diseases

Leptospirosis is known to exist in Dakar but no more specific information was available. Cholera outbreak in Dakar 1970-73 : 251 suspect cases, 44 vibrio isolated ; August to September 1971 : 11 vibrio isolated in Podor region of the valley, nothing in the region since. Salmonellosis and shigella identified in hospital population by Pasteur Institute in Dakar. During period of nine years (1963-1973), 2,894,000 cases of salmonellosis identified, and 1,610 shigella cases identified. Laboratory specimens were from hospital patients only; patients were from locations throughout Senegal. In St. Louis in 1975, 25 cases of salmonellosis were identified in the hospital population.

Schistosomiasis

The snails (intermediate host genus Bulinus) are said to be found in the delta swamps, marigots, and canals. A Yale University epidemiological study team found Bulinus snails in the canal carrying water to the water treatment plant that served St. Louis as recently as February 9, 1977. They are very prevalent around Lake Guier in the valley region. While this does not seem to be a problem in the more permanent population in the delta, there is considerable migration of persons from other regions where schistosomiasis is endemic. The examination in 1973-1975 of 3,500 urine specimens from students at the institute in Dakar seen by referral revealed a 5.3% positive for schistosome flukes. A report by experts in 1960 of a study

on students at the technical school indicated that 35% of the students were infected with schistosomes. Most of these students were from the southern portion of Senegal. These studies confirm the existence of a reservoir of infection of schistosomiasis in Senegal. Farther to the north of the delta and on into Mali the incidence is estimated to increase from 10% to 40%. It is estimated that 60% of the cattle in the area have the disease.

6. Summary of Recommendations

Development of the irrigated perimeters at Lampsar and Diagambal represents but a small percentage of the actual, and total proposed, perimeters to be developed in the river region. Consideration of the public health and/or water pollution concerns resulting from their development cannot readily be separated from the impact of what is happening in the region as a whole.

As noted previously, the Diagambal project with sprinkler irrigation does not present any harmful impacts on either the public health or the environment. One possible problem may be associated with the location of water under pressure in the close vicinity of villages. There will be a temptation to use this unsafe water for domestic purposes. The provision of safe water in the villages of the region would eliminate this hazard.

The potential public health problem associated with the drainage water from the Lampsar perimeter can be modified by concerted action on the part of the SAED and Regional Health Authority. Basic to the development of irrigation perimeters throughout the river region (and elsewhere in Senegal) is the establishment of effective vector control programs. In the river region, as a minimum, such programs should be considered as an integral element of the normal operations of the SAED. It should include as necessary, and as determined by routine monitoring and surveillance techniques,

programs for malaria control and schistosomiasis prevention. A malaria control program may include any and all of the following: routine clearing and maintenance of irrigation canals to reduce mosquito breeding in the canals, and water seepage from the canals; larviciding of mosquito breeding areas in and adjacent to the perimeters; residual spraying of living areas, particularly sleeping quarters of villagers and others in the region; distribution and use of anti-malarial prophylaxis as recommended by medical authority for the area. While malaria may not be eradicable from the region, its incidence can be reduced and the severity of its illness impact lessened. A scope of work for a demonstration vector control project in the Lampsar/Diagambal perimeters has been suggested.

The schistosomiasis prevention program should include a baseline study to determine (1) the location, prevalence, and infection rate of the snail (Bulinus) in the region; (2) the reservoir of and infection rate of the permanent population and migrants to the region, and (3) the subsequent establishment of a continuing surveillance program to alert the government to any increase in schistosomiasis in the region. While such a program should be incorporated into the operating responsibility of the SAED, the technical implementation probably would best be handled by the Regional Medical Authority.

The development of irrigated perimeters in the River Region may have contaminated the shallow ground water with fertilizer and pesticides. The health impact associated with the intake of water containing such agents is not specifically known. When chemical analysis reveals their presence preventive health practice recommends that other known safe sources of water be used if such sources are available. Since the water sources of the villagers also can be considered unsafe from bacteriological and probably virological contamination, it is recommended that plans be developed

and implemented that assure a safe water supply source to each village in the region. A scope of work for a demonstration project for a village water supply system has been suggested.

Alternatives to the planned irrigation techniques that could reduce the project impacts on public health and/or water pollution include the following:

1. Do not implement the project. Such an action would continue the present practices as they now exist. It does not fit the national program being implemented in the region. The potential for improved income and nutritional levels would be lost. The public health in the villages would not be improved. This alternative is not recommended.

2. Convert the Lampsar perimeter to a sprinkler irrigation system. This would enable irrigation to be practiced, eliminate the problem associated with the discharge of drainage water, and reduce the percolation of contaminated water to the ground water table. It would require substantial time for redesign, increase the capital and operating costs substantially, and cause serious delays in the GOS plan for development of the river basin and production of foodstuffs to help it gain self-sufficiency. The improvement in the public health and reduction in water pollution would not be of equal importance. This alternative is not recommended.

3. Recirculate all of the drainage water in the Lampsar perimeter. This would eliminate the problems associated with discharge of the drainage water to depressions adjacent to the perimeters. However, it could also limit the useful life of the perimeter for food production if recirculation results in a salts build-up in the soil. The primary purpose of these projects is long-term food production to help meet the requirement of the country. This alternative is not recommended.

The OMVS environmental assessment of the Senegal River Basin that is being implemented as AID Project 625-0617 will produce a more definitive picture of the overall impact of introducing irrigation to the basin in general and the river region of Senegal in particular. The recommendations resulting from that study will produce the best basis for developing a major preventive health program by the GOS, AID, and other donors.

Nothing under this discussion of recommendations should be construed as a reason for delay of these projects pending further study or implementation of activities associated with recognized environmental improvements or health protection. Neither should consideration of the health needs be unduly delayed. It must be accepted that healthy villagers are essential to the continuing success of the SAED development of the river region.

SUDAN

1. Objective:

A six-member team, supplemented by USAID program personnel, visited Sudan between March 20 and May 1, 1977 with the following objectives:

- to make recommendations concerning a strategy for USAID to render assistance to the traditional agricultural sector of Sudan;
- to identify agricultural project opportunities conforming to established guidelines, and
- to prepare project proposal documentation for as many such projects as time would permit.

One of the team members was provided by APHA's Sahel Environmental Assessments Program. His assignment was to accompany the agricultural team and to assist them in achieving the overall team objective by:

- examining the health problems in each geographical locality identified as a prospective project site.
- providing health input into agricultural project proposals to minimize negative impacts.
- identifying short-comings in the existing health care and endemic disease control programs existing in the areas selected for programs and to make suggestions for improvement.

2. Team Composition

Lenard Kornfeld, Agricultural Generalist/Planner
Team Leader - ATAC*

Peter Freeman, Geographer
ATAC

Robert Hunter, Agronomist
ATAC

* ATAC - American Technical Assistance Corporation

David Sharry, Anthropologist
ATAC*

Richard Huntington, Anthropologist
ATAC*

Robert Lennox, Epidemiologist/Health Specialist
APHA/Sahel Environmental Assessments Program

3. Background Information

The primary objective of the team was an agricultural one, and the role of the APHA Epidemiologist was supportive in nature. A second important consideration was that the team was sent to identify project areas and strategies rather than to evaluate or strengthen existing projects and attendent documentation.

Approximately 3 of the team's 6 weeks were spent in field visits to the following regions and provinces of the Sudan:

- Western Region - Northern Kordofan, Southern Kordofan, and Southern Darfur Provinces;
- Central Region - Blue Nile and Gazira Provinces;
- Southern Region - Eastern Equatoria, Western Equatoria, Lakes and Jonglei Provinces.

In all regions, but particularly in the Western and Central areas, in addition to meetings with government and other donor officials, emphasis was given to free-ranging discussions with farmers in their villages and pastoralists in their encampments. In all regions, field visits within provinces were designed primarily to permit inspection of areas designated by provincial authorities as areas in need of outside assistance, rather than visits to ongoing development projects.

The team's report identified seven agricultural project possibilities and included project proposals for two of those.

The report also included an assessment of the health situation in

* ATAC - American Technical Assistance Corporation

the regions visited by the team with recommendations as to needed action. Except as those recommendations impinged directly on the inputs of the proposed projects, they were not provided for in the guidelines or proposed project designs. In large part, the reasons for that decision were that:

1. there is a recently formulated national health plan; and
2. AID strategy/project design team for the health sector was to arrive shortly in the Sudan. (See Sudan - Assistance to Health Sector).

In each of the areas visited by the team, the Epidemiologist located the facility responsible for delivery of health care (if in existance) and interviewed those in charge (if present). In all cases, villagers were interviewed as to the nature and extent of their health problems. From this information, supplemented by review of available documents and interviews with national and international health officials in Khartoum and Juba, a health profile was constructed for each geographical area in which the team proposed to develop an agricultural program. Each of the profiles addressed the existing conditions of the area with regard to:

- The availability of preventive and curative health services;
- The prevalence and/or incidence of endemic diseases, particularly those associated with agricultural activities;
- The nutritional status of the population;
- The presence of vectors or potential vectors of disease;
- The availability of potable water and existing methods of sewage disposal.

The second section of the Health Annex to the Agriculture report is a discussion of the project inputs with regard to the health situation of each area and suggestions for minimizing potential negative impacts as well

as maximizing positive ones.

4. Summary of Findings

The agricultural team identified four geographical areas within Sudan in which assistance programs might be developed. Because of the diversity in the programs proposed for each area and the diversity in the health problems of each area, the findings must be discussed in this light.

a. Northern Kordofan Province

- Health services are almost entirely curative, centered in towns and numbering (41) dispensaries and (84) dressing stations to serve a primarily rural population that will number 877,000 by 1984;
- Conflicts over land use between settled farmers and nomads have resulted in isolation of the 200,000 nomads from both educational and health services;
- Annual malaria rates of 5000/100,000 population have been reported in the last 10 years;
- The province health authorities reported 77,982 cases of gastroenteritis among children attending health facilities in 1974;
- Tuberculosis in Kordofan associated with consumption of unpasturized milk accounted for 41,234 reported cases in 1974;
- Dietary imbalances associated with a high carbohydrate, low protein diet contributed to 61,541 cases of malnutrition and anemia in 1974.
- Malnutrition is considered to be the leading cause of death in children under 5.
- Anopheles Gambiae is the major malaria vector. Its extremely adaptable breeding habits have resulted in perennial transmission;
- There are no vector control programs operating within the province;
- No organized method for sewage disposal exists.

- In rural areas, water for drinking comes primarily from shallow unprotected wells or hafirs (water collection ponds);
- Water transportation in tins and goat skin bags over long distances probably contributes to the large incidence of gastroenteritis in the province.

b. Southern Darfur Province

- There are at present 6 hospitals (414 beds), 3 health centers, 26 dispensaries and 28 dressing stations to serve a provincial population of 850,000 which is 90% rural or nomadic.
- The area selected as a possible future AID program site (the Kongei river water shed) has no health facility at all.
- The 1974 malaria rate was in excess of 8,000/100,000 population.
- Both intestinal and urinary schistosomiasis are transmitted in the area and while few data exist experts have classified the situation as "grave". About 90% of the total is due to Schistosoma haematobium (urinary schistosomiasis).
- In addition to chronic protein calorie malnutrition, endemic goiter is considered to be a serious problem in the study area.
- Hand dug shallow wells are the main source of drinking water.
- No formal method of sewage disposal is used, but "night soil" is not used as fertilizer.

c. Lakes Province

- Lakes Province population is about 500,000 with a preponderance of nomads. The population is underserved by existing health care facilities.
- As with other provinces in the south some supplementary health services are delivered by voluntary international and religious organizations.
- Data concerning prevalence of endemic diseases is almost totally absent.

- Malaria is considered to be a major problem as is Gastroenteritis.
- In children, in addition to Malaria and Gastroenteritis, Tuberculosis (Bovine origin), Measles, Bilharzia (Schistosomiasis), Pneumonia and Tetanus are most serious problems.
- Occasional outbreaks of a dry season Cerebrospinal Meningitis carry a high fatality rate among children.
- Onchocerciasis and Trachoma occur with some frequency in Lakes Province and are responsible for significant blindness.
- Tsetse flies do not occur in the Province.
- Drinking water comes from wells which may be 200 feet deep and stored in hand-dug pits thus contributing to the high prevalence (estimated) of enteric disease.

d. Blue Nile Province

- With a population of nearly 1 million this province is situated close to the Nile from which it draws its drinking water and water for irrigation. Poor storage facilities for water contribute to the highest rate of Gastroenteritis in Sudan.
- The Nile is also an excellent breeding area for Anopheles gambiae, and the province has the highest rate of Malaria in the country.
- The third major problem is Tuberculosis for which there is an inadequate supply of BCG vaccine to mount an immunization campaign.
- Schistosomiasis is a common problem in Blue Nile Province. Originating from the irrigated perimeter, both Schistosomiasis mansoni and Schistosomiasis haematobium cause significant morbidity.
- In Upper Blue Nile, intense transmission of Onchocerciasis is known to occur.
- In recent years, Blue Nile Province has experienced several epidemics of Kala Azar (visceral leishmaniases).

- The Province is also one of three known foci of Bancroftian filariasis.
- There is a paucity of information regarding the nutritional status of Blue Nile residents as no studies or surveys have been conducted in the area.

5. Status of Major Endemic Diseases

Sudanese endemic disease records are largely based upon reports from existing health facilities. It is felt that these reports are mostly underestimates due to inadequate coverage. The following statements apply to the nation as a whole and are not strictly limited to the proposed program sites listed above.

a. Malaria

With the exception of the Northernmost desert areas and parts of Red Sea Province, malaria in Sudan must be considered to be a country-wide endemic disease. Differences in intensity of transmission, seasonality and public health impact that occur from province to province are closely linked to the availability of water for Anopheles mosquito breeding and therefore tend to increase, as does the rainfall, from North to South.

Most recent country-wide statistics on malaria prevalence are extrapolated from health facility attendance records, rather than from surveys, and consequently few inferences can be drawn with regard to national trends in the incidence and prevalence of this disease. A limited number of regional surveys have been conducted, however, from which a few assumptions and speculations may be formulated. One such study of blood parasite rates in children 2-9 years old living in 16 villages located within the Gezira conducted in 1975 can be compared with a similar study initiated 14 years earlier in 1961-62. Of 1,124 children examined in 1961-62, 37 (2.9%) had blood films positive for malarial parasites. The 1975 survey of 1,293

children from the same villages showed 255 positive blood films (19.7%).

More significant than positivity rate increase was the finding that all but 4 (98%) in the 1975 study were Plasmodium falciparum (malignant tertian) malaria. The earlier survey had shown only 5 (14%) to be P. falciparum. If this trend is accepted as indicative of the whole area, there is good reason for concern, as malignant tertian malaria is a significant contributor to morbidity in adults and ranks high among the major causes of infant mortality in Africa.

Within Gezira alone an estimated 2.5 million persons are at risk to infection. This observation gains in significance when one considers that the Gezira irrigated perimeter accounts for 40% of the nation's gross domestic product, generates over 1/2 of its total employment (direct or indirect) and is responsible for 98% of the country's export earnings.

The special socio-economic importance of the Gezira coupled with the enhanced opportunity for mosquito breeding brought about by the area's vast irrigation canal system has led the Sudanese to describe malaria in their country as two separate problems. The first of these is referred to as "Nationwide Malaria." This term is meant to apply to all malaria that is not associated with large scale irrigated agricultural production. It is felt that this latter activity (i.e., irrigated farming) creates special conditions for malaria transmission that are distinctly different from those of the nation at large. The term "Man-made Malaria" is used to describe the problem. The amount of irrigated acreage under cultivation has been expanded on an average of 5-6% per year and each new expansion has been accompanied by a rapid increase in the prevalence of malaria.

The major mosquito vector in Sudan is Anopheles gambiae, a particularly vigorous species with few preferences for breeding sites. It is extremely aggressive and has a preference for biting humans. A. gambiae is extremely

susceptible to malarial infection and as such is an efficient vector. In the South it is suspected that A. funestus may coexist with A. gambiae. A. funestus has a greater ability to survive in the drier months than A. gambiae and may be responsible for extending the malaria season and consequently maintaining transmission at a high rate.

In 1974 there were 1,000,000 cases of malaria reported in Sudan but due to under reporting and the inadequacy of diagnostic facilities, it is felt by the MOH and supported by WHO that the true nationwide figure is actually triple or more, bringing the estimated incidence rate to 20% of the population per year. While no increase in rate above the present 20% level has been anticipated during the next 6-year plan, it is expected that the absolute numbers will increase by 25% due to natural population increase.

In summary, despite the paucity of hard data there is little doubt that malaria is a serious problem in Sudan. Its apparent increase since the 1960's, its suspected shift from benign to malignant disease, its established serious effect upon infant survival and its expected potential for depressing socio-economic development and production have led the Ministry of Health to give malaria control first priority in the upcoming National Health Program.

b. Schistosomiasis

Schistosomiasis (Bilharzia) transmission has been reported to occur in all provinces of Sudan except the Red Sea Province.

Both species of schistosomes known to occur in Africa can be found in Sudan. The first of these is Schistosoma haematobium, the etiological agent of urinary schistosomiasis. Considered in Sudan to be primarily a disease of children, it, and its snail intermediate host Bulinus truncatus, tend to be distributed along the river courses and locally within the surface water impoundments and streams of the west and north. In spite of its

sporadically high prevalence and potential for causing significant urinary system damage and hematuria, it is not considered to be one of Sudan's major endemic disease problems.

The exact prevalence of schistosomiasis in Sudan is not known, but the records of health facilities show that in 1974, 6% of all visits were for bilharzia. Similarly, the records from health facilities indicate that there has been a net increase of reported cases per 100,000 population amounting to a 33% increase in 1965-1974.

In its country profile for Sudan, WHO has estimated the total economic loss to the country from Bilharzia to be LS 52,000,000 (US $130,000,000) per year.

c. Onchocerciasis

Onchocerciasis is a filarial infection with vast potential for economic impact as well as for producing human misery.

The causative agent, Onchocerca volvulus, is a nematode worm transmitted to man by the bite of the black fly Simulium damnosum. The resulting infection produces cutaneous nodules in the victim and, in a significant proportion of cases, blindness.

In Sudan, estimates of infected individuals, based upon WHO surveys and reports of the Ministry of Health, number 160,000, with nearly 40,000 categorized as "Economically Blind." The disease distribution closely parallels the location of the fast-moving streams which are the breeding places of the insect vector. The severity of pathology (i.e., blindness) is most intense in Bahr el Ghazal Province. But other foci occur around Abu Hamed, below the 5th cataract, along the Atbara River in Kassala Province, and in stretches of the Blue Nile in the vicinity of Rosseries Dam along the Ethiopian border. Another suspected focus is located in the Southeast corner of Eastern Equatoria Province.

In the continued absence of an integrated control program, it has been estimated that the number of infected and blind persons will approach 200,000 and 50,000 respectively by the end of the 6-year plan. It should be emphasized, however, that these projections take into account only the natural increases in population and do not anticipate any increase in the rate of transmission.

d. Trypanosomiasis

Exclusively a problem of the Southern Region, Trypanosomiasis or sleeping sickness tends to inhibit economic development in at least two ways: firstly, as a chronic progressively fatal disease of man (Trypanosoma gambiense) that is greatly feared; secondly, as a highly fatal disease of cattle (Trypanosoma brucei), called nagana, that makes the grazing of cattle impossible in the highly endemic areas of Equatoria.

Both diseases are transmitted by tsetse flies (Genus Glossina) and have greatly influenced the distribution of man and animals in Southern Sudan.

Sleeping sickness has been a problem in this area since early in the century, but periodic efforts to control its spread through prophylactic administration of pentamidine and elimination of tsetse flies and their breeding places has been historically effective. Since the recent civil strife, however, dispersion of the population and interruption of the control program have resulted in a sharp increase in the numbers of reported cases. In the absence of a comprehensive program of active case finding, it is difficult to estimate the severity of the situation, but it is believed to be deteriorating and is described as "epidemic" in the National Health Program.

Recent reports of new foci of Gambian sleeping sickness by WHO at Yei and Torit suggest that the range of the disease has spread in a ring around

Juba, and a focus of the highly fulminating form caused by Trypanosoma rhodesiense (Rhodesian sleeping sickness) has been reported from Pochala Area in Upper Nile Province along the Ethiopian border.

e. Bancroftian Filariasis

Known to exist in Sudan since 1944, Bancroftian filariasis (Wucheraria bancrofti), with associated hydrocele and elephantiasis, is presently restricted to a relatively small number of people in three areas of Sudan: Zalingi, close to the Chad border in southern Darfur; Kadougli area in Southern Kordafan; and in Southern Blue Nile Province near the Ethiopian border.

f. Other Endemic Disease Problems

Although not identified as priority health problems, other endemic and parasitic diseases exist in Sudan that have potential for causing widespread misery if not significant negative socio-economic impact. No attempt has been made in this report to address these problems in detail, but it would seem appropriate to mention them in passing.

Leprosy

Leprosy is endemic in the western and southern regions of Sudan, with infection rates approaching 3% in some areas. A 1966 survey sponsored by WHO gave an estimate of 100,000 cases in Sudan. With the help of several international donors, the MOH has established more than 10 leprosaria that monitor treatment with dapsone and are planning to establish rehabilitation and training centers near Wau.

Guinea Worm

About 3,000 cases of Dracontiasis are reported annually in Sudan. Most are located in areas of the Nuba Mountains, Blue Nile Province, Bahr el Ghazal and Equatoria, where step wells are in common use.

Hookworm

Primarily due to Ancylostoma duodenale, hookworm infection is highly prevalent in Sudan in the regions south of the Bahr el Ghazal. This rule of thumb also applies to the other common intestinal helminths such as Ascaris, Trichuris and Strongyloides.

Visceral Leishmaniasis - Kala Azar

Visceral leishmaniasis has been reported in Sudan since 1904 in both endemic and epidemic forms.

It is believed that the etiological agent, Leishmania donovani is present in a non-human reservoir as well as in man, but several recent attempts to identify that reservoir by field examination of likely species (rodent, canine and feline) have not been successful.

The usual vector, the sandfly (genus: Phlebotomus or Sergentomyia) is present as thirty-eight species or sub-species, but to this date the numbers of infected flies of any species have not been high enough to explain the prevalence of the disease or, indeed, to incriminate the usual vector species responsible for transmission.

Endemic in the area bounded by the Ethiopian border and the White Nile (East and West) and by Kassala and Malakal (North and South), Kala Azar appears to occur at all times of the year in men, women and children with about equal frequency. One isolated focus north of Khartoum seems to be confined to children, and other widespread foci are known in the west and as far south as Jongeli and Eastern Equatoria.

Lacking the more sophisticated methods of diagnosis, field hospitals diagnose the disease on clinical grounds. This practice probably results in an inflated prevalence report. Primarily considered to be of relatively low incidence, the disease has approached epidemic proportions about 8 times within the last 70 years. Recent information indicates that a

significant number of patients formerly diagnosed as having cutaneous leishmaniasis (Leishmania tropica) may have been exhibiting diffuse cutaneous symptoms due to L. donovani or perhaps to some unique species. If so, the dynamics of transmission of visceral leishmaniasis will become even more obscure.

Hydatid Disease

While very little information could be found on echinococcosis, most authorities questioned agreed that it does occur with some regularity in parts of Equatoria.

Cutaneous Leishmaniasis

Although the primary concern for leishmaniasis lies with the various forms of Leishmania donovani infection, some of the drier northern areas such as El Fasher, En Nahud and in the Gezira (Wad Medani) are known to be endemic areas for Leishmania tropica transmission.

In summary, it may be said that while Sudan has a wide variety of potentially serious problems with endemic diseases, the MOH has selected five as priority health problems:

1. Malignant Tertian Malaria (due to Plasmodium falciparum), in the irrigated areas as well as nationwide.

2. Intestinal Schistosomiasis (due to Schistosoma mansoni), primarily in irrigated areas.

3. Sleeping Sickness (due to Trypanosoma gambiense) in Western Equatoria.

4. Onchocerciasis (due to Onchocerca volvus) in the Bahr el Ghazal, the Nile Valley and its tributaries.

5. Kala Azar (due to Leishmania donovani) in the middle section of the country east of the White Nile.

6. Existing Health Infrastructure

The present health infrastructure is primarily geared toward curative

services and leaves the vast majority of the population unserved. This is particularly true of the rural and nomadic population in the geographical localities identified as potential AID program sites. Undertrained and unsupervised personnel with very little in the way of drugs or logistical support are staffing a minimal number of dispensaries and dressing stations throughout the rural areas of Sudan.

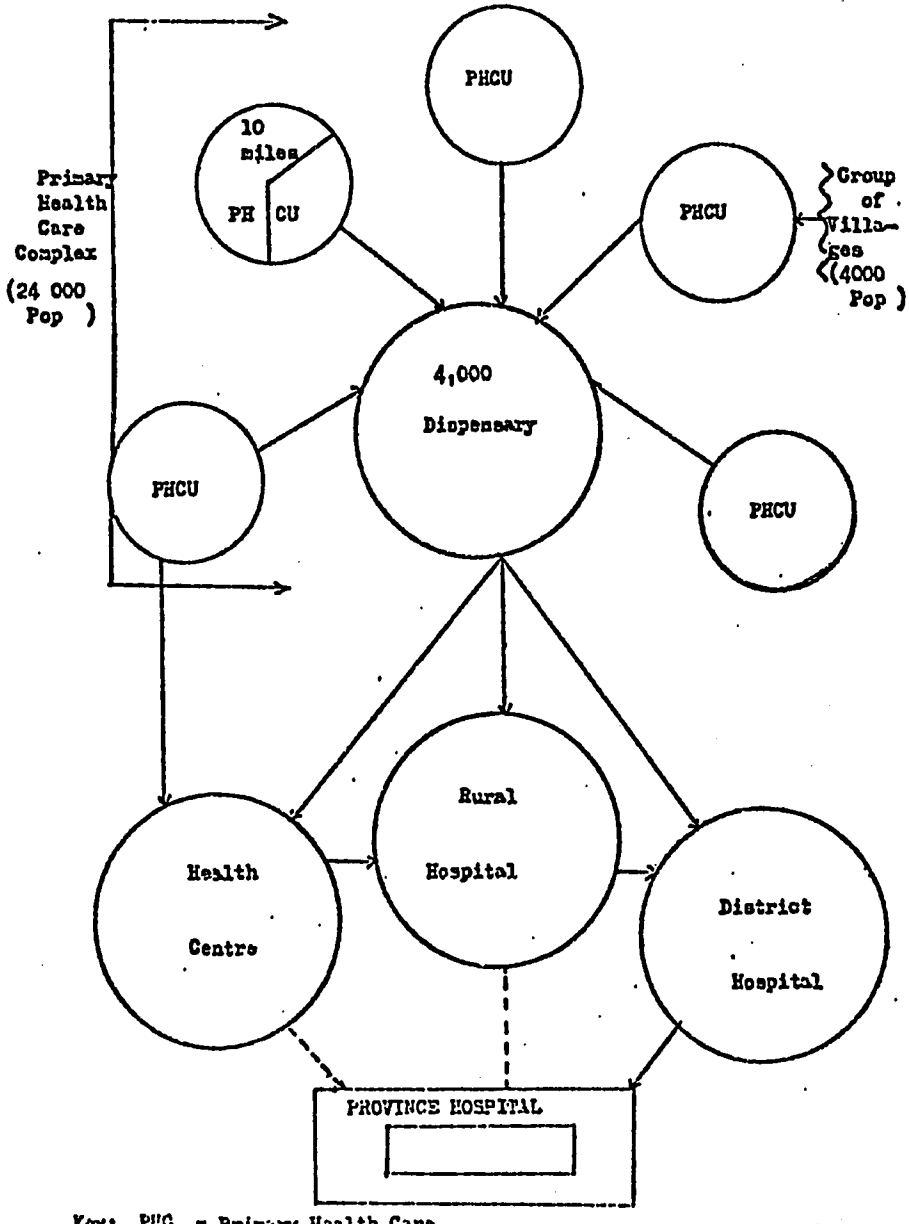
The Sudan National Health Program (1977-1984) recognizes the inadequacy of the present system, however, and has made primary health care a priority item for the future.

The main mechanism for delivery of primary health care to the masses will be the Primary Health Care Program which calls for extension of services to the entire population by 1984. The basic element of the Primary Health Care Program is the Primary Health Care Complex (PHCC) which consists of a dispensary with 5 primary health care units (PHCU). Each complex will serve 24,000 individuals with a combination of preventive and curative services. The basic personnel unit for delivery of services will be a community-based Primary Health Care Worker. These PHCWs will receive supervision and logistic support from the dispensary which in turn will receive support from the Provincial Hospital System (see chart).

7. Summary of Recommendations

The AID Traditional Agriculture team developed project proposal documents for three of the sites visited. The required inputs for each area program were uniquely suited to the needs of the residents. The health recommendations to accompany the proposals were in essence a response to each required program input and as such do not easily lend themselves to summarization. The reader is therefore advised to refer to the main report for a comprehensive summary.

PRIMARY HEALTH CARE COMPLEX



Key: PHC = Primary Health Care
——→ = Normal Referral
- - -→ = Emergency Referral

Source: NHP Document page 65

NB. This figure has been further perfected as far as referral from PHCU to Health Centre is concerned.

SUDAN

1. Objective

An eight-member team visited the Democratic Republic of Sudan between June 15 and July 10, 1977 with two major objectives:

- To prepare a comprehensive assessment of the Sudan Health Sector including an analysis of the objectives, priorities and constraints to the implementation of the Sudan National Health Program and Primary Health Care Program (1977-1984);

- To prepare a strategy for AID assistance to the implementation of the Health Program as well as an advanced project document to that effect.

The APHA/IHP Sahel Environmental Assessments Program supplied one of the team members, Dr. Robert Lennox, to serve as Epidemiologist on the team. His responsibilities included:

- Preparation of the Health Sector Assessment in the areas of Endemic Diseases and Environmental Health including "The Extent of Problems", "Evaluation of Program Elements for Control" and "Constraints to the Implementation of these Programs".

- Formulation of recommendations with regard to possible AID assistance to the Sudan Health Program in the areas of Endemic Disease Control and Environmental Health for inclusion in the Project Document.

2. Team Composition

Edward Cross
Generalist/Team Leader, AID/AFR

George Contis
Family Planning Specialist - MSC*

Joseph Hackett
Health Logistics Specialist - DHLW

Norman Holly
Health Economist - AID/PPC

Robert Lennox
Epidemiologist - APHA/IHP

Harvel Sebastian
Anthropoligist - AID

Alton Wilson
Health Manpower Specialist - MSC*

John Wooten
Project Design Officer - AID/AFR

3. Background Information

The team assembled in Khartoum where they met with officials of the GOS and international agencies and reviewed available documents, including the National Health and Primary Health Care Programs. Three field visits were made: One to Juba, the seat of government for the Southern Sudan, one to El Obied in Kordofan Province, and one to Wad Medani, the administrative center of the extensive irrigated agricultural area called the Gezira. The APHA epidemiologist did not make the trip to El Obied, but did make a side trip to Sennar which is the site of the Sudan malaria field training center.

This summary report will deal only with the observations and recommendations of the APHA epidemiologist with regard to Endemic Disease Control and Environmental Health.

* MSC - Medical Service Consultants, Inc.

This was the second visit of Dr. Lennox to the Sudan during 1977 (see Sudan - AID Assistance to Traditional Agriculture). In order to avoid repetition the reader is referred to the Traditional Agriculture Report summary for information concerning "Status of Endemic Diseases" and "Existing Health Infrastructure".

4. Summary of Findings

The preparation of the Health Sector Assessment and the AID Assistance Document called for the Epidemiologist/Environmental Health Specialist to:

- Assess the extent of major endemic disease and environmental health problems in the Sudan.
- Review the Sudan National Health Plan as to the nature of the programs to address these problems.
- Identify the constraints to the implementation of the programs dealing with endemic disease control and environmental health.
- Make recommendations for USAID assistance in the implementation of Endemic Disease Control/Environmental Health Programs.

The contribution with regard to the nature and extent of Endemic Disease and Environmental Health problems in the Sudan has been summarized in the report titled, "Sudan - AID Involvement in Traditional Sector Agriculture", and will not be repeated here.

The entire 6-year National Health Plan for Sudan has been set forth in the form of eight programs. Four of these are specifically aimed at the control of major endemic diseases and two deal with environmental health.

- Program No. 1: Malaria-Nationwide
- Program No. 2: Malaria-Man/Made

- Program No. 4: Control of Bilharzia in Irrigated Areas

- Program No. 8: Onchocerciasis

- Program No. 3: Primary Health Care, has three sub-elements that deal with control of endemic diseases, namely: Gastroenteritis, Sleeping Sickness (Trypanosomiasis), Kala Azar (Visceral Leishmaniasis)

- Program No. 5: Water Supply

- Program No. 6: Environmental Health

The plan has been described in international publications as one of the most comprehensive and implementable programs developed for Africa to date. Within that framework, an attempt was made to study the objectives, strategies, indicators of success and constraints to program implementation. Because many of the programs have common constraints, an outline for identification of several categories was proposed in which examples were recognized.

a. Those constraints inherent in the plan of the program:

(1) Lack of correlation between plan and objective (i.e., plan, if successfully implemented,will not have good chance of achieving the objective).

(2) Indicators that are not sufficiently sensitive to measure success.

(3) Plan that is not comprehensive enough to reach a large segment of the population.

(4) Plan that lacks coordination with other programs.

b. Those constraints associated with quantitative or qualitative deficiencies of personnel.

(1) Lack of manpower

(2) Lack of training

(3) Lack of financial support for salaries and incentives.

c. Those constraints associated with deficiencies in commodities and logistics.

(1) Shortage of raw materials, i.e., insecticides, larvacides, drugs, molluscicides.

(2) Shortage of logistical support, i.e., transport, storage, fuel, spraying equipment.

The input necessary to overcome these constraints is, in essence, the aim of the AID program.

The corresponding inputs to remedy the constraints in category a. are technological assistance/planning; for category b., training and subsidy; for category c., commodity supply.

What follows is an attempt to identify in a horizontal fashion the major constraints to the implementation of six Environmental Health related programs by the categories outlined above.

Major Constraints by Category

a. Constraints inherent in the plan

1. Lack of correlation between plan and objective

Each of the six national plans related to Environmental Health/ Endemic Disease Control has some degree of deficiency in this regard. The Malaria Nation-Wide Program, for example, hopes to reduce morbidity from 20% to 5% by the end of the 6-year plan in the South using only treatment of identified cases. Mosquito control will be attempted only in municipalities. In the North and West, DDT spraying is to be used to accomplish the objective without drug distribution (DDT resistance on the part of Malaria vector mosquitos is already wide-spread in parts of the Sudan). It has long been considered by most malaria control experts that a control program based upon a single control method has a limited chance of success.

Considering that fulfilling the stated program objective would require eliminating morbidity due to malaria by more than 2 million cases per year, it would appear that a much more comprehensive, multi-faceted approach is required.

Similar deficiencies can be found in the bilharzia program, where the objective is to reduce age specific prevalence rates among children, but as of now no effective, safe drug has been identified for treatment, and the delivery system for molluscicides is capable of treating less than 10% of the total irrigated area of the Gezira and Managil areas.

The safe water supply program has a reasonable chance of achieving its objective only because it is so limited (provides buckets, ropes and cement covers for 1900 wells).

The environmental health (sanitation) program is admittedly an important area, but, at present, lacks both objective and plan.

The plan for onchocerciasis control hopes to reduce the percentages of skin-snip positive males in certain age groups by 25% using, primarily, treatment of infected individuals with diethylcaribamizin. A very limited vector control program is planned. Only the malaria control program for the Gezira (man-made malaria) has any reasonable chance of accomplishing a worthwhile objective,- mainly because a comprehensive, multifaceted approach is planned.

In summary, at present it is doubtful if the plans set forth in the National Health Program can fulfill more than a token number of the stated objectives.

2. Insufficiently sensitive indicators

The majority of indicators on which program success is to be determined are related to passive case identification in Primary Health Care Units. For instance, success in reduction of malaria morbidity

will be achieved when there is a reduction in the number of cases reported by the Primary Health Care Units. It is more likely that an effective drug distribution program will record an increase rather than a decrease in cases initially. A true indicator of reduced morbidity should be based upon sample survey, rather than on clinic visits.

3. Plan not comprehensive enough to reach a large segment of population

In this respect, all of the Endemic Disease/Environmental Health programs are deficient. To cite a few examples:

- Bilharzia program does not deal with populations outside of Gezira.
- Malaria program does not serve the nomad populations.
- Onchocerciasis program only serves those in imminent danger of blindness..
- Safe water supply program is designed to protect only 1900 wells; No protection of water from hafirs, the rivers or privately owned wells.

These are only illustrative examples.. Many additional unserved populations could be listed.

4. Lack of coordination with other programs

Due to the vertical organization of the elements of the National Health Care Program, there is very little evidence of intra-program coordination. To cite a few examples:

- DDT spraying for insect control is stated as a program function for the malaria program, the sanitation program and various agricultural programs.
- Abate^{R}larvacide will be distributed by persons involved in both malaria and onchocerciasis control.
- Each of the endemic disease control programs maintains its own training program for field workers, in spite of the similarity of their functions (specimen collection, spraying, water testing).

- Those involved in insect vector control hold the agricultural planners responsible for having induced insecticide resistance in vector population by indiscriminate use of DDT and other chemicals.
- Each of the programs has its own infrastructure, supervisory personnel and vehicles.

In spite of many possibilities for coordination between programs there is little evidence that it exists or has been planned for in the future.

b. Constraints Associated with Quantitative or Qualitative Deficiencies of Personnel

1. Lack of manpower

Each of the program representatives interviewed expressed little concern about finding a sufficient number of individuals to carry out the activities in the programs. The only reservations they had were in finding the funds to support their salaries. It should be considered, however, that most of their projections of available manpower, like the programs themselves, are vertical. It is questionable whether sufficient manpower exists to fill all of the needs of all programs unless intra-program coordination is forthcoming. This is particularly true in the South, where secondary school graduates are in limited supply and will be competed for not only by the Primary Health Care Program, but by various agricultural programs as well. It is clearly a potential problem worthy of more study.

2. Lack of training

All of the Endemic Disease Control/Environmental Health programs maintain their own training program which is administratively and physically separated from the others. In some cases, the programs observed were reasonably sophisticated and functional. One case in point was the malaria field training center at Sennar that has been giving field and classroom

training in all aspects of malaria work to a variety of health workers for more than 10 years. There is a similar program for bilharzia (schistosomiasis) at the University of Khartoum, with a field station at Abu Ushar in the Gezira. Onchocerciasis training is centered at Wau in Bahr el Ghazal province.

In short, it appears that each of the programs has a corresponding training element which is functioning at present. Some are apparently more functional than others, and it is unknown whether the existing facilities can produce all of the individuals in all categories to carry out the proposed programs. It would be anticipated that problems will arise in this area.

3. Lack of financial support for salaries and incentives

It is in this area that the program personnel were most vocal. They expressed concern that recent budget allocations were not sufficient to meet the needs for salaries of workers involved in current programs. In fact, they stated that some workers in the field have been working without compensation for several months. This was said to be particularly true of the lower level field staff.

The program personnel have had problems in the past in keeping workers in more rural control areas. Traditionally, incentives (money, bicycles, donkeys) had been given to keep them in the place where they were needed. However, this incentive program was terminated due to lack of funds. The anticipated resistance to maintaining personnel in the more remote areas in the absence of incentives is regarded as a serious constraint to program success.

c. Constraints Associated with Deficiencies in Commodities and Logistics

Expectedly, lack of commodities and transport vehicles was viewed as the most important obstacle to achieving program goals by all of the

program personnel.

1. Shortage of raw materials

Most of the endemic disease control programs have some requirement for consumable raw materials such as:

- insecticides: DDT for nation-wide malaria
- larvacides: Abate^{R}for malaria and onchocerciasis
- molluscicides: bayluscide and trescon for bilharzia
- ambilhar or hycanthone for bilharzia
- chloroquine and pyramethamine for malaria
- diethylcarmanazin for onchocerciasis

The total requirement for commodities in this category for all programs could be estimated to be in excess of 4 million dollars per year. It is expected that more than 60% of the funding will have to be from external donors. Current pledges from OPEC countries and from WHO (the two most important outside sources to date) are expected to amount to less than 1 million next year. Sudanese program personnel stated categorically that if the AID program did not provide funds for their chemicals that it was doubtful if their assistance would have much relevance.

2. Shortage of Logistical Support

This category was identified as a second major area of need for foreign donor support by program officials. Some of the major requirements were:

- vehicles (Landrover station wagons and pick-ups for personnel, 5-ton trucks for equipment)
- spraying equipment for delivery of insecticides, molluscicides and larvacides
- storage facilities for insecticides and chemicals

- water testing equipment
- teaching materials (films, projectors and classroom materials for use in training programs)
- field and laboratory equipment for research programs

In summary, the major expressed constraints on the part of Sudanese program officials were in the areas of commodities. Following discussions, however, it was conceded that constraints existed in the areas of planning, coordination and manpower development as well. In the section on recommendations, an attempt will be made to realistically address the major constraints and provide alternatives for AID assistance to overcome them.

3. Status of Major Endemic Diseases

See "Sudan AID Involvement in Traditional Agriculture" (Section 5)

4. Existing Health Infrastructure

See "Sudan AID Involvement in Traditional Agriculture" (Section 6)

5. Summary of Recommendations

The following programs were identified as likely candidates for AID support:

a. Malaria - Nationwide and Man-made

The program objective in this area will be to assist the GOS, insofar as possible, in achieving their goal of reducing malaria transmission countrywide and in irrigated areas by 70% of expected levels through assistance in the areas of planning, programmatic research and training. This assistance will be facilitated by:

1. Providing two qualified professionals (one specialist in the epidemiology of malaria to be stationed at the MOH in Khartoum and one specialist in the entomological aspects of malaria to be stationed at the malaria training center at Sennar). These two individuals will assist the MOH in identifying and resolving problems in such areas as:

(a) Choice of the most cost-effective technologies and commodities, i.e., insecticides, larvacides;

(b) Developing additional valid indicators of success;

(c) Long and short-term manpower requirements/training in-country.

2. Providing short-term consultants to deal with questions such as:

(a) Insecticide and drug resistance.

(b) Engineering methods for control of mosquito larvae;

(c) Statistical methods for sample selection and data analysis.

3. Providing fellowships for advanced foreign study in malaria.

4. Providing reasonable quantities of commodities in the form of vehicles, chemicals, drugs, and teaching, laboratory and office equipment and supplies.

At the end of the 6 year plan, it is expected that the inputs of the AID program will have helped the GOS:

- Produce a cadre of malaria control specialists at all levels;
- Plan a replicable program for reducing malaria transmission; and
- Extend the malaria program to all segments of the population.

b. Bilharzia Control in Irrigated Areas

The objectives of the program put forth by the GOS are to be:

1. Reduce age specific infection rates of children (S. mansoni) age 3-7 yrs. old by the following:

- 3 yrs. old from 11% to 0
- 4 yrs. old from 25% to 0
- 5 yrs. old from 35% to 0
- 6 yrs. old from 45% to 0
- 7 yrs. from 60% to 10%

2. Reduce the prevalence of diarrhea with blood in 9-12 yrs. old

school children from about 40% to about 10%.

3. To reduce the numbers of vector snails to 1% of the current level.

The program objective of AID will be to assist the GOS in achieving its goal through an assistance program involving inputs in the areas of technical assistance, training, commodities and supplies.

1. Technical assistance will be provided through the services of two long-term professionals:

   - A schistosomiasis specialist with experience in epidemiology and control of snails. This individual would be provided space in the Public Health Laboratory in Khartoum and be assimilated into all phases of the control program, i.e., Planning, Evaluation and Research.
   - A water resource/sanitary engineer with knowledge and experience in all aspects of schistosomiasis control to be based at Sennar. He would have joint responsibility with the media specialist in helping the MOH expand the rpesent malaria training center into a combined malaria and schistosomiasis training center, and would participate in curriculum development teaching, research and program development/evaluation.
   - Short-term consultants would be provided to AID for solutions of special problems such as:

     (a) Irrigation patterns and possible regulation to facilitate snail control.

     (b) Advising on the most cost effective molluscicides and delivery systems.

     (c) Construction alternatives for sanitary facilities in

irrigated areas.

2. Training inputs will be provided by:
   - participation in in-country training of middle level technical staff at the University of Khartoum and at the proposed center in Sennar by the two specialists.
   - foreign training in aspects of schistosomiasis for advanced personnel through fellowships.
3. Some commodities in the form of vehicles, chemicals, drugs, teaching, laboratory and office equipment and supplies will be provided.
4. Renovation and improvement of the Sennar Training Center will be undertaken to facilitate training of personnel in both the malaria and schistosomiasis programs.

At the end of the 6-year Plan, it is expected that the AID program inputs will have assisted in the development of a viable and replicable schistosomiasis control program based upon snail control, environmental sanitation and utilization of good water engineering practices that will minimize the need for mass drug treatment campaigns. A training program will have been developed that combines all aspects of schistosomiasis and malaria control in an integrated fashion, and a cadre of personnel will have been produced that will be capable of maintaining schistosomiasis control over the entire 2,000,000 acres of irrigated areas of the Gezira and Managil.

c. Onchocerciasis

Due to limited resources, the MOH has proposed a program, within the National Health Program, for onchocerciasis control with objectives primarily directed toward the prevention of economic blindness, with little input directed toward control of the transmission of the disease.

While it would be possible and advisable for AID to assist in this effort, discussions with the MOH personnel indicated that, if assistance were available, a more comprehensive program incorporating their stated objective with a control effort would be desireable. Toward that end, it is proposed that AID provide assistance for developing a more comprehensive program combining prevention of blindness with a component designed to reduce transmission.

The proposed AID assistance would be in the form of technical assistance, training, commodities and supplies. The key individual in the assistance program would be an Onchocerciasis Control Expert stationed at the Onchocerciasis Control Center at Wau. It is essential that this person be a field worker knowledgable in all aspects of onchocerciasis control programs. Despite the fact that the major focus of Onchocerciasis is in the area of Wau, other widespread foci are present, and the expert would be expected to travel to those areas as well. An important part of the expert's activity would be collaboration on the development of a comprehensive plan for controlling the transmission of the disease in Sudan. It is suggested that he be assisted in this effort by the inputs of a variety of short-term consultants knowledgeable in such areas as:

1. Chemoprophylaxis and follow-up
2. Cartography - to map black fly breeding sites.
3. Opthomology - to determine the most cost effective methods to reduce economic blindness.
4. Water Control Engineering - to suggest methods of controlling breeding habitats.

The services of an intermediate-term consultant (entomologist) to study the breeding cycle and bionomics of black flies could be of assistance in developing a cost effect program of vector control.

Assistance in the area of training will be required.

1. Fellowships - To be used for short-term special courses of study for the professional staff and for technical training in techniques such as serology, e.g., the type of courses offered by CDC Atlanta.
2. In-country training in the form of teaching aids and materials to support the Onchocerciasis Training Center at Wau.

Commodities and supplies to supplement those from WHO to support the program would be in the form of transport for control personnel and larvaciding teams and drugs and larvacides. By the end of the 6-year plan. It would be expected that the AID input would have been instrumental in producing a comprehensive plan for the control of onchocerciasis in Sudan.

d. Environmental Sanitation and Water Supply

In the National Health Program, two program categories appear in the area of environmental sanitation and water supply. The first (Program No. 5), Safe Water Supply, has the objective of providing facilities (buckets, ropes and cement covers) to prevent fecal contamination of 1900 wells. The second program (Program No. 6), Environmental Health, sets forth neither program nor objective. In discussions with the officials in charge of these areas, it was explained that what was needed was a more comprehensive plan to approach the problems of sanitation and potable water supply.

It is proposed, therefore, that AID offer assistance in these vital areas to develop a relevant and practical plan with achievable objectives and goals and to proceed with its implementation.

The first phase of such a program would be to secure the services of a Sanitarian/Water Resource Engineer with special skills and experience in planning rural systems. This individual, to be based in the MOH, would then work with a counterpart staff to develop the plan with assistance from

short-term consultants to provide input for solving relevant special problems such as:

1. Rat Control
2. Waste Water Disposal
3. Food Quality Control
4. Water Quality Control and Maintenance
5. Sewage Disposal (Construction of socially acceptable privies and/or latrines)
6. Control of Insect Pests
7. Pollution of Water and Air
8. Port Health Control

A need exists for trained personnel at nearly every level (technicians and management alike). It is proposed to support training activities in in-country programs involved in training sanitation and water supply personnel. The form of support is to be determined as part of the plan.

In the area of supplies and commodities, it is clear that whatever program is developed might require substantial inputs in the areas of:

1. Transport for personnel, supplies and equipment
2. Teaching aids and materials
3. Specialized equipment such as water test kits, chlorine dispensers, fumigation equipment.

By the end of the 6-year plan, it would be expected that AID input would have succeeded in helping the MOH in developing an implementable, reproducible and relevant plan for delivering safe water and sanitation services to large segments of Sudan's rural populations and that a pilot scheme for testing this plan would be in place.

SWAZILAND

1. Objectives

A two member team visited Swaziland between May 8 and May 19, 1977 with the following objectives:

Review of previous reports (Jobin/Jones, Gish, Syncrisis and others which they felt would aid them) as well as various current proposals now under discussion in Mbabane. After carrying out on-site visits and consultations with Swaziland government officials and OSRAC, the team was to recommend feasible activities for United States Government support, either under bilateral or regional funding. Within the constraints of time, the team was to assist in preparing the necessary documentation (PID) for the GOS to secure such funding.

2. Team Composition

The team was comprised as follows:

John I. Bruce, Ph.D.
Biologist

Gladwin O. Unrau
Engineer

The team was joined in Swaziland by:

Lewis E. Swanson
Engineer - AID Nairobi

3. Background Information

In February 1976, Dr. W.R. Jobin, Engineering Consultant (AID), and Dr. C.E. Jones, Epidemiologist (WHO), carried out a joint AID/WHO consultation on the status of bilharzia control in Swaziland. The Ministry of Health (MOH) of the Government of Swaziland expressed satisfaction with the report and recommendations submitted by Drs. Jobin and Jones and now desires to undertake an intensified natural bilharzia control program. The MOH submitted a draft project proposal incorporating the Jobin-

Jones recommendations to the Ministry of Finance and Planning for consideration. The OSRAC in the meantime received requests for related assistance from the Ministry of Agriculture and the Water Resources Board. It was immediately recognized that a potential exists for a much broader and beneficial program for the country. The program envisioned would be for an inter-ministerial, multi-sectoral approach to the complex and broader health problem of providing clean rural water supplies for drinking/washing/bathing/cooking to avoid schistosomiasis as well as other water-related and prevalent health hazards. With this objective in mind, OSRAC requested the services of two short-term technicians who could discuss with officials of the Government of Swaziland (GOS) a possible project(s) suitable for AID financing in the above mentioned areas.

4. Summary of Findings

Recent studies (Jobin-Jones, Duncan-Fenwick and others), as well as observations by the AID/PID Team, reveal that Swaziland's major health problem centers upon diseases related to water and unsanitary conditions.

Of these diseases, bilharzia appears to require the most urgent attention as 80% of the school children of the irrigated areas are infected and in non-irrigated areas, 40 to 60% are infected. Older age groups are reported to have an even higher incidence of infection. Topographically, the middleveld and lowveld have the highest incidence of infection. Government publications indicate that bilharzia is debilitating to both children and adults, restricting productivity both at school and at daily work.

According to the above surveys and substantiated by government reports, the incidence of bilharzia is increasing with the expansion of irrigation, despite the fact that a considerable amount of the irrigated area is under government and/or private sector control programs.

Other diseases such as malaria, dengue, typhoid, cattle tape-worm, hydatid, amoebiasis, hepatitis, gastro-enteritis and fascioliasis remain serious health risks. Information given to the AID/PID Team revealed that malaria appears to be on the increase in certain areas, and in addition, there is suggested evidence that the mosquito vector is developing resistance to DDT and dieldrin.

Transmission of the above mentioned diseases are a direct result of the lack of an adequate, convenient and safe water supply and the availability and the education to use sanitary human waste disposal and laundry/shower facilities in rural areas. This is in contrast with most of the urban areas where these facilities are provided under controlled conditions and standards. There are, at present, numerous plans and programs proposed by various agencies that would, at least, alleviate some of the above risks. However, their effectiveness has been limited due to the lack of funds, trained personnel, and coordinated effort.

The Government of Swaziland (GOS) is, and has been, aware of the need to control water-related diseases as evidenced by programs presently in effect. They actually have prepared plans for a national program to provide sanitary waste disposal, laundries/shower facilities, protected springs and wells, and a safe, convenient water supply to the rural homestead.

In 1974, the Water and Sewerage Board was established within the Ministry of Works, Power and Communication and, subsequently, a Rural Water Branch was established "to coordinate the development and establishment of a rural water system." However, the Ministry of Agriculture (MOA) and the Ministry of Health (MOH) are also presently engaged in similar activities. At present, the Bilharzia Control Unit is directed from the Health Office in Manzini in conjunction with a program for malaria control,

resulting in a lesser emphasis on bilharzia. The efforts required for malaria control vary yearly according to the incidence of mosquitoes. At the present time, the majority of the staff of the Malaria/Bilharzia Unit is engaged in constant control measures against malaria. Therefore, current activities against bilharzia, despite its high prevalence, are limited to a small number of projects.

Present facilities, equipment, shortage of technical personnel and procedures used for specimen collection and examination limit the identification to predominately Schistosoma haematobium. Schistosoma mansoni is under-reported in spite of the widespread prevalence of Biomphalaria sp.

A social custom that may be a constraint in the establishment of rural water supplies, observed by the AID/PID Team and recognized by the GOS, is the wide dispersal of the population over the rural areas and the lack of established villages. Schools, hospitals, clinics, municipal offices and marketing facilities necessary for rural centers are also widely dispersed. However, the GOS has developed plans and presently is engaged in a program for the resettlement and the concentration of these homes and facilities into rural centers.

There is every indication that with present plans for future agricultural development, and the expansion of irrigation and increased utilization of water resources, the incidence of bilharzia and other water-related diseases will continue to increase.

This is recognized by the GOS and has resulted in their request to USAID for assistance in planning appropriate measures for inclusion in development/expansion plans that will facilitate control of these diseases.

5. Status of Major Endemic Diseases

Very limited data were available on the endemic disease situation. Much of what were available represented results of school health surveys conducted since an AID team visit in 1975.

a. Schistosomiasis

Examination of the results of a Mar/Oct. 1976 school health survey shows that it constituted the major disease problem when considered both in terms of the great numbers of children infected and the known severity of the disease. A total of 9434 urines were examined and 11.37% or 1073 children contained S. haematobium eggs in their urine, while 7938 or 84.1% were free of bilharzia. These figures represent approximately one-third (1/3) of the total grade I and II students and do not include all the schools in the country.

In general it is apparent that schools examined in the Hhohho district, primarily a highveld area, exhibit the lowest percentage (4%) of infection than the other districts. One explanation may be that the water supply which must support the snail host to allow for bilharzia is not entirely appropriate to support good snail populations or bilharzia. There is little or no transmission above an altitude of 1800 meters where water temperature are too low. Also, snails are not usually found in swiftly flowing or heavily shaded streams. This may also account for the low percentage of infection in the highveld areas.

The Manzini district showed the highest overall percentage of infection at 19%. Preliminarily, it appears that there is a significantly higher number of infections in the northeast section of the district, lowveld, and the section west of Manzini which is a middleveld area. This focus which is in the Lobamba area, corresponds to the only significant incidence of infections in the Hhohho schools, which increase as one proceeds south-

east of Mbabane towards Lubombo. Shiselweni has a district percentage of infection of 13% and shows a relatively high incidence in the area south of Nhlangano. However, there is little or no bilharzia in the highveld schools in and around Gege.

The Lubombo district has a 14% incidence rate. Its greatest incidence is in the southwestern area and also around the irrigation complex at Big Bend. The major factors which may contribute to a high incidence of bilharzia in the lowveld and middleveld areas include slow, heavily-vegetated streams that provide an ideal habitat for growth and reproduction of bilharzia-carrying snails, large irrigation canals that are also easily populated and a large human population that contaminates the water supply through promiscuous urination and defecation. In the dense areas of the Southwestern Lubombo district, small watersheds provide the entire water supply for large communities. Once these water holes are contaminated with infected snails, entire communities are exposed.

Certain cultural aspects may cause an increase of bilharzia in some areas. At the Dumisa School in the lowveld area near the Usutu River a large percentage of Grade II girls were infected but very few boys. One explanation may be that the girls wash clothes in the shallow area of the river where the snails that carry bilharzia are very numerous, while the boys swim in the middle of the Usutu which does not support snails very well and therefore have limited contact with the snail infected water.

There was no significant difference found when incidences of infection were compared between sexes. There does appear to be a very real trend from the perspective of age however in the incidence of bilharzia in children ranging in age from 0-5 yrs. to 12 yrs. Starting with 93% of normal urines against 4% bilharzia at age 0-5 yrs., a decline in normal values is noted at age 6 to 87% normal versus 6% bilharzia; 86% normal versus 7% bilharzia at age 7; 84% normal versus 11% bilharzia at age 8; 79% normal versus 14%

bilharzia at age 9; 77% normal versus 18% bilharzia at age 10; 75% normal versus 21% bilharzia at age 11 and 75% normal versus 22% bilharzia at age 12. From these data, a probable interpretation may be that the older the age of the children, the greater the opportunity for them to become infected. It is also reasonable to assume that in older age groups an even higher incidence of urinary bilharzia might be encountered.

Intestinal bilharzia constituted less than 1% of the total parasites found in stools. This number is surprisingly low in view of the large numbers of Biomphalaria (the intermediate host of S. mansoni) found in various areas of Swaziland. It is felt that the figure obtained is not representative of the true incidence of S. mansoni for reasons which may be due to the number of samples examined, low level of S. mansoni infections and others.

A survey was conducted by MOH to obtain some information concerning the incidence of bilharzia in areas where irrigation, surveillance and water-treatment was occuring or not. Specimens (fecal and urine) were taken from 13,677 children ranging in age from 0-15 yrs. The total number of fecal specimens examined was 3,675 while 10,002 urine specimens were examined. Of the 3,675 fecal specimens examined 9% were positive for S. mansoni while 34% of the 10,002 urine specimen were positive for S. haematobium. Of the six areas surveyed, only three were done for fecal samples. Fecal samples were apparently more difficult to obtain than urines. The results however do point out that S. mansoni infections are nevertheless quite prevalent.

The results of a survey for S. mansoni and S. haematobium conducted by a school health team in each of the four geographical districts of Swaziland during the months of Nov. 1976 and March 1977 showed the Hhohho, Manzini and Lubombo districts to have the highest infection rates for S. haematobium. S. mansoni infections were detected only in the Manzini district.

The results of a school health team survey for urinary bilharzia in the Manzini district as recent as March 1977, in which a total of 650 children were examined showed 105 positive cases for a 16% infection rate.

At the Central Public Health Laboratory in Manzini, the urines of 685 pregnant females were examined for presence of S. haematobium eggs during

Jan. 1977 to May 1977. A total of 83 cases were detected for a 12% infection rate. At the same laboratory, the urines of 198 military personnel were examined, and 46 cases of S. haematobium were detected for an infection rate of twenty three (23%) percent.

To summarize, the results of various surveys conducted in 1976 and 1977 for both urinary and intestinal bilharzia by the MOH reveals that the disease is widespread especially among school children of grades I and II and up to ages of 15 yrs. Smaller surveys conducted on pregnant females and military personnel show that the disease is present at relatively high incidences among adults. The data from the surveys presented also show that examinations are, more frequently than not, conducted on urines rather than on fecal specimen. This apparently suggests that S. mansoni is under-reported. However, in surveys where examinations for S. haematobium and S. mansoni were conducted simultaneously, S. haematobium was clearly the predominate species.

The APHA Team's survey of 52 school children ages 7-9, at a school in the Hhohho District, found a prevalence rate of 42.3% for S. haematobium and 1.9% for S. mansoni.

b. Malaria

During the course of the advisory team's travels throughout Swaziland to accomplish its mission frequent statements were made by various persons in regard to the increase in malaria cases during the past several years. Definite evidence of this increase was provided by the malaria unit of the Public Health Laboratory in Manzini. During the period from July 1, 1973 to June 30, 1974 a total of 70 cases were detected; during July 1, 1974 to June 30, 1975, 165 cases were detected, and during July 1, 1975 to June 30, 1976, 210 cases were detected. This data reflects a significant increase during the period of 1973 - 1976.

The APHA Team's survey of 52 school children ages 7-9 in the Hhohho District found no infections. Resistance of mosquitos to DDT and Dieldrin were observed by the malaria unit. Statements were made by various Public Health and Private Clinic staff that deaths had occurred recently from malaria. No statistical data concerning these deaths were obtained.

c. Other Parasitic Infections

The Mar/Oct. 1976 school health survey for intestinal parasites was conducted on 792 school children in the Manzini District. Fecals were collected and examined microscopically for evidence of parasitic infections. The parasite showing the highest rate of infection was Ascaris lumbricoides (roundworm) with 13% of the children infected. Infection rates for other parasites were all below 1% except Entorobius vermicularis with 1.64%.

6. Existing Health Infrastructure

The Office of the Senior Medical Officer of Health is located in Mbabane from which the national public health program, environmental health and hygiene, health education, the enforcement of health legislation, supervision of two city health departments and the public health nursing unit are directed. There is another health office at Manzini under the direction of a second Medical Officer of Health, who has responsibility for the control of bilharzia and malaria. The Office of Health support staff consists of a Senior Health Inspector, four Health Inspectors (one per district) and five Health Assistants. It has the support services of the pathology laboratory in Manzini where routine biochemical, bacteriological and haematological examinations are performed.

a. Public Health Centers

At the present time there are two urban public health centers, in Mbabane and Manzini, with similar services being offered at Siteki, Hlatikulu and Mankayane hospitals. These centers concentrate on preventive aspects of health care and service. Activities include health education, medical examinations (includes establishing vital statistics data bank), prophylactic injections, medications, maternal and child health services and nutrition guidance. These centers are staffed by a Sister and a number of public health nurses. There are regular visits by doctors.

The public health center at Mbabane appeared to be very well organized. There were many patients waiting to be seen during our visit. The staff (matron), nurses and health visitors were very well informed and concerned about the health needs of Swaziland. The concept that health education should be a component of all health programs was being perpetuated by this office. In evidence was part of the media, such as posters, and other material which are used in their efforts to encourage good nutritional personal hygiene and family planning by the citizens of Swaziland (Photograph 10).

Three health centers will be constructed within the near future at Siteki, Pigg's Peak and at a still to be determined site in southern Swaziland. UNFPA has agreed to finance the center at Siteki while equipment will be provided by UNICEF.

b. Rural Clinics

There are approximately 60 rural clinics in Swaziland 31 of them are operated by the GOS, and the remainder are run by industry and private organizations. In many instances, there are gross inadequacies in these clinics such as lack of equipment, poor physical conditions (piped water), understaffing and lack of general supervision. In most instances, the private

clinics (those located on the sugar estates) are better equipped but some have a general lack of support staff.

The government operated clinic at Nkowade was recently constructed and was staffed by a registered nurse and a nurse's assistant. The clinic was located at a school complex. There was water available from a standpipe in the courtyard, and toilet facilities were also available for the clinic and school. There was also a water storage tank across from which water was piped to the clinic and school. There was a general lack of basic equipment. Approximately 2 patients with boood in their urine are seen each week. The patients are usually referred to a doctor who then recommends the specific treatment. No fecal examinations are performed. There was no laboratory equipment available for conducting urine or fecal examinations for schistosome ova.

In contrast to the rural government-operated clinic at Nkowade, the privately operated one at Big Bend was well equipped. The professional staff consisted of one expatriate physician and a Swaziland-registered nurse or matron who attend to approximately 15,000 patients per year. An average of 50 to 60 schistosomiasis patients are seen each year. There is no organized treatment scheme and no specific diagnostic procedure for schistosomiasis. Patients suspected of having bilharzia (irregardless of species) are treated with a specific drug.

The clinic operated by the CDC/SIS Mhlume sugar estates was also well equipped and housed in a very well kept building with air conditioning. The professional staff are all expatriates; two physicians (1 full- and 1 part-time), nurses, receptionist and a biologist who had arrived for duty only three months prior to our visit and who will administer the bilharzia control program at CDC/SIS. The biologist was appointed as a result of one of the recommendations made in the Duncan/Fenwick report for CDC/SIS.

The diagnostic procedure used to detect bilharzia is usually a urine examination technique; only in certain instances are fecal examinations carried out. When patients are initially examined, liver enlargement or its absence determines the drug of choice for treatment of bilharzia. This examination usually precedes the specimen examinations. Recent cases of bilharzia were reported among expatriates who had been water-skiing at the yacht club. Estimates of the number of schistosomiasis cases each month vary from 4 - 30. Malaria cases were also reported at this clinic, but the information given was not followed up.

The United Kingdom and the UNFPA will soon finance the construction of six clinics, while equipment for them will be provided by UNICEF. The Government of Swaziland has plans for upgrading the staff of all clinics including non-government operated ones as well. Each clinic is slated to be staffed by two nurses (one trained in clinical medicine and one in public health) and one health assistant.

7. Summary of Recommendations

From available evidence, bilharzia appears to be widespread in Swaziland with about 30% or more of the population infected. Furthermore, the major water resource schemes all are currently serving as snail habitats, and human exposures can be obtained at various times. There are several schemes such as fish ponds, newly established rice cultivation areas and others which have the potential for serving as snail habitats.

Although recommendations have been made, a much broader set, which the advisory team considers will aid in the development of rational approaches to permit progress towards the development of a 'Safe Rural Water Supply' with major emphasis on the control of bilharzia and other water related diseases are presented below:

- Recommend the support of a program costing 2.3 million dollars over a five year period with implementation of a "Safe Rural Water Supply" to include among others control programs for bilharzia and other water-related diseases for the Kingdom of Swaziland.
- Consistent with the implementation of a "Safe Rural Water Supply" Program, the Government of Swaziland should establish a national committee to plan, coordinate and direct the Rural Water Supply Program which includes control activities against bilharzia and water-related diseases. The establishment of this committee would eliminate the costly duplication of efforts occuring among the Ministries which have and will continue to contribute to the increased incidence of bilharzia and other water-related diseases.
- There should be closer cooperation between the Government of Swaziland and the business community, i.e., sugar estate owners and others, in implementing and carrying out control of programs against Bilharzia/ Malaria and other water-related diseases. This cooperation should include exchange of information concerning plans for snail control, drugs used in treatment of infection, etc.
- The existing National Health Program should be expanded to include a national program aimed at educating the entire population, especially those in rural areas who use infected bodies of water, of the danger of bilharzia and the need to exchange current social/cultural practices for use of government provided domestic water, laundry and toilet facilities.
- Training of Swaziland citizens in such areas of expertise as medical and engineering technology, professional Engineer/Sanitarian, Biologist/ Malacologist, Epidemiologist /Statistician, Health Education Specialists, Entomologists, Ecologists and other specialists as needed is strongly recommended.

- The search for alternative control techniques, other than chemicals, such as Biological Control, Engineering (Syphon Spillways and Manual Control Gates), Removal of Vegetation, Solar Distillation, Water Conservation and Canal Relocation and others is strongly recommended.
- All established fish ponds and rice cultivation fields should be carefully surveyed over a 1-2 year period to ascertain the extent of snail populations (if any) and to determine their role in bilharzia transmission. All newly established fish ponds and rice cultivation areas should include in the initial plans preventive measures against bilharzia as well as control programs if needed.
- Immediate and relatively simple techniques such as fencing of water resources facilities or schemes such as springs, wells, fish ponds, dams-reservoirs, major canals (irrigation, distributary and others) should be carried out on a nation wide basis.
- In return for the restriction of use of water bodies by Swazi population, piped-treated water, laundry facilities with safe water, toilet facilities and recreational facilities with swimming pools must be planned.
- Fencing of cattle and their restricted use of domestic water schemes is strongly recommended.
- Crossing points at rivers and streams used by workers at various sugar estates in Swaziland should be bridged.
- It is strongly suggested that, in addition to the school children, surveys for incidence of bilharzia infection should be conducted among older age groups and that fecal, as well as urine, examinations should be included in the National Survey.
- New investments by both Swaziland and the donors should support:
    a. the development of village-based health services delivery infrastructure with emphasis on environmental health;

b. investments within the context of the village-based health systems, in particular emphasizing:

   - safe water supply

   - nutrition

   - environmental sanitation

   - health education;

c. the policy, planning, management and training initiatives essential to create village-based systems;

d. the specific bilharzia disease control measures.

UPPER VOLTA

1. Objective

A five member team visited Upper Volta between February 9 and March 20, 1977 with the following scope of work.

Objectives:

- To assess the nature and extent of the health problems throughout the country, particularly with respect to the major endemic diseases, nutrition and population dynamics.
- To assess the adequacy of the health infrastructure to meet the health needs, including management capability, policies, data collection and processing, equipment and facilities.
- To assess the health manpower availability, projected requirements and training needs.
- To make recommendations and suggest alternative proposals to meet any determined deficiencies.
- To assist in the preparation of a draft Project Identification Document (PID).

Activities

- Accumulate and review all relevant reports, records and documents.
- Interview in-country officials responsible for health planning and delivery.
- Conduct site visits of existing health organizations and facilities.

- Conduct original investigations where information is found to be insufficient to fulfill objectives.
- Prepare comprehensive health sector assessment report that includes all major findings, observations and recommendations.

2. Team Composition

Robert P. Juni D.V.M. - Epidemiologist/Team Leader

Vernon M. Bailey, M.P.H. - Health Services Management Specialist.

Ruth W. Camacho, M.D. M.P.H. - Health Administrator/Planner

Jean A. Blumhagen, M.D. - Rural Health Delivery Specialist

Theresa A. Dupuis, R.N., M.P.H. - Health Manpower Specialist

3. Background Information

In carrying out the Health Sector Assessment in Upper Volta, the team was guided by the basic objectives in Appendix A of Contract No. AID/Afr-C-1253 and the scope of work established by APHA for the team dated 17 January 1977. The broad mission was directed toward ascertaining the situation within the health sector as follows:

a. The nature and extent of health problems.
b. The adequacy of health infrastructure to meet health needs.
c. Manpower availability, requirements, and training needs.
d. Suggested approaches to meet deficiencies within present constraints.
e. Prepare to assist the mission in formulating a basis to identify good possibilities for project activities within the context of regional and long-term programs.

In the Mission concurrence for the study (State 017167), it was considered to be an analysis of Health Structures, Health Problems and Policies, Manpower, Nutrition and Population Factors, and to give results in the form of recommended strategies for the health sector. The setting within the Government of Upper Volta (GOUV) for a special team to study the health sector was laid in a letter from the Country Development Officer (CDO) to the Minister of Health dated 10 July 1976. A preliminary survey by the Regional Economic Development Support Office (REDSO) had made proposals to the CDO for the conduct of the health sector analysis which lead to mounting this study. Attention was directed to the regional office of "Strengthening Health Delivery Systems" (SHDS), with the suggestion that its potential be considered in the recommendations. A synthesis of the various concepts for a study was made by the team, and a plan of action presented to the CDO on arrival during his initial briefing. A certain flexibility was built into the study outline in view of the great amount of descriptive details already accumulated for a country health profile by the WHO Country Representative. The health profile report covered the Health, Nutrition, and Water Sub-group planning program of the Club des Amis du Sahel. This study was adjusted to utilize this assemblage of current, detailed information on the country situation relevant to the health sector and to sharpen the team's focus on providing a more factual basis for programming AID assistance.

The basic documents utilized have been the Proposal for Long-term Comprehensive Development Programs for the Sahel (April, 1976) and the basis for program activities as expressed in the country Development Assistance Paper (DAP). The Project Budget Submission

(PBS) for 1978 had already recognized the need for updating the assessment of the DAP health sector. Questions that appeared to require clarification were identified in the early document review and became specific points for examination while in the field, so that a truer interpretation of program directions could be obtained. In broad terms, the DAP considered areas of malnutrition, certain transmissible diseases, health infrastructure, and the health politics situation. As the present assessment progressed, the changes in these areas were evaluated in terms of their possible influence on the validity of DAP strategies. An assessment of the present situation pertaining to those points appears in the body of this report.

Also of relevancy have been the Congressional Presentation of the Health/Nutrition/Population Sector objectives for the Sahel Development Program, AID/W, and its commitment of cooperation with the Club des Amis, OECD.. Strategies developed so far for the U.S. initiatives seemed to have settled into a pattern of objectives relating to community-based preventive and first-line medical care with national health service structure for back up referral care, overall planning and guidance, training, popular health education, and program evaluation. In addition, the essential nature of existing in-state or regional approaches to some aspects of the total health problem has been recognized.

4. Summary of Findings

Following a review of relevant documents, discussions with officials of the MOH and international donor agencies and a series of site visits, the team's findings and observations were summarized

in the following catagories:

Summary of Health Problems:

National Health Priorities:

a. Endemic Disease Control:

Out of a wide variety of maladies which exist among the nation's population, the Voltaics have selected the following major endemic parasitological and other infectious diseases against which nationally organized control efforts are to be made:

Onchocerciasis

Shistosomiasis

Filariasis

Malaria

Trachoma

Leprosy, and

Intestinal infections.

b. National Health Care Facility:

The Government's second priority is to maintain one or more definitive medical and surgical treatment facilities as a national base for relatively sophisticated medical care.

c. Rural Health Delivery Services:

Of relatively low priority is the Government's response to the common illnesses and injuries of the rural population by extending national (free) medical care directly out to all small villages. The Voltaic perception seems to rest on the first preliminary step of strengthening the administrative control of prefecture-based health sector public health activities. They seem to interpret the health problems in the villages as being divisible into two parts for the time being; one as the site of the human element in their

fight against the selected parasitic diseases through mobile teams and secondly the general burden of ailments and injuries that villagers must cope with, making such use as they can of established dispensary outposts.

Health Related Influences:

As in other developing countries there exist in Upper Volta environmental, educational, societal and developmental forces which influence the health status of both urban and rural communities. These forces contribute to a large mass of vaguely defined illnesses and deaths which up to the present time have not been identified and quantified in the usual public health programming sense. But the fact that they accentuate the health problems facing the national health service cannot be denied, even before health statistics and demographic studies have been able to clarify them. Health hazards associated with rural development, irrigation, water exploitation, agribusiness and transhumance all merit attention. The task confronting the Minister of Health is how to apply the skills and knowledges of the health sciences to the well-being of society indirectly through leadership and cooperation with other social entities and agencies that concern themselves with those forces.

Administration of Health Services:

The Ministry of Health operates currently within a system which it has inherited, i.e., the Grandes Endemies, with a few major hospitals, and a loose network of health outposts which are inadequate in number and resources to give full population coverage. Budget increases to expand the coverage by increasing the number of conventional dispensaries are unrealistic under present economic conditions. The feasibility of the present system of health data collection to provide acceptable demographic data for realistic health programming

against the total burden of illnesses thwarts national policy to reform the system.

While the outward appearance of MOH activities seems directed toward continuing more of the same past efforts, the Presidential mandate of December 9, 1975 for 1977-78 planning makes it clear that innovative approaches involving popular participation must be devised to attain socio-economic development within the available resources while not prejudicing external assistance in the meantime. It calls for a realignment of existing human and material resources for their rational utilization and the progressive involvement of the social framework of rural population groups. Specifically, the instructions were to integrate the social/sanitary services delivered at the national and departmental administrative organizations with regional efforts for economic, cultural, and educational development.

It is difficult to say at this time whether there are some hidden constraints preventing the MOH from approaching the health needs of the rural population in this way or whether they are unsure of how to begin to extend themselves other than by the conventional and fiscally impossible route. It also seems that some of the external assistance contributes to, if not directly encouraging, the pursuit of the existing courses of action which are demanding increasing portions of the national budget. However, the strategies developed by International and African regional organizations of which the Government of Upper Volta is a participant should mold national philosophies of rural health delivery systems into channels compatible with the recommendations contained in this report. These recommendations for bilateral assistance are directed toward encouraging implementation of national responses to the fundamental health needs of rural populations that are receiving regional endorsement.

Hopefully, the choice of intervention at the primary operating level of the prefecture will provide a base unit where the national aspirations for a health service can be crystallized, refined and developed.

External Factors

(a) Voltaic-French Assistance

In the administration of its health services the Voltaics continue to maintain close association with France. Thus, a number of key positions for the execution of the public health program are filled by technical personnel furnished under the French technical assistance program. This has the effect of reducing the opportunities for the Voltaics themselves to develop their own capabilities for coping with their health requirements. While the services gained through technical assistance are recognized as being essential, the placement of expatriates in positions of administrative responsibility rather than as advisors tends to restrict local initiatives to manage and innovate within their own cultural context.

(b) International Organizations

There has been an appreciable amount of external assistance in the form of direct delivery of health care to selected population groups which at times has not contributed to development of an overall health sector program. This has included World Health Organization projects for strengthening health services, and a gradual coordination of the health services has been fostered. Currently, the WHO country representative provides a point of coordination for health sector development projects by external donors. A country-level strategy for health sector development in Upper Volta has not

yet been well defined. However, the participation of the Government of Upper Volta in WHO regional projects, particularly those developed for training and guidance in national health planning, dictates maintaining a close liaison with the WHO representative.

(c) African Regional Organizations

Three major regional organizations in which the Government of Upper Volta is a member appear to have a great potential for impact on the development of national health strategies; these are Club des Amis du Sahel, OCCGE , and the WHO Regional Project, Strengthening Health Delivery Systems (SHDS), for which AID provides the secretariat and primary funding. These development efforts on a regional basis are setting certain patterns of change which add an element of direction to the national health situation. In addition to higher level technical support services in specific areas, there are also available to member states facilities for training, operational research, and health program development. The development of such mutual approaches by the African nations in seeking solutions to their health problems has been taken into consideration in bilateral U.S. assistance planning.

5. Status of Major Endemic Diseases

Malaria

Malaria continues to be a major burden on the population throughout the country. For the second reporting week of 1977, 4,402 cases of malaria were reported from all but 14 of the 46 reporting areas (keeping in mind that 9 of these did not report any case of the 18 reportable diseases). Malaria transmissions are frequent and widespread so that the extent of parasitization with malaria may reach as high as 75% among the younger children. The effect of the hyperendemicity of this single disease on the health of the infant and

young child is extremely great. A major portion of deaths in this age group is attributed to acute malaria attacks until a balance is struck by the body in an accommodation to chronic infection.

The role of the national health services has become one of caring for pernicious attacks and advocating a regimen of chemosuppresents for the infants up to five years and for pregnant women. At the dispensaries visited it was noted that patient visitors with fever were immediately classified as "malaria" and a few doses of chloroquine were handed out. With few exceptions, well-baby clinics (PMI) were not emphasizing a program of chemosuppression, rather sending out a mother with a feverish child to the dispensary where treatment for temporary relief might be available. Also, an observation made at one hospital laboratory is revealing. The lab record book showed a large number of blood slides submitted in support of a clinic operation. Only a few of the examinations were positive for malaria. The laboratory technician demonstrated his technique and showed slides he had read. His work was competent enough. Inquiry of the clinic physician revealed that he asked for no tests on the very obvious malaria cases, but was using the lab as a tool for differential diagnosis where he, as an experienced physician, saw the need. One can draw conclusions from that as to the value of the large number of malaria cases being reported each week by the other smaller health posts.

The nature of the malaria problem does not appear to be solely one of extent of infection, but one of a misdirected public health response to the realities of widespread exposure and a process of gradual adaptation as the individual matures. The field of transmission potentials would provide more revealing information regarding the extent of this health problem than the morbidity figures usually given in

public health reports. Knowledge of transmission dynamics, including the size of the human reservoir pool for infecting vectors, is an important factor in order that existing activities and resources can obtain better results against the main threats to health. The actual pattern of vectors and their vectorial potential can be translated into guidance for primary care level activities and community action to further protect vulnerable age groups.

Schistosomiasis

This seems to be the forgotten "major endemic parasitic disease" within the rural health program. It is not one of the diseases included in the mobile active case finding list of diseases; it is not an obligatory reportable disease; and it seems to receive no more attention than to appear on the monthly report of cases diagnosed and treated. The 1974 Annual Report records 19,635 cases of vesicular bilharziasis, and the WHO Health Profile cites a three-year survey, 1952-53, where 44% of the young surveyed were infected and 25% of the adults.

The general feeling is that it is much more common but that people with the disease are not unwell and are not disturbed by occasional bloody urine so they do not seek medical help. Also, the laboratories at fixed facilities are not often used and, when they are, positive results do not get back to the writer of the monthly reports. One wonders, though, of the significance of the sector level Laboratory Activity Report for 1974 that gave figures of 2,953 positives for the parasitological examination of urine specimens (43% of samples examined). With a significant reservoir of human cases and widely distributed snail hosts, the potential for even more serious impact of this disease takes on reality for those who plan further irrigation or water-related agriculture.

The Minister of Health himself expressed his concern by voting for bilharzia as the top priority for applied research by the Centre Muraz in last year's technical conference of the OCCGE. The actual program of research published by OCCGE in their October-November 1976 Bulletin of Information includes a proposal for geo-epidemiologic and sociologic studies of endemic areas. This may be a first start for an organized approach to schistosomiasis in Upper Volta, but it is noted that restrictions have been placed on field work by the Centre Muraz because of financial constraints within OCCGE.

Onchocerciasis

Although once a major consideration for the rural health program, the successful beginning of a regional control program has altered its importance for national health service intervention. Blindness is still prevalent and the reservoirs of infections still move about. But with transmission being interrupted, there is now an opportunity to identify and follow carriers. Expectations are that methods of clinically managing these persons to reduce infectivity will be found during the life of the project. Much of the success in keeping the infection down after the vector control project ends depends on a strong and capable local health service monitoring the still existing human reservoir. A Preliminary Assistance Project (PAG) estimated that there were over one-half million carriers. An important surveillance element is the geographic coverage to detect small focal areas not under the formal regional control program where occasional transmissions occur to perpetuate the life cycle of the parasite. The inclusion of these reponsibilities within the scope of the rural health system would be of great value and is discussed in more detail in relation to the Volta Valleys Authority (AVV).

Trypanosomiasis

This disease continues to be a burden on the country with an increasing number of new cases imported back into the country having been infected in the Ivory Coast and Ghana. The total number of infected persons registered under the control program is decreasing but also the number of new cases found by active case detection is much lower. The percentage of new cases being found by passive case finding in fixed facilities has increased drastically over previous years. The decreased effectiveness of the mobile teams is understandable under the restricted means available to them and this raises the significance of the data coming in spottily from scattered active sentinel stations.

The new UNDP regional project for "Applied Research on Trypanosomiasis Epidemiology and Control: Surveillance and Glossina Control in the Moist Savannah Zones" has as its objectives to develop methods for holding down the riverine vectors and for increasing the sensitivity of detecting early infection in man. A high priority is being given to preventing this disease because the widely scattered foci of the vector each constitute a potential for sharp increases in new infections. Also there is the desire to maintain the confidence of the population, particularly in the newly opened lands under the Oncho program.

Although the parasites are distinct between human and animal forms, the vectors, geographic distribution, and diagnostic methods are similar for both. Considering the economic priorities attached to the animal form, close coordination with veterinary activities reduces the dependency of public health control activities on humanitarian justifications under an integrated rural development program.

Trachoma

A total of 27,826 trachoma-related ocular affections were found in 1974. Over 75% of these cases were brought to treatment by the mobile teams as compared to 15% coming into fixed eye clinics. The national Mobile Opthalmologic Group still make some rounds, but since it lost its opthalmologist, it cannot provide the surgical repairs in the field as it once did.

Reports on field studies performed by OCCGE indicate that a low intake of beta carotene or retinol foods operates in many localities as a predisposing cause of chronic ocular infection and scarring, along with the environmental conditions of fine dust, water scarcity, and opportunistic infecting organisms. In any event, the frequent finding of simple xeropthalmia lead the previous opthalmologist with the Mobile Opthalmology Group to advise the periodic loading by vitamin A tablets to target groups.

Cerebral Spinal Meningitis

This disease should also be mentioned as an important health problem. Although the number of reported cases had been decreasing up to 1975, the case fatality rate for that year reached almost one out of five. Some trials of vaccine have been made which may be of help. Studies in the Centre Muraz on antibiotic resistance have not found that this may be a problem. Some bacteriologic surveys have found that among the group studied pneumacoccus, hemophilus, and other organisms were in predominance rather than meningococcus. Early diagnosis and prompt antibiotic therapy seems to be coping with the problem so far, if the patient can reach an adequately supplied dispensary in time.

Diarrhea

Another health problem that deserves attention is the morbidity associated with poorly managed bouts of diarrhea in infants. The fact is that the population in a village is essentially one continuous gut in that each shares the intestinal flora of the other as well as whatever new organisms appear in the environment. Salmonelloses and to a lesser extent Shigellosis have been readily isolated in specific investigations around Bobo-Dioulasso. Diarrheas together with fevers place a drain on the already fragile nutritional reserves that can quickly lead to critical situations. With hospitals being few and far between, the health problem becomes one of being able to intercede early at low level health facilities with oral rehydration and proper management during times of crisis, being vigilant for specific serious causes, and helping the family raise the child in a fragile symbiotic adaptation to its environment.

6. Existing Health Infrastructure

The major product of the Upper Volta team's visit was a Health Sector Assessment Document. That Assessment deals in detail with the administrative and infrastructural makeup of the Health Sector at national, international, provincial and local levels. The reader is advised to refer to the main document for infrastructural information as any attempt to summarize the teams findings in this area would be superficial and incomplete.

7. Summary of Recommendations

a. The conclusion is that U.S. bilateral assistance should contribute toward Voltaic development of indiginous middle-level health resources required for the support of community based health delivery programs, which extend simple health services to the mass of rural inhabitants. In view of the fact that principal current resources

secured directly from MOH within the fairly firm ceilinged budget are the health cadre in place or in training, emphasis of external assistance for newer health activities should be placed on expanding the availability of technical support from sector level to locally selected primary health care workers based at the village level. Recognizing that considerable donor assistance is already being given health services, the centralized conventional additional assistance is needed for the management of a health sector where alternative approaches can be explored for meeting the basic health needs through a system of simplified primary health care.

Some areas at prefectural level meriting added external support are:

1. Developing technical support resources and competence at the inter-face of the national public health system with local civil administrative/village level organisms.
2. Improving the efficiency of sector level effort in the prevention of the major endemic diseases through simplified but advanced technologies.
3. Increasing the capability of MOH to more effectively administer and manage sector resources in response to the newer roles of the prefectural health sector in supporting health care for the village.
4. Augmenting the contributions of curative medicine to established preventive measures and improving cost/benefit ratios at fixed facilities.
5. Encouraging the introduction of a health sector planning process into socio-economic development schemes.

b. Recommendations for Action

1. Support for the identification and design of community based health services as self-supporting components in selected health sector/prefectural-level organizations.

   (a) Consultation and assistance at sector administrative level in interpreting MOH policies and guidelines into operational methodologies, including the management of MOH goals for Protection of Family, control of diarrhea, malaria, etc.

   (b) Development of linkages at the community level for technological support referred back up to sub-sector levels and other national health services.

   (c) An initial programmatic approach of combining primary health care with community development may be within an Integrated Rural Development demonstration area, along with an operational research study of the socio-economic return of health.

2. Increased facilities for orientation and training in the implementation and management of sector-level public health programs and community involvement.

   (a) Technical and material support to the National School of Public Health for satellite rural training centers.

   (b) Sponsorship of a 3-5 year period of training in health administration and management perhaps in conjunction with the National School of Administration.

   (c) Financial support for seminar/refresher training on methodologies and evaluation of case detection and control of the major endemic diseases, most logically at Centre Muraz.

3. Expanded medical intelligence on major preventable diseases for use in Health Sector/Prefectural public health programming and operations.

   (a) Joint project with Centre Muraz to map the geographic distribution of major endemic diseases of natural focality and to determine a reasonable array of sentinal surveillance stations.

   (b) Field trials and evaluations of various combinations of polyvalency in specific disease case findings and surveillance teams.

   (c) Adaptations of efficient methods for maintenance, review and analysis of case files and treatment records of chronic carriers.

4. Reduction of per patient operating costs of hospital units and fixed facilities through more efficiency, logistical and support procedures,

   (a) Installation of tableting capability in-country to utilize lower cost of bulk generic drugs for the expansion of distribution and marketing facilities at lower health echelons and "village pharmacies", (joint private industry with autonomous National Pharmacy).

   (b) Cost/benefit analysis and identification of building layout inefficiencies at Yaigado Hospital.

   (c) Supplement to patient care costs by the use of PL 480 feeds for nutritional maintenance of all in-patients as well as for nutritional rehabilitation.

5. Strengthening health components of social and economic development by the addition of a Health Economist/Planner to the agricultural and rural development projects.

(a) Introduction of a health sector planning process through liaison with ORD's and AVV activities.

(b) Program support to Social Affairs/Community Action programs addressed to health maintenance and nutritional education elements of the Protection of the Family Services.

(c) Health advisory support to Home Economics and Young Farmer projects of the Ministry of Rural Development.

(e) Project to add a health annex to Tambao Mineral Development Project.

ZAIRE

Research on Onchocerciasis

Imeloko

1. Objective

A four member team from the Armed Forces Institute of Pathology visited Imeloko Republic of Zaire between March 4 and March 26, 1977 with the following general and specific objectives:

General

To determine how and why O. volvulus damages man and how other filarial infections (loiasis, dipetalonemiasis and perhaps others) may modulate onchocerciasis.

Specific

a. determine which filariae infect residents in the IMELOKO region of Zaire, and the prevalence of each of these filaria;

b. determine the prevalence, the cause, and the mechanisms of elephantiasis, hanging groin, and other regional lymphedemas in inhabitants of Mbwasenge and Loko;

c. determine whether long-range therapy with diethylcarbamazine (DEC) will reduce regional lymphedemas and elephantiasis;

d. determine whether abdominal lymph nodes are involved in onchocerciasis;

e. determine the concentration of microfilariae in different regions of the skin and determine especially whether those with elephantiasis have higher concentrations in the pelvic region; and

f. determine whether the patients in the IMELOKO region have microfilariae in sputum, urine, blood, and spinal fluid, before and after treatment with diethylcarbamazine.

2. Team Composition

The research team was comprised of four members of the Department of Infectious and Parasitic Disease Pathology, Armed Forces Institute of Pathology, Washington, D.C.

Daniel H. Connor, M.D.
Chairman

Wayne M. Meyers, M.D., Ph.D.
Chief, Microbiology Division

Ronald C. Neafie, M.S.,
Diagnostic Parasitologist

John F. Duncan, HMC, USN, Technician, and NCOIC
(Noncommissioned Officer in Charge)

3. Background Information

Although onchocerciasis has been known for over 100 years (discovered in 1875 by Surgeon John O'Neil), the disease has been regarded as rare and inconsequential by most American physicians. Before World War II few American physicians had heard of onchocerciasis, and even today, probably no more than six American physicians have done field research on onchocerciasis. Since World War II, however, there has been a gradually increasing awareness of the severity and extent of onchocerciasis and today onchocerciasis is recognized as one of the world's major public health problems. An estimated 40 million Africans are infected and of these approximately 500,000 are blinded or have severely compromised vision. In addition to personal hardship, onchocerciasis prevents utilization of some of Africa's most fertile valleys, thus hindering economic advance. During the past five years, a number of agencies and organizations, including the International Bank for Reconstruction and Development, the World Health Organization, the Pan American Health Organization, and the U.S. Agency for International Development, have taken steps to promote research on the control and prevention of onchocerciasis. Detailed knowledge of the pathology and

pathogenesis of onchocerciasis is lacking and thus, to gain a better understanding of these aspects, this study was undertaken.

Onchocerciasis continues to be a severe problem at IMELOKO, Zaire, afflicting virtually all indigenous adult Africans in that geographical area. No research has been done on onchocerciasis at IMELOKO since our studies in 1968. That year we established that onchocerciasis was a severe disease there and, further, that Onchocerca volvulus microfilariae cause severe lymphadenitis. Unproven, however, is whether O. volvulus alone causes elephantiasis. Since 1968, Dr. Arden Almquist has developed at IMELOKO a modern hospital with an average daily census of 120 patients. In this environment we collected specimens, data, photographs and performed an autopsy, and established a basis for an ongoing program of research in onchocerciasis and other filarial diseases.

The present visit was suggested by Dr. Arden Almquist, Medical Director, IMELOKO, Zaire and supported jointly by AFIP, USAID, APHA, Gulf Oil Corp. and WHO.

4. Summary of Findings

From Friday, March 4, 1977, 1500 hours, until Saturday, March 26, 1977, at 1130 hours, the team worked at IMELOKO in the Ubangi area of Zaire. We collected a variety of specimens from approximately 1,000 patients. These have been accessioned to the Registry of Geographic Pathology at the Armed Forces Institute of Pathology (accession numbers 1607000 to 1608000 and 1610031 to 1610041). Clinical data, parasitological data, pathological specimens, and detailed clinical photographs are now being catalogued and correlated. Complex and nonobvious correlations will be hastened by CLIPSTARS, a modern highspeed computer at the AFIP, specially designed and programmed for clinicopathological correlations. Our studies include light, electron, and fluorescent microscopy in addition to standard

clinical and pathological analyses. Our formal presentations will require ten to twenty months of work by various members of the Department, but we can offer the following preliminary findings:

a. Smears were collected from 1,000 patients. These were thick and thin films, Knott's concentrations, and preparations by millipore filter techniques. Blood for these were drawn during the forenoon, afternoon, and between 2130 and 2330 hours at night. Circulating microfilariae identified were Loa loa, Dipetalonema perstans, and Wuchereria bancrofti. Prevalence and concentrations of each species will be determined and reported in detail later.

b. Clinical data - The data on the 1,000 subjects include the prevalence and distribution of onchocercal nodules, evaluation of vision, degree, type, and distribution of dermatitis, presence of lymphadenopathy, hanging groin, hanging scrotum, hydrocele, and elephantiasis.

c. Skin snips - These were done to reveal the presence and concentration of microfilariae in the skin - taken routinely from the hip and serially from shoulder, hip and knee from patients specially studied and from those selected for treatment.

d. Lymph nodes - Specimens of femoral or inguinal lymph nodes were taken from 50 patients. The gross and microscopic changes in these nodes will be correlated with the clinical severity and distribution of onchocercal edema, elephantiasis, and dermatitis. The few nodes studies so far reveal characteristic changes of onchocercal lymphadenitis. These are fibrosis of the capsule, sinus histiocytosis, follicular atrophy, dilatation of sinusoids, and perivascular fibrosis.

e. Photographs - Approximately 1,000 photographs depicting overall and clinical changes were taken. Both color and monochrome were taken on bellows, large format (2-1/4" x 2-3/4")cameras. These will document, better than

words, the unusual and extreme effects of onchocerciasis among these people.

f. Autopsies - We performed the first medical autopsy at IMELOKO. The subject was a 60-yr. old female and died of a staphylococcal pyemia. The cause of death was a severe staphylococcal pericarditis and staphylococcal abscesses of the liver. This women lived in the village of Mbwasenge, where our research was concentrated. She also had advanced changes of onchocerciasis. In addition to this autopsy, Dr. Leo Lanoie of the Karawa Mission Hospital performed three autopsies and contributed these to our collection. These also revealed unusual features of exotic and parasitic diseases.

g. Therapy - Eighteen patients with elephantoid changes were begun on a long-range therapeutic regime. This regime included DEC, 50 mgm/wk, aspirin, and antihistamines, as necessary to control pruritus and pain.

h. Village of Mbwasenge - This village is located ten kms from IMELOKO, along the Businga road. Of 425 villagers studied, 305 were infected. Thus overall, 71.76% were infected. Uninfected villagers, however, tended to be the infants and children. After age 20, virtually every villager had overt manifestations of onchocerciasis. (See attached data sheet and graph.)

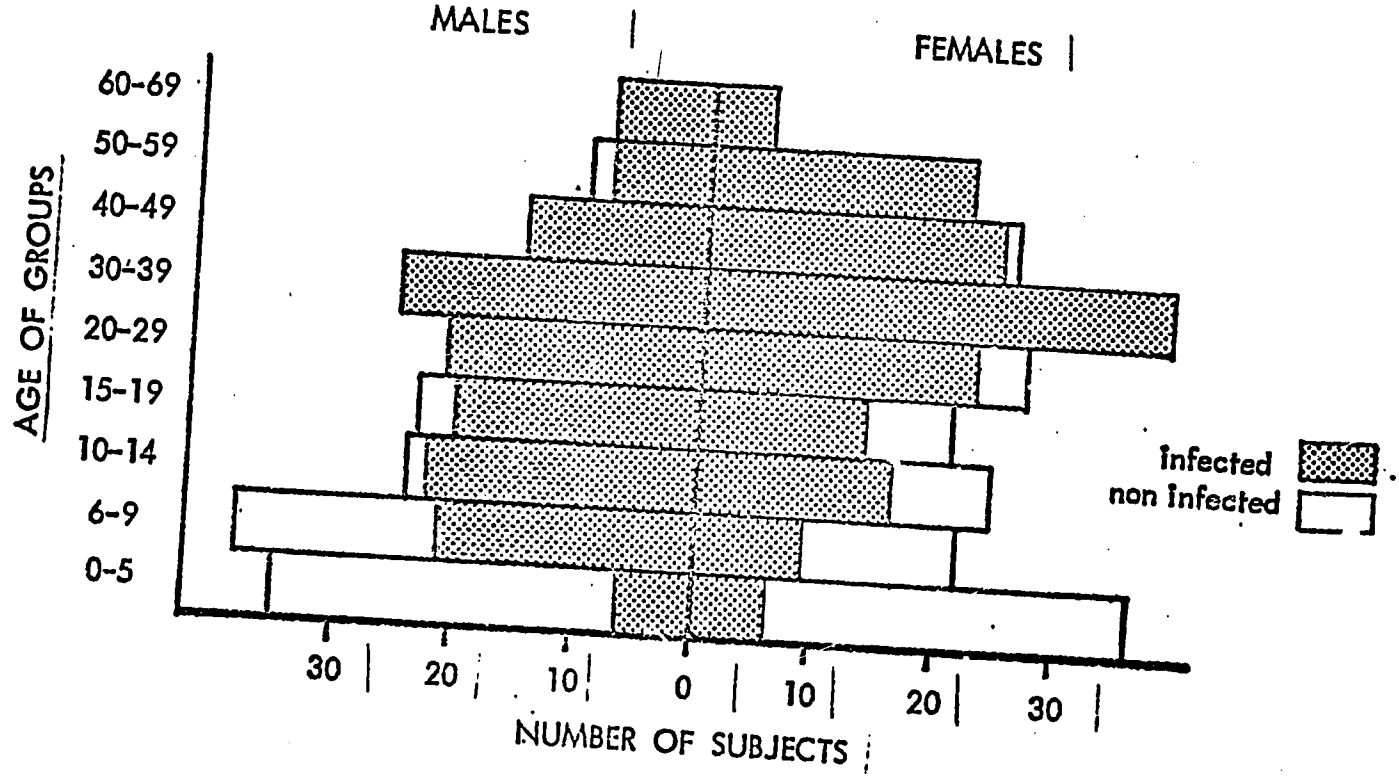
i. Town of Businga - Businga is located 40 kms from IMELOKO and is the shipping terminus on the Mongala River. 201 subjects were examined for eye changes, dermatitis, regional edemas, nodules, lymphadenopathy, and for microfilariae in the skin. This material is now being studied.

j. IMELOKO - The indigenous population living in and around the hospital were examined for signs, symptoms, and laboratory features of onchocerciasis and other filarial infections. This material is now being studied.

ONCHOCERCIASIS

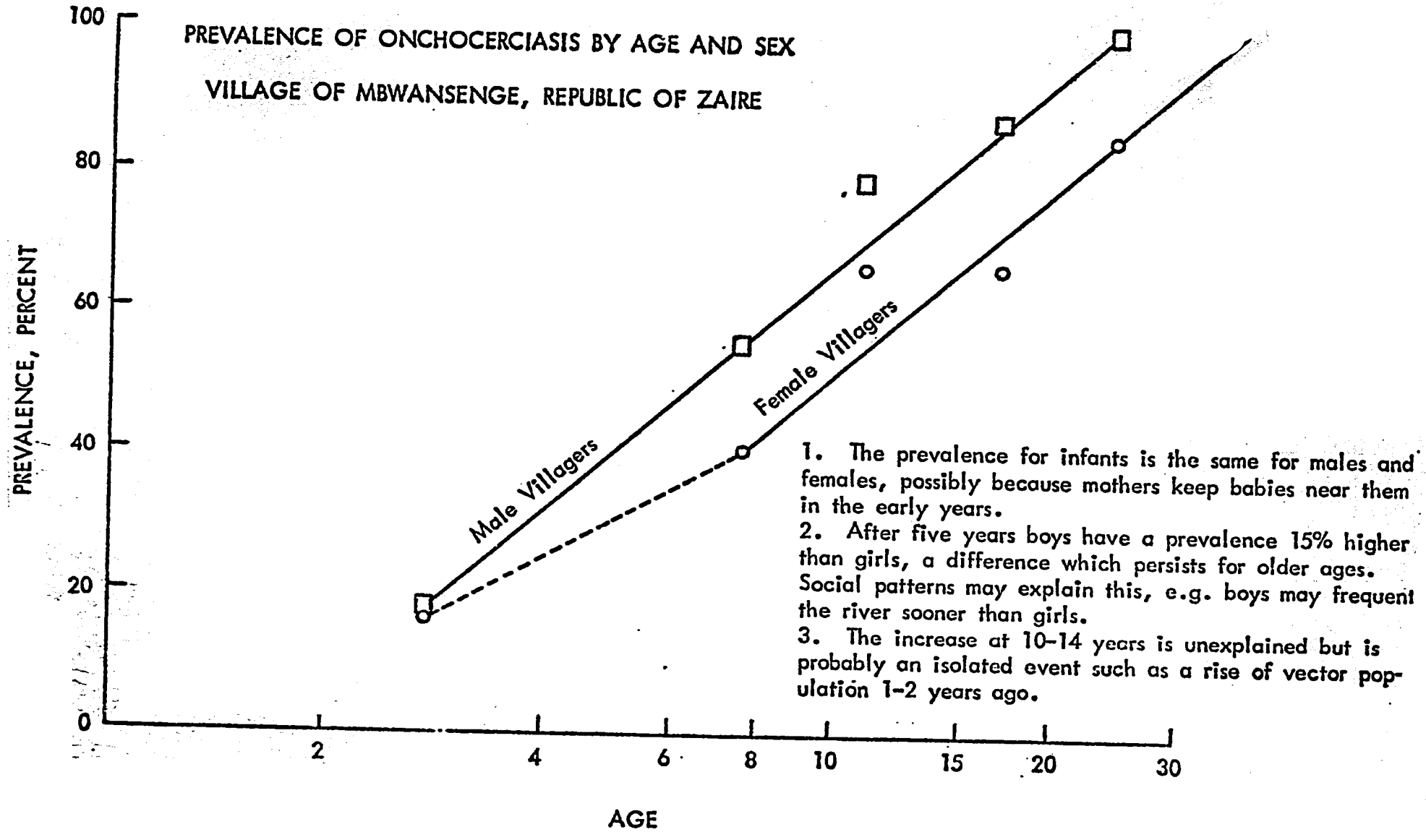
MBAWSENGE VILLAGE, REPUBLIC OF ZAIRE

(PREVALANCE BY AGE AND SEX, DETERMINED BY PALPABLE NODULES, SKIN SNIPS AND MAZZOTTI REACTIONS)



VILLAGE OF MBWASENGE - AGE DISTRIBUTION OF ONCHOCERCIASIS

Age (yrs)	+ - Total	Male	Female	Total	% Male	% Female	% Total
0-5	+	6	6	12	17.1%	16.7%	16.9%
	-	29	30	59	82.9%	83.3%	83.1%
	T	35	36	71			
6-9	+	21	9	30	55.3%	40.9%	50.0%
	-	17	13	30	44.7%	59.1%	50.0%
	T	38	22	60			
10-14	+	22	16	38	78.6%	66.7%	73.1%
	-	6	8	14	21.4%	33.3%	26.9%
	T	28	24	52			
15-19	+	20	14	34	87.0%	66.7%	77.3%
	-	3	7	10	13.0%	33.3%	22.7%
	T	23	21	44			
20-29	+	21	23	44	100%	85.2%	91.7%
	-	0	4	4	0	14.8%	8.3%
	T	21	27	48			
30-39	+	25	39	64	100%	100%	100%
	-	0	0	0	0	0	0
	T	25	39	64			
40-49	+	15	25	40	100%	96.2%	97.6%
	-	0	1	1	0	3.8%	2.4%
	T	15	26	41			
50-59	+	8	22	30	80%	100%	93.8%
	-	2	0	2	20%	0	6.2%
	T	10	22	32			
60-69	+	8	5	13	100%	100%	100%
	-	0	0	0	0	0	0
	T	8	5	13			
Total	+	146	159	305	71.9%	71.6%	71.8%
	-	57	63	120	28.1%	28.4%	28.2%
	T	203	222	425			


PREVALENCE OF ONCHOCERCIASIS BY AGE AND SEX
VILLAGE OF MBWANSENGE, REPUBLIC OF ZAIRE
PREVALENCE, PERCENT
100
80
60
40
20
0
Male Villagers
Female Villagers
2
4
6
8
10
15
20
30
AGE
1. The prevalence for infants is the same for males and females, possibly because mothers keep babies near them in the early years.
2. After five years boys have a prevalence 15% higher than girls, a difference which persists for older ages. Social patterns may explain this, e.g. boys may frequent the river sooner than girls.
3. The increase at 10–14 years is unexplained but is probably an isolated event such as a rise of vector population 1–2 years ago.

k. Gbado - The expatriate population of Gbado, 40 kms. from IMELOKO, was examined for evidence of filariasis. Brief histories, skin snips, and blood smears were taken from seventeen subjects.

5. Status of Endemic Diseases

Diseases Identified in the Imeloko Area

Parasitic

(1) onchocerciasis - one of the most prevalent diseases in the area

(2) dipetalonemiasis (perstans) - common but with severe clinical manifestations

(3) loiasis - common with symptoms following treatment with DEC

(4) bancroftian filariasis - rare microfilariae found in blood, no obvious clinical features but the relationship to elephantiasis awaits study

(5) streptocerciasis - prevails in that general area of Africa

(6) amebiasis - common and with severe and sometimes fatal complications

(7) tungiasis - common

(8) pentastomiasis - prevalence unknown but has been identified throughout Tropical Africa

(9) scabies - common and severe

(10) malaria - common and frequently fatal - a special problem during pregnancy

(11) ascariasis - common

(12) trichuriasis - common

(13) ancylostomiasis - common

(14) trypanosomiasis - suspected in a woman with painless enlargement of lymph nodes in the posterior cervical triangle

Bacterial and Fungal

(1) tropical phagedenic ulcer - common and severe - afflicts expatriate and indigenous people

(2) tuberculosis - common and severe, a common cause of death among young adults

(3) staphylococcal pyemia

(4) gonorrhea - common and with chronic complications, especially urethral stricture

(5) pneumococcal pneumonia

(6) syphilis - common

(7) leprosy - common - no regular or organized service, hence many complications and many with advanced lesions

(8) gas gangrene - fatal infection in an adult man following penetrating trauma to leg

(9) dermatophytosis - very common

(10) phaeomycotic cyst - not common

Viral

(1) rabies - in a dog brain - contributed by Dr. Lanoie

(2) veneral warts

(3) measles

(4) chicken pox

Other

(1) endemic goiter - common and severe

(2) cretenism - common

(3) lymphostatic verrucosa

(4) kwashiorkor

(5) ainhum

(6) Burkitt lymphoma

(7) Kaposi's sarcoma

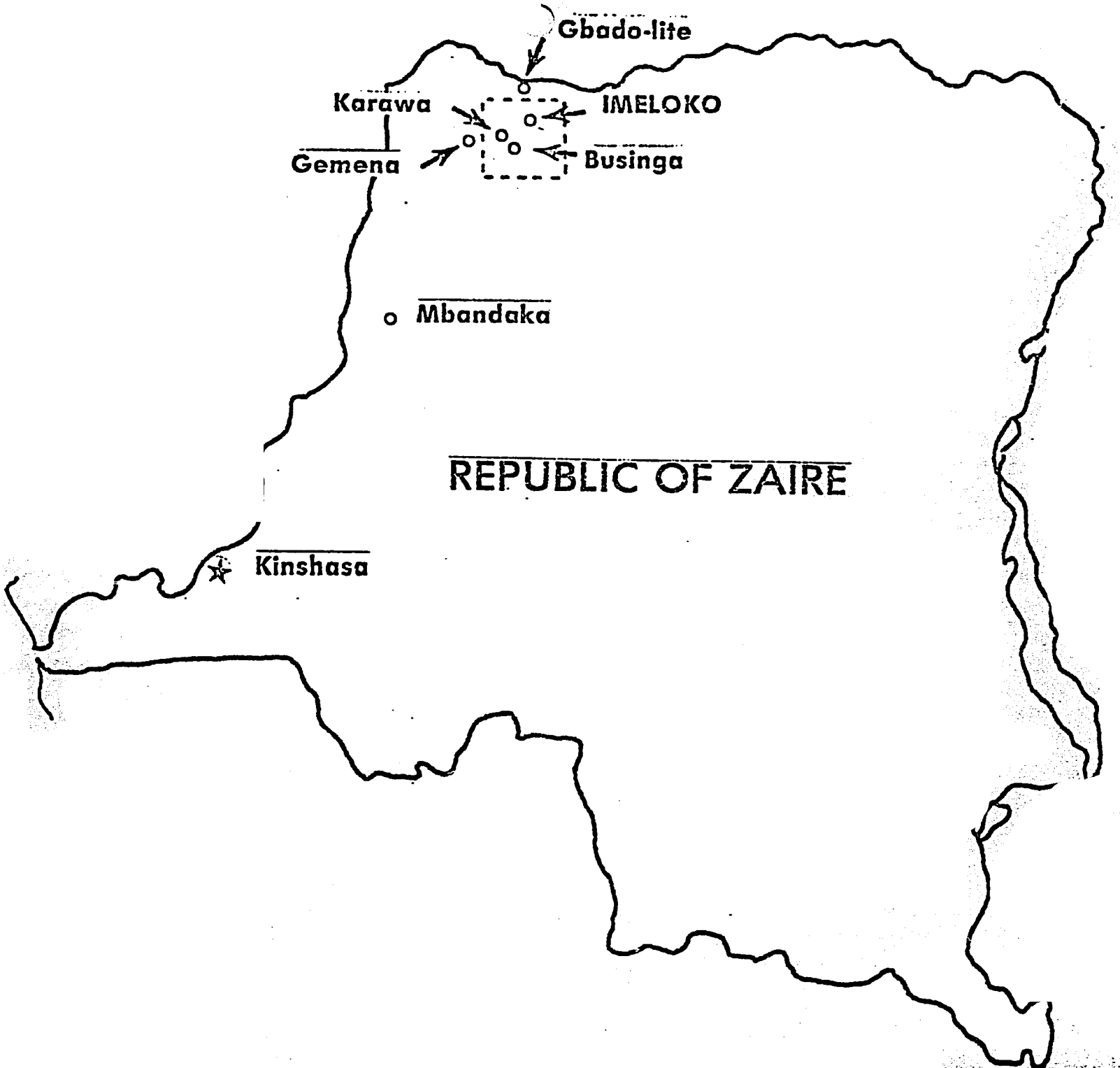
6. Existing Health Infrastructure

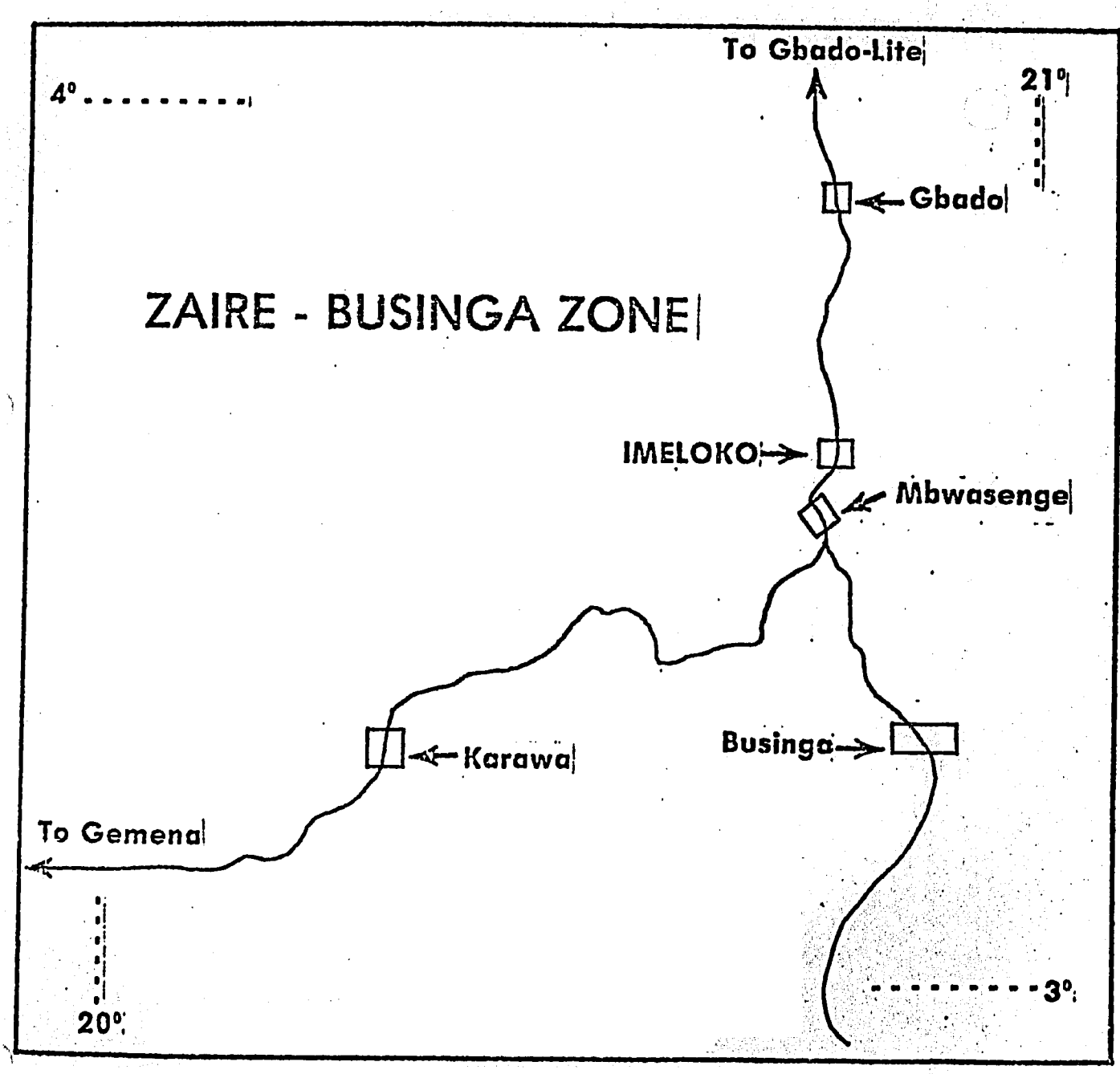
While the team's scope of work did not require an analysis of the local health infrastructure, several relevant comments can be extracted from their report:

- The Imeloko (Institut Medical Evangelique Loko) hospital is a 140 bed facility that has a daily census of about 120 patients, 10 to 15% of which suffer from filariasis.
- The hospital has surgical facilities
- Satellite medical facilities with well trained staff are present at Mbwasenge, Businga and Karawa (see maps)

8. Recommendations

None


Gbado-lite
Karawa
IMELOKO
Gemena
Businga
Mbandaka
REPUBLIC OF ZAIRE
Kinshasa


To Gbado-Lite
4°
21°
Gbado
ZAIRE - BUSINGA ZONE
IMELOKO
Mbwasenge
Karawa
Businga
To Gemena
20°
3°

Part D. Project Accomplishments and Future Directions

The American Public Health Association (APHA) on August 8, 1976, entered into Contract No. AID/Afr-C-1253 with the Bureau for Africa, Agency fo. International Development (AID), for the provision of technical services a... at providing the data basis for AID's contribution to the development of health delivery systems in the Lesser Developed Countries (LDC's) of Africa, particularly the Sahel.

Specifically the contract states:

"The Contractor shall provide technical services to AID so that the latter may provide assistance to LDC's in Africa in development of health delivery systems to reach the poor majority. Given the large number of African countries requiring such assistance, the specific objective of this contract will be to provide technical services in the following areas of activities in selected areas/countries in Africa:

A. Environmental Health Assessments in the major Basin Areas (Lake Chad, Niger River, and Senegal plus Liberia, Swaziland, and Zaire) with emphasis on major endemic diseases (Schistosomiasis, Onchocerciasis, Trypanosomiasis and Malaria).

B. Health Sector Assessments in the Lake Chad and Niger River Basin Areas."

"The majority of the technical services will be provided in Africa, in multidisciplinary team settings and consisting of varying mixes of categories of health professionals. The location, timing and composition of the teams will be along the following general lines and will under all circumstances be initiated with the Contracting Officer's prior written approval."

Modification #4 dated April 5, 1976 to the contract, deleted in its entirety paragraph A quoted above and substituted in lieu the following:

A. "Environmental Health Assessments in the Major Basin area (Lake Chad, Niger River, and Senegal plus Liberia, Swaziland, and Zaire and <u>such other African countries as required by program development needs and subject for availability of funds)</u> with emphasis on major endemic diseases (Schistosomiasis, Onchocerciasis, Trypanosomiasis and Malaria)".

The underlined clauses in the Modification broadened the geographic coverage and focused the activities on current rather than projected developmental needs of the LDC's and the USAID Missions in Africa.

Under the approved Project Plans, Epidemiological and Environmental Assessment Studies were undertaken in the following project sites:

Project Area I - Liberia - Lofa and Bong Counties.

Project Area II - Swaziland - Studies expanded to include all of Swaziland not just Middle and Lower Veld.

Project Area III(a) - Chad - Northern (Sazid) Zone Chad Basin - Bol - N'Djamena area. At the request of USAID/Chad, Moussoro area deleted. Diffa Department (Zinder), Niger deleted by USAID/Niger and host government.

Project Area III(b) - Chad - Southern (Lovid) Zone Chad Basin - Bongor - Logone Valley. Moundou deleted at request of USAID/Chad. Marova, Logone - Chari Department - Cameroon deleted at request of USAID/Chad.

Health Sector Studies which included limited environmental assessments were conducted in Niger and Upper Volta in Project Area IV(b).

In Niger at the specific request of the host government, a three man team undertook a health sector assessment in support of a pending Health Sector Grant to the Nigerian government.

The combined Health Sector and Environmental/Epidemiological assessment team planned, recruited, and organized for the Upper Volta studies was reconstituted to deal solely with health sector assessments at the request of the USAID and the Upper Volta Government.

Studies in Project Area IV(a) - Upper Niger Basin - Mali; Mopti Seg and GOA scheduled for April and May were postponed until July and then cancelled by the USAID Regional Development Officer in Niger on June 24, 1977. The studies to be undertaken during the month of August by the team, recruited and organized for the Benin sector of the Niger Basin, were not made due to termination of the contract prior to completion.

Not included in the Project Plan but undertaken at the specific request of the Bureau for Africa were environmental and epidemiological assessment studies in two additional project areas and epidemiological studies in one project site. These were:-

Project Area V(a) - Senegal River Delta - Environmental Health Assessment of impact of Perimeter Construction and Irrigation at sites Lampsar and Diagambal north of Saint Louis.

Project Area V(b) - Senegal and Faleme Rivers Basins - Environmental Health Assessment of impact in expansion of existing perimeter farming in Bakel area by irrigated crop production in areas previously characterized by dry land and recession farming.

Project Area VI(a) - Sudan-Northern and Southern Kordofan, Darfur, Blue Nile, Gazera, Eastern and Western Equatoria, Lakes and Jangler Provinces. Identification of the health problems in geographical locality identified as a prospective site for agricultural projects, assess potential health impact and project preventive measures required to minimize negative impacts if any.

Project Area VI(b) - Sudan - Nationwide Health Sector Assessment. Health sector assessments in the area of Environmental Health and Endemic Vector borne diseases.

Project Area VII - Zaire - Equateur Region - Determination of prevalence and manifestations of Onchocerciasis, related filarial infections in specific population segments and potential alternates in reducing incidence and prevalence rates.

Within the restraints of time, national boundries and revisions in scope of work and in country sites by USAID Missions and host governments, eleven consultation teams executed the specified tasks as set forth under sections A and B of Appendix A of the contract.

of the Literature Review.

The resulting product is a reference tool, suitable for publication which both provide information and identifies readily information gaps regarding five major endemic diseases in specific African countries and hence potential areas of needed future field studies and research.

Recommendations for Future Study

The accomplishments of the project staff and participating consultants during the limited period of these epidemiological and environmental studies have demonstrated:

1) the feasibility of assembling in a organized readily usuable and replicable manner current existing pertinent information on specific disease entities in specific geographical areas;
2) the research potential inherent in producing and maintaining a reference tool, namely Volume II of the studies which identifies information gaps and definitive areas of needed in field and laboratory research on disease entities which depress the health status and quality of life of rural populations worldwide;
3) the value of planning, developing the methodology and facilities and executing short term field studies designed to complete the epidemiological and environmental health profile of varying size geographical areas and population segments.

It is recommended that AID recognize the present and future potential of the products of this very limited project and provide for the continuation of the contracts which have made them possible.

The accomplishment included eleven detailed team reports updating prior data and providing new data on the incidence and prevalence of the five major endemic diseases - Schistosomiasis, Onchocerciasis, Filariasis, Trypanosomiasis, and Malaria in populations residing in the geographical areas the teams were permitted to study. From-on site field studies and in depth literature search, these team reports contain projected disease profiles for seven countries or major political segments of same, which included all significant transmissable disease entities. The data completed and prepared by the teams were the basis for environmental health impact assessments for seven agricultural developmental projects, one water resources development project and for recommended alternatives to reduce or eliminate potential negative health impact phenomena.

Team reports updated the health infrastructure in Niger, Upper Volta, Senegal, Swaziland and the Sudan. Team members collected and provided supporting data and technical consultation in the preparation of three Project Papers - Swaziland, Sudan and Niger.

Evolving out of the studies are the methodology and material resources necessary for undertaking on site studies of the incidence and prevalence of vector-borne environmental disease entities in human and animal hosts in remote geographical sites.

In the course of the study the staff invented, developed, and utilized a Matrix Format for the indexing and presentation of information on major endemic diseases by geographical area. It has also produced comprehensive and annotated literature reviews involving a wide variety of sources of information on the geographical distribution, etiology, transmission, epidemiology, treatment, prophylaxis, and preventive and protective control measures for schistosomiasis, onchocerciasis, malaria, trypanosomiasis and filariasis in humans in Benin, Cameroon, Chad, Liberia, Mali, Niger, Senegal, Swaziland, Upper Volta and Zaire.

Such a task required the collection and assession of an estimated 2,000 scientific papers containing information selected and utilized in the preparation