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ENVIRONMENTAL ASSESSMENT

APPENDICES

CHAD EXPORT PROJECT
CAMEROON PORTION

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CHAD EXPORT PROJECT

This Environmental Assessment of the Chad Export Project is being made available for public review in Chad and Cameroon, and through the World Bank Public Information Center in Washington, D.C., United States of America.

Written comments can be directed to the following:

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APPENDIX A

- **World Bank Environment, Health and Safety Guidelines, Onshore Oil and Gas Development**

- **Typical Oil Spill Response Plan Content**

- **Biological Diversity**

WORLD BANK

ENVIRONMENT, HEALTH AND SAFETY GUIDELINES

ONSHORE OIL AND GAS DEVELOPMENT

WORLD BANK ENVIRONMENT, HEALTH AND SAFETY GUIDELINES[1]

ONSHORE OIL AND GAS DEVELOPMENT

LIQUID EFFLUENTS

Process wastewater, domestic sewage and contaminated stormwater should be treated to meet the following specified limits before being discharged to surface waters:

pH	6 to 9
BOD_5	50 mg/ℓ
Oil and Grease	20 mg/ℓ
Heavy Metals, Total (except Barium)	10 mg/ℓ
Phenolic Compounds	100 mg/ℓ
Total Suspended Solids	50 mg/ℓ
Coliforms	Less than 400 MPN/100 ml (MPN - Most Probable Number)
Temperature - at the edge of a designated mixing zone	Max 5° C above ambient temperature of receiving waters - max 3° C if receiving waters >28° C

AMBIENT AIR

Concentrations of contaminants, measured outside the project property boundary, should not exceed the following limits:

Particulate Matter (<10 µm)	
Annual Arithmetic Mean	100 $\mu g/m^3$
Maximum 24-hour Average	500 $\mu g/m^3$
Nitrogen Oxides, as NO_2	
Annual Arithmetic Mean	100 $\mu g/m^3$
Maximum 24-hour Average	200 $\mu g/m^3$
Sulfur Dioxide	
Annual Arithmetic Mean	100 $\mu g/m^3$
Maximum 24-hour Average	500 $\mu g/m^3$

STACK EMISSIONS

Particulate Matter	100 mg/m^3
Sulfur Dioxide	100 TPD
Nitrogen Oxides, as NO_2	
Gaseous fossil fuel	90 g/million BTU of heat input
Liquid fossil fuel	135 g/million BTU of heat input

[1] Source: The World Bank policies and guidelines, supplemented with information from OECD sources and the proposed revisions to the World Bank guidelines.

OTHER GENERAL ENVIRONMENTAL REQUIREMENTS

a) Monitors for hydrogen sulfide must be installed wherever this gas may accumulate. The monitors should be set to activate warning signals whenever detected concentration levels of H_2S exceed 7 mg/m^3 (5 ppm).
b) An assessment of oil spill risks must be conducted, and an oil spill contingency plan must be developed and implemented.

ENVIRONMENTAL GUIDELINES SPECIFIC TO OIL PIPELINES

a) Positive pipe corrosion control measures
b) Program of periodic inspection and maintenance
c) Pressure sensors connected to alarms and automatic pump shutdown systems.
d) Metering system should provide continuous input/output comparison for leak detection.
e) Adequate engineering design providing adequate protection from likely external physical forces
f) Accurate and complete records of all inspections, leak incidents, unusual events, and safety measures taken
g) Minimization of disturbance to natural vegetation, soils, hydrological regimes, and topography
h) Positive measures to control population influx to remote areas due to increased access created by the pipeline right-of-way, and to prevent associated secondary impacts (e.g., encroachment on traditional indigenous population lands or preserves; uncontrolled exploitation of natural resources)

WORKPLACE AIR QUALITY

a) Periodic monitoring of workplace air quality should be conducted for air contaminants relevant to employee tasks and the plant's operations.
b) Ventilation, air contaminant control equipment, protective respiratory equipment and air quality monitoring equipment should be well maintained.
c) Protective respiratory equipment must be used by employees when the exposure levels for welding fumes, solvents and other materials present in the workplace exceed local or internationally accepted standards, or the following threshold limit values (TLVs):

Carbon Monoxide	29 mg/m^3
Hydrogen Sulfide	14 mg/m^3
Nitrogen Dioxide	5 mg/m^3
Sulfur Dioxide	5 mg/m^3

e) Monitors should be installed which activate an audible alarm when toxic gas concentrations exceed 1/2 the above threshold limit values.

WORKPLACE NOISE

a) Feasible administrative and engineering controls, including sound-insulated equipment and control rooms should be employed to reduce the average noise level in normal work areas.
b) Plant equipment should be well maintained to minimize noise levels.
c) Personnel must use hearing protection when exposed to noise levels above 85 dBA.

WORK IN CONFINED SPACES

a) Prior to entry and occupancy, all confined spaces (e.g., tanks, sumps, vessels, sewers, excavations) must be tested for the presence of toxic, flammable and explosive gases or vapors, and for the lack of oxygen.
b) Adequate ventilation must be provided before entry and during occupancy of these spaces.
c) Personnel must use air-supplied respirators when working in confined spaces which may become contaminated or deficient in oxygen during the period of occupancy.
d) Observers/assistants must be stationed outside of confined spaces to provide emergency assistance, if necessary, to personnel working inside these areas.

HAZARDOUS MATERIAL HANDLING AND STORAGE

a) All hazardous (reactive, flammable, radioactive, corrosive and toxic) materials must be stored in clearly labeled containers or vessels.
b) Storage and handling of hazardous materials must be in accordance with local regulations, and appropriate to their hazard characteristics.
c) Fire prevention systems and secondary containment should be provided for storage facilities, where necessary or required by regulation, to prevent fires or the release of hazardous materials to the environment.

HEALTH - GENERAL

a) Sanitary facilities should be well equipped with supplies (e.g., protective creams) and employees should be encouraged to wash frequently, particularly those exposed to dust, chemicals or pathogens.
b) Ventilation systems should be provided to control work area temperatures and humidity.
c) Personnel required to work in areas of high temperature and/or high humidity should be allowed to take frequent breaks away from these areas.
d) Pre-employment and periodic medical examinations should be conducted for all personnel, and specific surveillance programs instituted for personnel potentially exposed to toxic or radioactive substances.

SAFETY - GENERAL

a) Shield guards or guard railings should be installed at all belts, pulleys, gears and other moving parts.
b) Elevated platforms and walkways, and stairways and ramps should be equipped with handrails, toeboards and non-slip surfaces.
c) Electrical equipment should be grounded, well insulated and conform with applicable codes.
d) Personnel should use special footwear, masks and clothing for work in areas with high dust levels or contaminated with hazardous materials.
e) For work near molten or high temperature materials, employees should be provided with non-slip footwear, gloves, safety glasses, helmets, face protection, leggings and other necessary protective equipment.
f) Eye protection should be worn by personnel when in areas where there is a risk of flying chips or sparks, or where intense light is generated.
g) Personnel should wear protective clothing and goggles when in areas where corrosive materials are stored or processed.
h) Emergency eyewash and showers should be installed in areas containing corrosive materials.
i) A safety program should be established for construction and maintenance work.
j) A fire prevention and fire safety program should be implemented and include regular drills.

TRAINING

a) Employees should be trained on the hazards, precautions and procedures for the safe storage, handling and use of all potentially harmful materials relevant to each employee's task and work area.
b) Training should incorporate information from the Material Safety Data Sheets (MSDSs) for potentially harmful materials.
c) Personnel should be trained in environmental, health and safety matters including accident prevention, safe lifting practices, the use of MSDSs, safe chemical handling practices, and proper control and maintenance of equipment and facilities.
d) Training also should include emergency response, including the location and proper use of emergency equipment, use of personal protective equipment, procedures for raising the alarm and notifying emergency response teams, and proper response actions for each foreseeable emergency situation.

RECORDKEEPING AND REPORTING

a) The sponsor should maintain records of significant environmental matters, including monitoring data, accidents and occupational illnesses, and spills, fires and other emergencies.

b) This information should be reviewed and evaluated to improve the effectiveness of the environmental, health and safety program.
c) An annual summary of the above information should be provided to IFC.

[illegible]
May 31, 1995

TYPICAL OIL SPILL RESPONSE PLAN CONTENT

OIL SPILL RESPONSE PLAN CONTENT

PART I: EMERGENCY RESPONSE ACTION PLAN

1.0 OVERVIEW

Part I contains information to assist in responding to a spill resulting from the Chad Export Project. It is arranged in a logical format so response actions are not delayed and responders have the information needed to contain, recover, and dispose of the oil. This part also contains references to additional sources of information that will be included in Part II and the Appendices of the document.

Part I contains information on the following issues:

- Initial Response Actions
- Evacuation Plan
- Communication Plan
- Oil Spill Response Organization
- Incident Checklists
- Forms (to be completed during or after a spill response).

2.0 INITIAL RESPONSE ACTIONS

2.1 INCIDENT ASSESSMENT

This section will provide guidance for performing an initial incident assessment to assist in determining the level of response required.

2.2 NOTIFICATION PROCEDURES

Defines procedures for notification to be used in the event of a spill. Parties to be notified will include Esso management and response teams, local and national government agencies, locally potentially affected communities, and other countries which may be affected. Depending on the nature of the spill, cooperative and mutual aid spill response organizations may also be notified.

2.3 EMERGENCY CONTACT NUMBERS

Provides a list of emergency contact phone numbers for all three tiers of oil spill response team members, local community and government contacts, company management, local affiliate/ industry operators, and regional and worldwide industry cooperative organizations.

3.0 EVACUATION PLAN

Defines the procedures for evacuating company personnel or the area communities. The Evacuation Plan provides evacuation procedures and identifies potential muster areas.

4.0 COMMUNICATION PLAN

Defines requirements for the response organization's internal communications, including equipment to be used, radio frequencies, etc. This could include specifications for all manners of response vessels (boats, land vehicles, aircraft).

5.0 OIL SPILL RESPONSE ORGANIZATION

Defines the structure for oil spill response organization, responsibilities and job descriptions, and the person(s) responsible for each job description. This could include defining changes in the structure for the different level of three-tiered response system, as well as changes in the structure between the initial response (first few days) and a longer-term response.

6.0 INCIDENT CHECKLISTS

Provides checklists to assist personnel described in Section 5.0.

7.0 FORMS

Provides blank copies of forms to be completed by responders to document response actions and assist in communicating with internal and external interested parties, such as company management, local communities, and local government officials.

PART II: SUPPLEMENTAL INFORMATION

1.0 ADMINISTRATION

1.1 SCOPE

The Oil Spill Response Plan will be developed to serve as a tool for establishing a response framework in the event of an oil spill. Preparation for an oil spill is the key to efficient implementation of response containment actions. The goal of the Plan is to provide general guidance and resource information for conducting oil spill response operations.

1.2 OBJECTIVES

The primary objectives of the Oil Spill Response Plan are to:

- Prepare personnel with training and drills
- Ensure an effective, comprehensive response
- Define notification procedures to be followed when a spill or the threat of one occurs
- Document equipment, personnel, and other resources available to assist with spill response
- Establish a response team and define the roles and responsibilities of team members
- Define lines of responsibility to be adhered to during a response
- Outline procedures and techniques for responding to a spill (including most credible event scenarios)
- Satisfy Environmental, Health and Safety Policies to protect employees, local communities, and the environment.

1.3 PROJECT AND SITE DESCRIPTION

Provides a general description of the operations, environment, and local community activities.

1.4 PLAN DISTRIBUTION

Provides a list of Plan holders and their location.

2.0 GENERAL FACILITY INFORMATION

Provides a detailed description of each facility, product properties, quantity of oil transported and stored, prevention activities, maps, and access roads.

3.0 INCIDENT MANAGEMENT SYSTEM

Provides an explanation of the management system that will be used to respond to an incident.

The incident management system includes a response organization that can perform the functions dictated by the incident and provides rapid, continuous access to accurate, up-to-date information. The incident management system establishes communication procedures from the field to senior management, government agencies, and the local communities. It enables the response organization to establish priorities based upon a realistic appraisal of personnel requirements and equipment resources.

4.0 RESOURCES

Defines quantity and types of response equipment required to be stored at specific locations or made available through cooperative efforts.

5.0 SITE SPECIFIC RESPONSE STRATEGIES

5.1 SENSITIVE ENVIRONMENTAL, SOCIAL, AND CULTURAL RESOURCES

Information on sensitive environmental, social, and cultural resources will be collected and clearly identified in the plan.

5.2 OIL SPILL RISK ASSESSMENT

Defines potential most-credible and most-likely spills.

5.3 SPILL RESPONSE STRATEGIES

5.3.1 Land Spills

Includes information on spill detection, response considerations, and methods for responding to a land spill which may include manual containment and cleanup, heavy equipment use, mechanical clean-up options or in-situ bioremediation.

5.3.2 River Spills

Includes information on spill detection, response considerations, and methods for responding to a river spill which may include boom deployment options, containment strategies, mechanical clean-up methods, or in-situ burning and dispersant use.

5.3.3 Open Water Spills

Includes information on spill detection, response considerations, and methods for responding to an open water spill which may include boom deployment options, containment strategies, mechanical clean-up methods, or in-situ burning and dispersant use.

6.0 WILDLIFE RESCUE AND REHABILITATION

Identifies agencies that can be used for wildlife rescue and rehabilitation. Although every spill is different, certain facilities that could be used for such efforts can be identified in advance and listed.

7.0 WASTE DISPOSAL

Defines methods that would be used to store, transport, and dispose of recovered oily waste.

8.0 TRAINING AND DRILLS

Defines drill and training requirements for spill response personnel, including frequency drills/training, content of training, nature of drills, etc. Training will address personnel health and safety issues in addition to oil spill response operations.

9.0 HEALTH AND SAFETY

Defines procedures and equipment required for working personnel.

10.0 SECURITY

Defines security procedures and personnel requirements for establishing and maintaining site security.

11.0 TERMS AND ABBREVIATIONS

APPENDICES

Appendices could include additional information on sensitive environments and wildlife resources, communities, available support infrastructure in the area, typical climatological and oceanographic conditions, etc.

BIOLOGICAL DIVERSITY

BIOLOGICAL DIVERSITY

Introduction

The concept of biological diversity has become recognized as an important guide to the existing status of a habitat, community or region. Biological diversity has been defined as "the variety and variability of life and its processes in an area" (U.S. Congress, 1987). The biological diversity of an ecosystem can easily encompass thousands of species, their genetic composition, the assemblages of plants and animals that are recognized as distinct communities, and countless evolutionary and ecological processes and pathways through which species interact. Plant and animal species do not exist independently, but are instead a part of a multi-scaled web of associations encompassing several levels - from molecular structures to entire landscapes. It is important to comprehend each level, and its relationship to others, in order to understand biodiversity and its implications in light of development.

Species Diversity refers to the number or variety of plant and animal species and their abundance. The term includes both the number of species and the evenness of abundance among species. The number of species in a region (i.e., its species "richness") is one measurement used, though a more precise measurement, "taxonomic diversity," also considers the relationship of species to each other. A community with a fairly even distribution of individuals among species is considered more diverse than another community with an equal number of species, some of which are very common and others rare. Some species are particularly important to biodiversity because many other species depend on them directly or indirectly (= keystone species). Loss of these keystone species that play pivotal ecological roles in a community may change the nature of a natural system considerably and result in many secondary extinctions.

Ecosystem Diversity relates to geographically mappable units composed of commonly associated flora and fauna. In the context of the proposed project, ecosystems are distinguished by assemblages of vegetation types, also referred to as communities or habitats. These ecosystems or habitats are defined according to the species that use them and include both physical substrates and successional stages of plant communities. Because an ecosystem encompasses many species and their inherent genetic variability, loss of ecosystem diversity may result in loss of diversity at other levels as well.

Ecological and evolutionary processes affecting biological diversity include interactions within and between species (e.g., predation, competition, pollination, parasitism), natural disturbances (fire, drought, storms), and nutrient cycles (weathering, decay, nutrient uptake by plants). Evolutionary processes such as mutation, gene flow, geographic

isolation, and hybridization must be maintained at rates characteristic of the natural ecological system to preserve existing and future biological diversity.

The Reduction or Loss of Biological Diversity

Tropical forests and savannas, by nature of their composition and dynamics, are particularly vulnerable to the loss of, damage to, or fragmentation of habitat resulting from human disturbance. Forests are particularly diverse and thus prone to multiple extinctions, and many forest species are specialized, interrelated, and consequently intolerant of general disturbance.

With the loss or alteration of a habitat, its capacity to sustain animal or plant populations is modified. Species dependent on intact habitat are the first affected, either from a direct loss of individuals or of essential resources required for the maintenance of local populations. Even if some members of affected populations survive by moving to adjacent intact habitat, they face increased competition with others of their own species. Consequently, they may suffer a loss of fitness or early mortality from an inability to garner sufficient resources to sustain reproduction. As the sizes of local populations decline, demographic factors that affect small populations also become more important. Population sizes tend to fluctuate more widely due to random processes (e.g., climatic variation, disease, floods, storms, drought, fire) that influence natural birth and death rates.

Habitat Loss and Fragmentation

A fragment is defined as a detached, isolated, or incomplete part broken away from a whole. Habitat fragmentation is, therefore, the subdivision of a certain habitat into several isolated patches. The primary impact of habitat fragmentation is the loss of habitat continuity (i.e., insularization). This is because it is possible to reduce habitat size without disturbing its continuity; that is, habitat loss *per se*. Nevertheless, habitat loss is an important byproduct of fragmentation and vice versa.

Fragmentation inevitably implies a reduction of the total area of one habitat and a simultaneous increase in the areas of others. Consequently, it results in a biased sampling of the landscape mosaic, such that fragments will primarily represent only one, or at most, a few of the regionally available habitat elements.

Habitat fragmentation is a complex process involving many interrelated components, including fragment size, habitat heterogeneity (e.g., microclimate, vegetation structure, etc.) within fragments, surrounding habitat (mosaic), and edge effects. For the following discussion, habitat fragmentation will be used as a collective term to describe a wide range of habitat alterations, all of which are consequences of the initial subdivision of a continuous habitat.

Habitat fragmentation leads, over a range of time scales, to a variety of effects, both physical and biotic. Migration and dispersal patterns are disrupted, population sizes and gene pools are reduced, nutrient and energy inputs and outputs can be altered by the modification of adjacent areas, exotic species gain access to a previously insulated habitat, the creation of edges modifies the physical microenvironment. In forests, this can lead to accelerated tree mortality and the penetration of nonforest species into forest habitat.

Habitat fragments may initially contain plant or animal species that require missing habitats on a seasonal basis, or that are able to reproduce at levels above the replacement rate, only in habitats that no longer exist. Consequently, a general loss or fragmentation of sensitive natural habitats will directly affect species abundance and diversity, population size, structure, and distribution, reproduction and survival, and ecosystem structure and function.

Habitat loss reduces biological diversity by direct elimination of locally adapted populations of plants and animals. Habitat fragmentation affects populations in several different ways. Subdivision of a continuous habitat increases insularization and reduces total area. This influences dispersal and population size directly by reducing immigration rate and increasing the extinction rate. A reduced fragment area and its changed configuration affect habitat composition within fragments, between the fragment interior and its edges, and in relation to surrounding habitats. These effects influence mortality and production through increased pressures from the surroundings, both biotic (e.g., predators, competitors, parasites) and abiotic (e.g., temperature, wind, light).

Scale is crucial to the issue of fragmentation. A fragment of a given size may provide perfectly well for one species and be wholly insufficient for another. There are macroscopic animals whose spatial requirements vary by orders of magnitude. Some invertebrates are capable of carrying out their entire life cycles within the space occupied by one tree, while others involved in complex dependencies and mutualisms might need as much as 10 hectares to meet all their requirements on a long-term basis. On the other end of the spectrum are highly mobile bird and mammals that function as top predators or seed dispersers and need thousands of hectares to maintain breeding populations, but whose loss from smaller patches may have serious consequences for the persistence of many other species with far more modest spatial requirements. Current evidence suggests that species with the largest spatial requirements play indispensable roles in the long-term maintenance of diversity.

A local population may eventually become extinct if the size of a habitat fragment decreases below a threshold value, set by the minimum territory size requirements of a species. The effective population size of such species may then fall below the threshold of genetic viability or below some minimum size needed for recovery. This "effective population number" considers the relation between the effective number of reproducing individuals and the loss

of genetic variation over time in populations of various sizes and demographics. The smaller the population and faster the turnover of generations, the quicker inbreeding may occur and genetic variation be lost. Genetic variation provides for continual adaptation of a species to changing environmental conditions and the production of offspring that can persist in the face of new environments, new competitors, and new predators.

Fragmentation can affect the genetic diversity of and within species by its influence on the evolutionary processes of extinction, selection, genetic drift, gene flow, and mutation. Even if the level of diversity does not change, mating systems can be altered, which can affect the genetic structure of populations. Demographic changes influence survival by increasing the incidence of disease and introducing exotic pathogens, insects, mammalian herbivores, domestic predators, and competing vegetation, all of which have documented effects on genetic diversity, reducing the diversity of and within species.

Plants and animals confined to fragmented areas, therefore, have to cope with two basic problems: (1) whether the remaining fragments are large enough and close enough to each other to provide living space and opportunities for dispersal, and (2) the impact of the surroundings (the external threat). Man-made habitats support predators (e.g., dogs and cats), competitors (e.g., cattle, goats, pigs), parasites, and diseases which can spread into the fragments and interact with their residents.

Forest Fragmentation

The biological and physical effects of forest fragmentation are still poorly understood. Certain changes are easy to predict, at least qualitatively. Population sizes will be reduced, which may have deleterious genetic consequences. Because most species' distributions are not homogenous, some species will be absent from certain fragments simply because they were not in the patches of forest before the fragments were isolated. Species requiring large home ranges (e.g., monkeys, large predators) will not survive in small fragments. Microclimate may change within fragments, especially along the edges, and local macroclimatic patterns may also be altered.

Forest fragmentation also creates non-forest habitat, which may increase the carrying capacity for generalist predators, open-field competitors, or parasites that may interact with species from the interior of the forest. A significant threshold probably appears when the amount of forest habitat decreases below 50 percent, i.e., when forest habitat shifts from a habitat mosaic to fragments. Forests become fragmented and may become transient habitat for specialist species from the interior of the forest, while non-forest habitat becomes continuous and becomes a more permanent habitat for generalist species.

Deforestation inevitably results in fragmentation of forests that are already disappearing in the face of regional development and colonization. Consequently, islands of forest are left

amidst a "sea" of non-forest habitat. Understanding the implications of forest fragmentation is essential to land use planning if development is to proceed with minimal disturbance to the natural ecosystem. Questions that need to be addressed include the following:

How great a distance of separation from continuous forest effectively isolates a forest fragment? Studies have indicated that a break of as little as 80 m is a strong barrier to movement to an isolated forest fragment by some insects and mammals and the vast majority of understory birds. When interpreting the consequences of forest fragmentation, it becomes crucial to take into account the scale. On a local scale, individuals and the minimum area requirement for territories is the key issue. On a regional scale, a continuous population may retreat to less fragmented parts of a region and become patchily distributed. At a certain point, movement between populations in fragments is prevented by one or more hostile intervening habitats, which in turn results in complete loss and isolation of local populations. If the isolating process continues, the population could become extinct.

What is the effect of fragment size on the degree to which the forest community is preserved? The MacArthur and Wilson model of Island Biogeography (1963) predicts that small forest remnants will support smaller populations and fewer species than larger ones. Studies of insects, birds, and mammals in forest reserves of varying sizes indicate that the number of species, and in some cases population sizes, in these groups varies with the size of the forest fragment. As forest is felled around a remnant patch, individual animal numbers and activity within the newly isolated forest fragments may increase for a period of time before population sizes drop to below pre-isolation values. The rate and extent of this faunal collapse seems to be greater in smaller forest remnants than in larger ones and the extent of alteration of faunal community structure appears to be more drastic the smaller the forest fragment.

What is the role of edge effects? By definition, the periphery of a forest fragment is an "edge" between forest and non-forest habitat. Changes that occur along these edges may affect both form and function of the isolated ecosystem. Increased sunlight and wind penetration along a newly formed forest edge can be expected to change temperature and relative humidity in the remnant forest patch and structural damage is likely to occur when storms buffet trees along a forest edge. Changes in vegetation structure caused by edge-related tree mortality are likely the major cause of increasing complexity of microenvironmental climatic gradients in remnant forest patches.

How important is the vegetation surrounding a forest fragment? Vegetation surrounding a forest fragment is dynamic, changing with natural succession and maintenance of agricultural (and/or urban) land uses, and is not necessarily hospitable to many of the organisms in the remnant forest patch. Whereas community structure of

primates, understory birds, and some insects seems strongly affected by patch size, small mobile mammals and some butterflies are apparently more sensitive to the vegetation structure around the forest fragments than to the size of the fragment itself. Where population sizes and species numbers of understory birds tends to decline as fragment size decreases, species richness, biomass, and abundance of most small mammal species tend to be greater in smaller patches. In addition, the communities in fragments show a shift in the vertical distribution of mammalian biomass. In continuous forest, arboreal biomass tends to be slightly greater than terrestrial, whereas the reverse is true in fragments, mainly due to the development of a denser understory component at or near the edges of the fragment. Insect abundance also tends to be greater in the understory of forest fragments, where foliage density is higher than in continuous forest.

What indirect effects of fragmentation can affect forest populations? Indirect effects refer to the propagation of disturbances through one or more trophic (i.e., food chain) levels in an ecosystem, so that effects are felt in organisms that may seem far removed, both ecologically and taxonomically, from the subjects of the disturbance. The role of predators in regulating relative and absolute abundances of their prey species is an elementary type of indirect effect. More recently, ecologists have discovered a process called "apparent competition," in which an inverse density relationship between two prey species is mediated, not by the exploitation of a common pool of resources, but by the intervention of a selective predator. Other researchers have found that, while species may compete on a year-to-year basis through their sharing of a common pool of resources, they engage over the longer term in a type of "indirect mutualism," where a balance in the species' respective resource requirements is maintained to mutually assure each other's food supply.

In summary then, it becomes clear that distortions of any link in the chain of interaction in ecosystems such as tropical forests will induce changes in the remaining links. So long as disturbances are mild and of short duration, the system can probably recover, although the time needed for recovery may have to be measured in tree generations. However, when there is a complete loss of any one of the links, the whole system could fall out of balance with consequent repercussions for both plant and animal communities. By far the most vulnerable link is that represented by top carnivores. Where these have been extirpated, it may be impractical to reintroduce them, and once they are gone, it may be impossible to reverse the chain reaction leading to loss of diversity.

APPENDIX B

HUMAN ENVIRONMENT

THE CHAD EXPORT PROJECT

SOCIOECONOMIC AND CULTURAL SURVEY IN THE PROJECT AREA

BY MUNEERA SALEM-MURDOCK

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I. INTRODUCTION

Often referred to as Africa in miniature, Cameroon is climatically, agroecologically, topographically, culturally, linguistically, and ethnically an extremely diversified country of about 475,000 km² with a population of about 13 million. Stretching from the Gulf of Guinea in the Atlantic Ocean to Lake Chad in the North, it borders with six countries: Chad, the Central African Republic (CAR), Congo, Gabon, Equatorial Guinea, and Nigeria. Although most of the country is populated sparsely, an annual population growth rate of 3.1 percent is becoming increasingly a critical factor in land tenure, land use, and rural-urban migration, especially of young men.

After a period of rapid economic growth from 1977 to 1985, based principally on oil production, Cameroon has experienced an economic crisis due primarily to falling oil, coffee, cocoa, cotton, rubber, and palm oil revenues. According to USAID's FY 1990-94 *Country Development Strategy Statement* (April 1989):

The impact of oil/cocoa/coffee price declines caused the gross domestic product to drop by an average annual rate of 5.5 percent in current values and by almost 4 percent in constant values during the period 1984/85 to 1987/88. The bulk of this reduction was on account of the oil sector whose value added declined at current prices from 19.6 percent of GDP in 1984/85 to 7.0 percent of GDP in 1987/88 (p. 5).

The general decrease in revenues led to a 22 percent decline in per capita income (World Bank 1991). The situation worsened with the 1991 devaluation of the FCFA.

A. Project Description

Based on projections of approximately 929 million barrels (MB) of reserves, the proposed project aims at the extraction of oil from three main fields in Southern Chad (Komé, Bolobo, and Miandoum) and the transportation of the crude through an approximate 1,050 kilometer (km) buried trunk export pipeline (150 km in Southern Chad and 900 km in Cameroon) to a floating storage and offloading vessel (FSO) in the Gulf of Guinea in the Atlantic Ocean. The movement of the crude through the pipe will be facilitated by an originating pump station in Chad, three intermediate pump stations in Cameroon, and a pressure reduction station on the Cameroon coast.

B. The Task at Hand

Although the commercial extraction of oil from the Doba Basin in Chad and the profitable export of the extracted crude to international markets is the ultimate objective of the proposed project, the Consortium aspires to ascertain that its business operation will be carried out in a manner that is "compatible with the balanced environmental and socioeconomic needs of the people of Chad and Cameroon" (Dames & Moore 1995:1). In other words, the "[p]rotection of the physical, biological, and socioeconomic environment is a key objective of the project. The location, construction, and operation of the pipeline and other project facilities will consider regional biodiversity, important ecosystems, protected areas, sensitive species and habitats, and local socioeconomic and land use issues" (ibid.).

C. Issues Addressed

It was in this vein and in accordance with the World Bank's "Social and Cultural Issues in Environmental Review" (World Bank 1989) that the terms of reference for the socioeconomic component of the environmental assessment (EA) were defined. Guided by the World Bank's statement, "Social assessment for EA purposes focuses on how various groups of people affected by a project allocate, regulate and defend access to the environmental resources upon which they depend for their livelihood" (ibid.: 108) as applicable in the context of the Republic of Cameroon, the socioeconomic team for Cameroon resolved to consider the following issues:

- Variation within communities: this included ethnic, tribal, cultural, and linguistic variation; occupational differentiation; socioeconomic stratification; age and gender differentiation; local institutions; and tribal people.

- Settlement and resettlement whether forced, voluntary/involuntary, or voluntary.

- Differential access to and control over productive resources.

- Variations among and within production systems.

The ultimate objective of the exercise is a sound assessment of the potential negative and positive impacts of the proposed project, both direct and indirect, on the local population and mitigation measures for negative impacts.

II. METHODOLOGY

A. Project Area

For field research purposes the study area is defined as that area along the proposed pipeline which extends from southeast of the town of Touboro in the Département of Mayo Rey in the North Province and continues in a southwest direction until a point below the town of Kribi, Département of Océan in the South Province. Administratively, the area corresponds roughly to the Départements of Mayo Rey in the North Province, Mbéré in the Adamawa Province, Lom and Djérem in the East Province, Haute Sanaga, Mefou, and Nyong and Mfoumou in the Central Province, and Océan in the South Province. Spanning over 900 km, the pipeline area is differentiated extremely by climate and rainfall patterns, production systems and strategies, ethnicity, languages, culture, and religion. The tremendous complexity of this proposed project is due only partially to the length of the pipeline corridor. An efficient way of exposing this complexity might be a glance at the four major proposed project areas/activities in the Republic of Cameroon:

- **The export pipeline area**: "defined broadly as the corridor between Komé (Chad) and Kribi (Cameroon) in which the preferred pipeline alignment will be located" (Dames & Moore 1995:5-2). For data collection purposes, the study area was defined as 15-20 km each side of the 50 meter (m) right-of-way within the identified corridor.

- **Pump stations and ancillary facilities**: three intermediate pump stations, which "will contain main line pump units, electric power generation facilities, a central control room, and ancillary facilities to support pump station operations" (ibid.: 2-2). The ancillary facilities will include "heliport or airstrip, communications facilities, parts storage, fuel treatment, storage" (ibid.).

- **Land use changes**: the enhanced associated infrastructure such as port facilities, bridges, railroads, and roads for the movement of approximately 500,000 tons of material over a period of four or more years at the rate of 800 tons per day in the peak period, is likely to change the nature of real and perceived opportunities in the area and consequently allocation of resources and labor strategies. For example, improved feeder roads and farm to market roads are likely to augment the value of agricultural land within a certain distance from the road. Who is using these lands now? Are the persons with present use rights the same as those with land allocation- redistribution rights when the value of land changes? If the present users belong to particularly vulnerable groups (women, ethnic strangers, etc.), what will the likely change in degree of access mean and how will this change affect their ability to meet their daily needs?

- **Labor migration**: another consequence (this is also true of pipeline construction) is the likely arrival of large numbers of strangers in search of jobs. Undoubtedly, this will have a host of direct and indirect socioeconomic, health, nutritional, and other implications.

Particular attention has been paid to the road between Ngaoundéré (Cameroon) and Komé (Chad) via Touboro (Cameroon) and Baibokoum (Chad), which the Consortium, in collaboration with the European Development Fund (EDF), is considering blacktopping and which will have an estimated peak of 70 truck movements each way, per day.

- **Marine terminal facilities** in the Kribi area.

B. Survey Site Selection

A main objective of the socioeconomic field research component of the proposed project has been a sound understanding of the potential impact of the pipeline and other project components on the socioeconomy and ecology of the study area. The selection of specific field sites was driven by the vastness of the proposed project area (pipeline, associated infrastructure, pump station, marine facility). The area's tremendous diversity (agroecological zones, production systems, settlement patterns, ethnicity, language, religion), severe road conditions, and serious time constraints precluded meaningful systematic sampling of the entire region. Accordingly, we started by dividing the larger area of influence into subregions that portray the agroecological diversity of the larger unit as follows. Extending in the Republic of Cameroon for almost 900 km, the pipeline crosses three agroecological zones:

1. The pipeline's entry point into the Republic of Cameroon near Touboro lies at a cross section of two zones: a Soudano-Sahelian zone of the northern parts of the country and the Soudano-Guinean one of the Adamawa Plateau just below. Annual precipitation ranges between 815-1,500 mm per year from north to south, concentrated in a single rainy season that extends from May/June to October/November. The vegetation cover is largely "bushy and wooded savannah, transitioning to semi-deciduous forest, with evergreen gallery forest in most of the river valleys" (Dames & Moore 1995: 5-3). Administratively, this area corresponds with the North (Département de Mayo-Rey) and Adamawa (Départements de Vina et Mbéré) Provinces.

2. Advancing in a southwest direction the pipeline enters an equatorial zone with an annual rainfall of 1,500 to 2,000 mm. This zone is characterized by rain throughout the year with two peaks in August/September and April/May, referred to respectively as "*la grande saison des pluies*" and "*la petite saison des pluies*"; the two periods (December/January

and July/August) with the least amount of rain are, on the other hand, referred to respectively as "*la grande saison sèche*" and "*la petite saison sèche*" (*Atlas de Jeune Afrique* 1973: 16). The zone is "characterized by semi-deciduous forest transitioning into a mixed forest belt before entering the Atlantic evergreen forest zone" (Dames & Moore 1995: 5-3). Administratively, the zone corresponds with the East (Département Lom and Djerem) and Center (Départements de Haute-Sanaga, Méfou, and Lekie) Provinces. In the latter two départements, the proposed pipeline route passes through what is referred to as the Yaoundé Pass, which, in turn, passes through several peri-urban areas of the capitol city, Yaoundé.

3. In its last leg the proposed pipeline route enters the southwestern tip of Cameroon's coastal zone, characterized by littoral evergreen rain forests and a wet equatorial climate with an average annual rainfall of 2,500 to 4,000 mm. Administratively, the zone corresponds with the Province of the South (Département d'Océan).

Having identified three such subregions, we proceeded by superimposing a map that delineates the proposed pipeline route and the four fixed facilities (pump stations and the pressure reducing station), noting that one or more of the proposed fixed facilities is located in each of the identified subregions. Since it was not feasible, for the reasons mentioned above, to do systematic sampling in each of these subregions to select representative villages, we decided to use the team's social science knowledge and its combined intimate familiarity with the entire region to select, from each of these units, a cluster of villages that were: 1) within a radius of about 100 km from a certain gathering point; 2) within a reasonable distance from the proposed infrastructure (pipeline, roads, etc.); and 3) at least one of the villages in each cluster was within the vicinity of a fixed facility in that area. Accordingly, we decided to carry out the socioeconomic surveys in the wider areas of Touboro in the North Province, Meiganga in the Adamawa Province, Nanga Eboko in the Center Province, and Kribi in the Province of the South. We also selected a number of peri-urban areas around the capitol city of Yaoundé as representative of the Yaoundé Pass.

C. Data Collection Methods

Due to time constraints the team was able to spend only several hours in each of the selected sites. A combination of qualitative and quantitative data collection techniques (rapid rural appraisal, community and household surveys, formal and informal interviews) were utilized to get the maximum amount of information in the allotted time. Altogether, 68 sites (villages, camps, neighborhoods) and 185 households were covered.

1. Village Baseline Data

To describe effectively the general characteristics of an area without having to interview large numbers of persons, we developed and administered a village baseline data survey that solicited information on issues such as: name of the administrative area the settlement/village is a part of and its location; population size; names of ethnic, linguistic, or other groups resident in or adjacent to the site; religion; the most important crops and cropping patterns and seasons; major water (artesian wells, hand-dug wells, water fountains, natural springs) and energy sources (firewood, petrol, bottled gas); agricultural inputs such as improved seeds, fertilizers, animal traction, and agricultural machinery; types and estimated numbers of animals; major economic activities other than cultivation or herding, according to relative importance; educational, health, and administrative services available in or near the village; transportation and infrastructure; and the nearest and most accessible major towns.

Major production systems in each area also were identified (farming, herding, fishing, hunting and gathering) and each system including nature of cultivation (slash- and-burn shifting cultivation, food versus industrial crops, irrigation, etc.), land tenure and land use, division of labor and allocation of resources by ethnicity, gender, age, etc. was described. This part of the investigation was driven by concerns such as the likely effects of project construction, operation, and maintenance on the agricultural labor situation. Are the labor burdens of a particular category, i.e., women, likely to increase if men, for example, abandon farming for the more lucrative wages associated with construction? How will this affect the regional economy after construction is completed and these new employment opportunities decline?

In addition to the above, we obtained information on the nature of the biotic community existing within the study area that might be affected by the construction, presence, and operation of the proposed project, paying special attention to the multiple-use capacities and multiple-right realities of most resources and the possibility of constraint in use or outright foreclosure of present or future resource use options. We also considered those life forms that are culturally, economically, medically, or ecologically important (sacred areas, wildlife, fish resources, forestry, rangelands, and vegetation such as: medicinal herbs, roots, tree leaves and barks).

In each site, village baseline surveys were complemented by qualitative data gathering on such issues as ideology and beliefs, local perceptions of health and disease including causes and cures, and indigenous knowledge (at the household, farm, and community levels) and the way such knowledge is transferred.

2. Household Baseline Data

The household baseline survey solicited information on the following topics:

- Household composition: this included household size, name, gender, and education of each household member above age 10 and relationship to household head; ethnicity; religion; major occupation; location in or outside of villages; and marital status.

- Household access to resources of land, labor, and capital: land resources, including all types of land both inside and outside the project boundaries; labor resources including both household and hired (or exchange) labor; and capital concentrated on more easily observed sources of wealth such as agricultural tools and machinery, transport vehicles, animals, the type of house (type of construction, number of rooms, the presence of a separate kitchen, bathroom, toilet; electricity; and running water), and furniture (the presence of a cooking stove, refrigerator, television, videotape, radio, tape recorder, etc.).

a. Household Production Systems

Identifying major production activities that sample households engage in (e.g., farming, herding, fishing, hunting and gathering, trade, or on- or off-farm wage labor) is a necessary antecedent to sound prediction of behavior. It is not at all uncommon for one household to engage in two or more economic activities in the same season if the proper mix of labor is available. Therefore all households were encouraged to list more than one strategy or economic activity. As different production systems were investigated, we also considered the mix of production, varieties of product produced, and the destination — are they mainly subsistence or market oriented? What are the relative percentages of each? What conditions influence decisions regarding production?

b. The Farm Economy and Division of Labor

A sound understanding of the existing farm economy is crucial to the effective implementation of development interventions. What does the daily operation of a farm entail? How are resources, labor, and time allocated to meet the different demands of the farm enterprise? In other words, a close investigation is needed of time, resources, and labor allocation including the division of labor by age, gender, education, etc. Since surveys and questionnaires necessarily are limited in their time perspective, we had to content ourselves with general questions concerning the different types of farm tasks, family member(s) most likely to perform each task, and the amount of time each task might take for an average field, estimated at about one-fourth of a hectare. In raising these questions

we paid particular attention to seasonal variation. We also paid attention to activities such as child care that are sometimes referred to as "unproductive labor," recording the estimated time that household members, especially women and young girls, spend daily on this and related activities. This gives us an idea not only of the present division of labor but also of the potential availability of various household members to meet additional labor demands. To ascertain that both farm and household activities were covered we distinguished among agricultural activities, nonagricultural activities, and domestic activities.

c. Land Tenure and Land Use

Land tenure and land use rights have been shown to be the framework within which traditional farming patterns operate. As such, tenure and use rights are often critical in determining natural and productive resource management practices. In this study, we distinguished among different types of access to land. The most important distinguishing factor in Cameroon was found to be that between the *autochtone* access (native) and *allogène* access (nonnative or foreign population). Persons with *autochtone* access were accorded their rights at birth, whereas persons with *allogène* access have the often restricted rights afforded to them by natives. In the case of cultivation rights afforded to nonnatives, is access restricted to "temporary" crops such as cassava, maize, and groundnuts (where the land reverts back to the original "owner(s)" at the end of one or two seasons) or "permanent" crops (recognized by the fact that the cultivator is allowed to put perennial crops or erect "plantations" on the land)? Is it open and year-round or periodic?

d. Household Expenditure

Although the nature of this data gathering did not permit adequate understanding of household expenditure and budget allocation, the information gathered gives us at least some indication of household spending priorities. It also allows an assessment of the surplus revenues available for investment.

D. Problems Encountered

1. Team Size/Composition

The team size (13 persons, including three drivers, traveling in a convoy of three 4-wheel drive vehicles), composition (IDA, Exxon, Dames & Moore, the University of Yaoundé I, the Ministry of Scientific and Technical Research, the Ministry of Territorial Administration, the Ministry of the Environment and Forestry, the Ministry of Fisheries and Animal Husbandry, SNH, and the Ministry of Defense) and layers of authority proved to be cumbersome

logistically, overpowering to villagers, and often intimidating. This problem was resolved partially by dividing he team into three smaller units.

2. Security Issues

Security problems within the country, especially in the North and Adamawa Provinces where attacks on travelers by armed bandits is a common phenomenon, necessitated that we travel with an armed policeman and that we returned to our base before 6:00 p.m. In general, the armed policemen were cooperative and sensitive to the fact that their presence intimidated villagers. Most left their arms in the vehicle and stayed at some distance from the site of community interviews. Their presence even at some distance, nevertheless, tended to make at least some of the people interviewed uncomfortable and reluctant; at the same time, in the presence of such power, they wanted to at least appear cooperative.

This presence of arms, by necessity, has influenced some of the information obtained, especially in relationship to questions concerning access to and utilization of productive resources. This was particularly relevant in reference to forest utilization for hunting and gathering including firewood since, in many areas, both activities have fallen under official restrictions. The fact that we had to be back at the base no later than 6:00 pm everyday, coupled with poor road conditions, proved particularly problematic in the more distant sites (over 100 km from the base), necessitating that some interviews were cut short and others were never carried out.

3. Agricultural Season and Distance of Farms

The very common substantial distance between farms and villages, the fact that among many of the ethnic groups the entire family is actively engaged in cultivation and, in the northern areas unlike the central and the southern areas, the fact that cultivation is concentrated in one rainy season (May/June to October/November) meant that frequently we arrived at a village that was empty of people except for a few children too young to walk the long distance to the farm, or the sick.

4. Communications

Because of the nature of the proposed project and team composition a hierarchy of regional and local officials had to be alerted to our arrival. In most cases, given local constraints, the channel of communication was very effective. There were times, however, when a village chief, otherwise very friendly and hospitable, was reluctant to allow us to conduct interviews in his village because he had not been alerted previously of our coming by the local

authorities concerned. At other times, people were caught in the middle of demanding work which they were obliged to put aside to accommodate our powerful delegation. Sometimes the awkward timing created a reluctance and impatience that may be reflected in some of their responses.

5. Site Location

Due partially to the very small size of some villages (two or three households), consequently known by name only to people in the immediate vicinity, and the fact that some villages carry multiple names (e.g., in addition to their own names, some villages also are called after a river or a small seasonal stream that runs through the village; after a well-known, wealthy, or respected man who resides or resided in the village; or a well-known nearby periodic market), often the names that appear on published 1:200,000 scale map sheets had little to do with the on-the-ground locations of villages.

In one instance, the "map" village name, Taii, northeast of Meiganga, was totally unfamiliar to the local inhabitants. We asked for the names of the villages in the vicinity and were given three names: Laïnga Baani, Houri Kouné, and Ngoua. The following day we were told that Houri Kouné was the name of a periodic market near Ngoua but that the village no longer existed. In other words, there were only two villages in that particular vicinity: Ngoua and Laïnga Baani. Having walked for about 8 km to arrive at the village that was identified to us as Laïnga Baani, we asked a villager what the name of the village was; Houri Kouné, he said. We asked where Laïnga Baani was. He said that there was no such village but that there was a stream with that name that ran near the village; "outsiders" sometimes called the village by the name of the stream, he commented.

6. Reluctance Toward Household Surveys

In some cases after the completion of the community survey there was a reluctance on the part of some villagers to have household surveys conducted in their midst, saying "we have already told you all there is to know about our village." This reluctance may be due to time constraints, desire not to be singled out, or fear of intense scrutiny.

III. THE AFFECTED ENVIRONMENT

A. The Physical Environment

The proposed pipeline corridor stretches over 900 km as it moves in a southwestward direction from the Chadian border just northeast of the town of Touboro, Department of Mayo-Rey, North Province, to its final destination, the Atlantic Ocean, south of the town of Kribi, Département d'Océan, South Province. In this long journey the proposed pipeline corridor cuts through agroecological zones as diverse as the tropical rain forests of the South Province and the thick savanna of the North Province and five of the country's 10 provinces: North, Adamawa, East, Central, and South.

Climatically the area can be divided into three zones, the Equatorial, the Sudanic, and the Sudano-Sahelian, which are described as follows (*Les Atlas Jeune Afrique* 1973: 16):

- The Equatorial Zone, which extends from the southern tip of the country to 6° north latitude and includes within it two climatic zones. 1) The Guinean Zone, bounded by the Lom (East Province) and Mékié (Central Province) Rivers to the north and by the Atlantic Ocean and the Lower Sanaga to the west. Rainfall is spread throughout the year with two peaks in September (*la grande saison des pluies*) and March/April (*petite saison des pluies*). The two minimum peaks known respectively as *la grande saison sèche* and *la petite saison sèche* fall during December/January and July/August. 2) The Cameroonian hot and humid climate of the southwest littoral zone outside of the proposed project area.

- The Sudanic Zone, which extends from 7° to a little above 10° latitude and is characterized by a long rainy season (March-November) with an average annual rainfall of 1,500 mm in Ngaoundéré.

- The Sudano-Sahelian Zone, which extends to the most northern tip of the country and is characterized by both a shorter (May-October) and much less abundant rainfall (depending on the area rainfall ranges between 400-800 mm per year).

From an agroecological viewpoint the study area is divided into two general zones, with a wide variation within each:

- The Great Equatorial Forest Zone

  Represented by the Kribi and Nanga Eboko areas the zone is characterized by a widely spread water network of rivers, swamps, creeks, and lagoons. A rich variety of wild

animals and medicinal plants that form the core of indigenous medicine is made abundant by extensive forests that range from evergreen dense forests, semi deciduous moist forests, deciduous moist forests, mangroves, and gallery forests. The density of each type is increasingly diminished in some areas. Contrary to what conventional wisdom might say, the biggest contributors to this degradation are not the ongoing slash-and-burn shifting cultivation practices but large scale commercial logging.

Climatically, as the name indicates, the zone is equatorial.

- The Sudano-Savanna and Savanna Zones

A wide variety of savanna lands that range between bushy and wooded savanna, interspersed by pockets of evergreen gallery forests to periodically inundated prairie and grass savanna, is a prime feature of this zone, represented by the Touboro and Meiganga areas.

B. Survey Sites, Population, and Infrastructure

Table 1 presents a listing of the sites surveyed. The list does not include a number of sites where only qualitative information was collected. These include the towns of Kribi, Nanga Eboko, Mbandjock, Nkoteng, Meiganga, and Touboro; the SOCOPALM village of Kienké (Village I) near Kribi; Douala, a neighborhood of Nkoteng; Aloum, a peri-urban area of Nanga Eboko; the Paul Khoury Sawmill in Nanga Eboko; and the market towns of Bélél and Tourningal on the road from Meiganga to Ngaoundéré.

TABLE 1
NAMES, LOCATIONS, ELECTRICITY STATUS AND POPULATION SIZE IN 68 SITES IN THE REPUBLIC OF CAMEROON

No.	Province	Department	Arrondissement	Site Name	Type Other than Village	Pop.	Elec.
1	Adamawa	Mbéré	Djohong	Fada	Periodic Livestock Market Town	2,000	N
2				Madding		80	N
3			Meiganga	Bakoungue		400	N
4				Gbaata		130	N
5				Hori Kouni		200	N
6				Mbaraang	Permanent Market Town	3,000	N
7				Meidougou	Transhumant Town	3,000	N
8				Meiganga I	Neighborhood of Meiganga	1,500	Y

TABLE 1
NAMES, LOCATIONS, ELECTRICITY STATUS AND POPULATION SIZE IN 68 SITES IN THE REPUBLIC OF CAMEROON (CONTINUED)

No.	Province	Department	Arrondissement	Site Name	Type Other than Village	Pop.	Elec.
9				Ngoa		100	N
10				Sabongari		3,000	Y
11		Vina	Bélél	Tello	Period Livestock Market Town	550	N
12	Central	Haute Sanaga	Mbandjock	Biboto		1,200	N
13				Mamra II		500	Y
14				Metsim	Neighborhood of Mbandjock	2,500	Y
15				Minkouma		45	N
16				Ndiore II		308	Y
17				Ndjoré		125	Y
18			Nanga Eboko	Abang I	Hausa Neighborhood of Nanga Ebok	3,000	Y
19				Bifogo		600	N
20				Bitam		1,000	N
21				Epegang		30	N
22				Etignang		600	N
23				Kaa		140	N
24				Mendongo		1,000	Y
25				Mengang		60	N
26				Meyang		200	N
27				Ndjombé		60	N
28				Sika		15	N
29			Nkoteng	Biloné	Neighborhood of Nkoteng	2,500	Y
30				Camp Martin	A Camsuco Neighborhood of Nkoteng	10,000	Y
31				Camsuco Cite 3	A Camsuco Neighborhood of Nkoteng	1,450	Y
32				Mendjoui		100	N
33				Simbane	Peri-Urban Area of Nkoteng	4,000	N
34		Lekie	Obala	Nkometou II	Peri-Urban Area of Yaoundé	7,500	Y
35				Nkometou III	Peri-Urban Area of Yaoundé	1,500	Y
36			Okola	Ngoya I	Peri-Urban Area of Yaoundé	2,500	N

TABLE 1
NAMES, LOCATIONS, ELECTRICITY STATUS AND POPULATION SIZE IN 68 SITES IN THE REPUBLIC OF CAMEROON (CONTINUED)

No.	Province	Department	Arrondissement	Site Name	Type Other than Village	Pop.	Elec.
37			Sa'a	Nkolngok Sa'a		300	N
38		Mefou	Esse	Nkoayos		100	N
39		Mefou Akono	Akono	Akono I	Peri-Urban Area of Yaoundé	1,500	N
40				Nkolnlong I	Peri-Urban Area of Yaoundé	3,000	Y
41			Mbankomo	Binguela II	Peri-Urban Area of Yaoundé	7,000	N
42				Okoa	Peri-Urban Area of Yaoundé	800	Y
43		Mefou-Akono	Mbankomo	Angon II	Peri-Urban Area of Yaoundé	2,000	N
44		Mfoundi	Yaoundé II	Nkolkoumou	Peri-Urban Area of Yaoundé	525	N
45	North	Mayo Rey	Touboro	Baldi		100	N
46				Bogdibo	Frontier Town for Transhumants	1,200	N
47				Djom		450	N
48				Kouman		150	N
49				Mbaiboum	International Market Town	4,000	N
50				Mbodo		550	N
51				Sodecoton I	Neighborhood of Touboro	750	Y
52				Sogbe-Toukoulou		250	N
53				Touboro I	Neighborhood of Touboro	1,000	Y
54				Wangtounou		250	N
55	South	Ocean	Bipindi	Maschuer-Masche	Pygmy Camp	58	N
56			Kribi	Bidou I		400	N
57				Bidou II		100	N
58				Bikondo	Peri-Urban Area of Kribi	3,000	N
59				Bissiang		400	N
60				Abomé	Peri-Urban Area of Kribi	2,502	Y
61				Ikeike	Peri-Urban Area of Grand Batanga	1,000	N
62				Makoura I		235	N
63				Makoura II		105	N

TABLE 1
NAMES, LOCATIONS, ELECTRICITY STATUS AND POPULATION SIZE IN 68 SITES IN THE REPUBLIC OF CAMEROON (CONTINUED)

No.	Province	Department	Arrondissement	Site Name	Type Other than Village	Pop.	Elec.
64				Mboamanga	Peri-Urban Area of Kribi	3,000	Y
65				Zaire	Neighborhood of Kribi	2,500	Y
66			Lolodorf	Ncongro Pygmies	Pygmy Camp	14	N
67				Ngovayang		850	N
68				Ngoyang		200	N
69				Ngoyang+		75	N

[1] The village of Ngoyang, differentiated as Ngoyang and Ngoyang+, was surveyed twice. The second survey was done in the context of a community interview of the Pygmy camp Ncongro, which has a dependency relationship with Ngoyang. Ngoyang+ hence refers to the section of the village with most dealings with the Pygmies.

1. Population Size

Columns 2, 3, and 4 show, respectively, the Province, *Département*, and *Arrondissement* where each village, peri-urban area, or urban neighborhood is located. Column 5 gives the names of villages and columns 7 and 8 show population size and the presence or absence of electricity. Population size was always a rough estimate. In most cases villagers had a much better idea of the number of households in a village than the overall population size. To calculate population size in those situations, average household size was estimated (the range was rather large but that was probably a function of what different people, ethnic groups, etc., considered a household) and multiplied by the number of households.

At first glance, whether we are considering the entire study area or each Province, *Département,* or *Arrondissement* separately, the wide range in population size is remarkable. For the entire region the range goes from a low 14 to a high 10,000. The range narrows as we move down to smaller units. In the Central Province, for example, the range is 15 to 7,500. The Département of Haute Sanaga shows a range of 15 to 4,000. In the Arrondissement of Mbandjock it narrows down further to 45 to 2,500. A more careful look reveals that the broadness of the range is a function of the inclusion in survey of sites with higher population concentration: peri-urban areas and urban neighborhoods. Virtually all of the sites with a population size of 1,000 or more belong to one of these two categories.

2. Presence or Absence of Electricity

Out of the 68 sites (counting Ngoyang only once), 48 are not electrified. Moreover, in many of the electrified sites, most dwellings either have no electricity or have had their power cut

off for a long time because of the inhabitants inability to pay the cost. The same observation was made regarding running water. Electricity tends to be available in urban neighborhoods and important peri-urban areas where populations are concentrated.

3. Educational, Administrative, Health, and Communication Services

The availability of social services follows the same general pattern, with services concentrating in peri-urban areas and urban neighborhoods (see Table 2). As this was a one-shot survey taken in the course of several hours, the information obtained is at best tentative and the quality varies from site to site and from one survey team to another. Distribution patterns of services are believed to be accurate, however. It should be noted that the urban neighborhood Meiganga I is listed four times in the table to allow for the number of services that are available to its inhabitants. The reason for the difference in availability of services from one urban neighborhood to another, for example Meiganga I in the town of Meiganga, and Abang I, the Hausa neighborhood in the town of Nanga Eboko, is much more likely to be a function of the respondents' interpretation of the meaning of the question than what is available in the town *per se*. Some respondents reported only those services in the vicinity of the neighborhood itself, while others spoke of the entire town.

Most respondents reported access to at least one primary school (45 out of 68). This does not necessarily mean the existence of a primary school in the immediate grounds of each site that responded positively to the question, or that the children in sites that did not report the existence of a school are totally deprived of primary schools. Some respondents reported only schools that exist in the villages themselves. Most, however, reported the existence of schools that are within walking distance (a range from 2 to 13 km) for the children.

The paucity of reported Koranic schools is due to two factors: 1) as shall be seen in Table 10, Islam is not a widespread religion in the Republic of Cameroon, especially in the southern and central parts of the country; 2) even in villages where some of the inhabitants are Muslim and where Koranic schools exist, they might go unreported if none of the persons present during a community interview were Muslim.

TABLE 2
SERVICES INFRASTRUCTURE IN 68 SURVEY SITES AND CONDITION OF NATIONAL RADIO RECEPTION

Department	Site Name	Educational Services	Admin. Services	Health Services	Communication Services	Radio Reception
Haute Sanaga	Abang I				TV & Radio	Average
	Biboto	Ecole Primaire			Television	Good
	Bifogo	Ecole Primaire				Med
	Bilone		Chefferie		Television	Med
	Bitam		Chefferie			Good
	Camp Martin	Ecole Primaire		Health Center	TV & Phone Service	Average
	Camsuco Cite 3	Ecole Primaire (2)		Hospital	Radio	Average
	Epegang	Ecole Primaire		Health Center		Bad
	Etignang		Chefferie			Good
	Kaa	Ecole Primaire	Fisheries		TV, Phone, & Radio	Average
	Mamra II				Television	Good
	Mendjoui		Chefferie			Average
	Mendongo	Ecole Primaire		Dispensary		Average
	Mengang	Ecole Primaire	Chefferie			Good
	Metsim	Ecole Primaire	Police, Chefferie	Health Center	Phone & TV	Good
	Meyang	Ecole Primaire				Good
	Minkouma					Good
	Ndiore II				Television	Good
	Nojombe	Ecole Primaire	Chefferie			Good
	Ndjore	Ecole Primaire		Health Center	Television	Good
	Sika					Bad
	Simbane	Ecole Primaire				Good
Lekie	Ngoya I	Ecole Primaire (2)		Health Center		Good
	Nkolngok Sa'a				Television	Good
	Nkometou II	Ecole Primaire	Chefferie		TV & Phone Access	Good
	Nkometou III	Ecole Primaire	Chefferie, Gendarme	Health Center	Television	Good
Mayo Rey	Baldi	Ecole Primaire 11 km		Hospital (13 km)		Average
	Bogdibo	Ecole Primaire & Kor				Bad
	Djom	Ecole Primaire		Dispensary		Bad
	Kouman	Ecole Primaire		Health Center/ Touboro		Bad
	Mbaiboum	Ecole Primaire	Gendarme, Customs of		Television	Bad
	Mbodo					Bad
	Sodecoton I	Ecole Primaire		Health Center		Bad
	Sogbe-Toukoulou					Bad
	Touboro I					Bad
	Wangtounou	Ecole Primaire				Bad
Mere	Bakoungue	Ecole Chorionic				Average
	Fada	Ecole Primaire				Average
	Gbaata	Ecole Chorionic (2)				Bad
	Hori Kouni	Ecole Chorionic				Bad
	Madding					Bad

TABLE 2
SERVICES INFRASTRUCTURE IN 68 SURVEY SITES AND CONDITION OF NATIONAL RADIO RECEPTION (CONTINUED)

Department	Site Name	Educational Services	Admin. Services	Health Services	Communication Services	Radio Reception
	Mbaraang	Ecole Primaire		Health Center	TV and Video	Bad
	Meidougou	Ecole Primaire		Health Center		Good
	Meiganga I	Ecole Intermediare	Camp Militiare	Hospital		Bad
	Meiganga I	Ecole Chorionic	Prefecture	Health Center		Bad
	Meiganga I	Ecole Primaire	Sous-Prefecture	Dispensary	TV & Video	Bad
	Meiganga I	Jardin d'Enfants	Post Police		Radio & Phone Service	Bad
	Ngoa					Bad
	Sabongari	Ecole Primaire				Average
Mefou	Nkoayos					Good
Mefou Akono	Akono I	Ecole Primaire	Chefferie	Dispensary	Television	Good
	Binguela II					Good
	Nkolnlong I	Ecole Primaire	Chefferie, Gendarme	Health Center	Television	Good
	Okoa	Ecole Primaire				Average
Mefou-Akono	Angon II	Ecole Primaire				Good
Mfoundi	Nkolkoumou	Ecole Primaire		Dispensary		Good
Ocean	Bidou I	Ecole Primaire	Chefferie		Television	Bad
	Bidou II					Bad
	Bikondo	Ecole Primaire			Television	Bad
	Bissiang	Ecole Primaire			Television	Bad
	Ebome	Ecole Primaire	Chefferie		TV & Phone Access	Bad
	Ikeike					Average
	Makoura I					Bad
	Makoura II					Bad
	Maschuer-Masche	Ecole Primaire				Average
	Mboamanga	Ecole Primaire	Chefferie	Dispensary		Average
	Ngongro Pygmies	Ecole Primaire				Bad
	Ngovayang	Ecole Primaire (2)	Chefferie (4)	Hospital	Television	Average
	Ngoyang	Ecole Primaire				Good
	Ngoyang+	Ecole Primaire			Television	Good
	Zaire	Ecole Primaire	Chefferie		Television	Bad
Vina	Tello	Ecole Primaire				Good

4. National Radio Reception

There is some correlation between people's knowledge and degree of knowledge of the proposed project and the condition of the reception of the national radio. Other important factors are: the presence of radios, television sets, and newspapers; the degree of political importance accorded by the government to an area, expressed by the degree and level of campaigning in favor of the proposed project; the general scope and level of education; proximity to important urban centers; and the frequency, level, duration, and orientation of

labor migration. Almost invariably villages that had not heard of the proposed project or had scanty, imprecise information were the ones that reported lack of many of the factors we mentioned above and/or bad or average radio reception.

5. Water Resources

Table 3 shows access to water resources. Respondents were asked to rank up to five sources of water by importance. Seven sources including "other" were noted. Of the 68 cases observed, 25 claimed to rely on a single source of water. Natural springs were reported as the first water source of primary and secondary importance. Twenty-one of the sites surveyed declared that springs were the most important source of water; 13 mentioned hand-dug wells. Water coming from the sugar factory was reported by one site to be the second most important source.

TABLE 3
FREQUENCY OF WATER SOURCES DECLARED
OF PRIMARY AND SECONDARY IMPORTANCE IN 68 SITES

Water Sources	Frequency 1	Frequency 2
Natural Springs	21	11
Hand-Dug Wells	13	9
Deep Wells	10	6
Water Fountains	8	8
Rivers/Marigots	6	6
Sugar Factory	0	1
Other Sources	11	2

6. Firewood and Other Sources of Energy

The perception that Cameroon society, whether urban or rural, is a very heavy consumer of fuel wood has been validated by the survey, as shown in Table 4. Only three principal sources of energy, firewood and to a much lesser extent charcoal, petrol, and bottled gas were reported, with the latter two sources being very secondary if used at all. Firewood was reported as the most important in all of the sites surveyed. Moreover, 49 of the 68 cases surveyed reported no other sources of energy. Petrol was reported as the second choice by 14 of the cases; bottled gas was the second choice of five cases.

According to the local *Service de Eaux et Forêts* in the Maroua area, for example (the Extreme North Province), an average family of six consumes an average of 50 dm^3 of

firewood daily. This translates into 1,500 dm^3 of fuel wood per family per month (Sale 1980:2).

TABLE 4
FREQUENCY OF ENERGY SOURCES DECLARED OF PRIMARY AND SECONDARY IMPORTANCE

Energy Sources	Frequency 1	Frequency 2
Fuel Wood	68	0
Petrol	0	14
Bottled Gas	0	5

C. The Human Environment

1. The People

A strong expression of the tremendous differentiation that exists in the study area is the enormous ethnic, linguistic, religious, socioeconomic, and cultural diversity communicated through different settlement patterns, languages, religious beliefs, and cultural norms such as marriage preferences, burial practices, sacred areas, and local organizations.

a. Ethnicity and Language

The enormous ethnic and linguistic complexity of the Republic of Cameroon, which boasts over 250 ethnic groups and tens of languages including the official ones of French and English (Atlas de Jeune Afrique, 1973), is an attestation of the claim that it is "Africa in miniature.) Especially in the southern portion of the proposed study area, a span of a handful of kilometers might exhibit several independent ethnic groups with separate, mutually incomprehensive languages. This ethnic and linguistic complexity could be, to a certain degree, a function of the enormous richness of the environment, which allows small groups of people to take care of all of their subsistence needs (farming, hunting and gathering, fishing) independent of other groups. A very active internal (within Cameroon) and regional (especially from Chad, Nigeria, and the CAR) migration has contributed further to this ethnic/linguistic diversity.

As Table 5 indicates, the ethnic/linguistic composition in the area follows the following general lines:

TABLE 5
ETHNIC/LINGUISTIC COMPOSITION
IN THE PROPOSED PROJECT AREA

Area	Principal Ethnic Groups	Principal Languages
Kribi	Batanga (Banoh and Bapuku) Mabea Ngoumba Boulou Bassa Fank Yassa Mvae Bagieli Pygmies Ewondo	Batanga Mabea Ngoumba Boulou Batieli French
Youndé Pass	Ewondo Eton	Ewondo Eton French
Nanga Eboko	Babouté Bamvélé Bavek	Vouté Ewondo
Nanga Eboko (cont)	Yekaba Yebekanga Yezoum Yekaba (Allogènes: plantatioans): Toupouri Massa Mosgoum Hausa Moudang Moffou\ (Allogènes: commerce): Bamiléké Hausa	Ewondo (cont) French
Touboro	Mboum Dourou Baya Mbéré Fulbé Bororo (Chad Origin): Pana (Allognes) Moudang Toupouri Moffou Hausa Bamiléké (Foreigners) Nigerians Central Africans Chadians Zatrois Sudanese	Fulfulde Mboum Baya Dourou Pidgin French

TABLE 5
ETHNIC/LINGUISTIC COMPOSITION
IN THE PROPOSED PROJECT AREA
(CONTINUED)

Area	Principal Ethnic Groups	Principal Languages
Meiganga	Baya Mbéré Fulbé Dourou Mboum Vrorroro (CAR Origin) Laka Kolé (Allogènes) Bamiléké Hausa Moudang	Fulfulde Baya Mbéré French

- The Kribi Area

A large number of loosely interrelated groups generally known as Bantou, but who regard themselves and are regarded by their neighbors as distinct from each other ethnically, linguistically, and sometimes culturally, occupy most of the Kribi area, as well as most of the southern region of the Republic. These groups include: the Batanga, composed of the Banoh and Bapuku; the Mabea; the Ngoumba; the Boulou; the Bassa; the Fang; the Yassa; the Mvae; the Bagieli Pygmies; and the Ewondo. There also are a large number of migrants especially in the larger towns such as Kribi and on plantations such as SOCOPALM. These include the Bamiléké from the west, the Bamanga from the northwest and southwest, the Maka or Makia from the east, and the Hausa, Choa Arabs, and Toupouri from the north, generally known as *nordist*. There also are migrants from Benin, the Congo, the CAR, Chad, Zaire, and Sudan.

The principal languages in the Kribi area are Batanga, Mabea, Ngoumba, Boulou, Bagieli, and French.

- The Yaoundé Pass

Virtually all ethnic groups in the Republic (including the Bamiléké, the Bassa, the Boulou, the Fulbe, the Baya or Gbaya, and the Mboum) as well as several groups from neighboring countries, reside in the capital city of Yaoundé and form the majority of its population. The *autochtones*, or natives, are in relatively small number in this zone, constitute the majority of the population in Yaoundé's peri-urban areas and dominate, at least numerically, certain villages or entire arrondissements. However, in the Arrondissement of Obala, for example, which claims a population density of 9 persons per km² (about 75,000 people over an area

of 816 km²), the Eton and Ewondo form the great majority, with the *allogènes* (non-natives, mainly Bamilékés and Hausa or *nordist*) being confined to about 7.5 percent of total population.

The principal languages are Ewondo, Eton, and French.

- The Nanga Eboko Area

A large number of interrelated *autochtone* (native) ethnic groups cohabit the area. These include the Babouté or Vouté, the Bamvélé, the Bavek, the Yekaba, the Yébékanga, the Yamgavock, the Yezoum, and the Yekaba. A large number of migrant groups including the Toupouri, the Massa, the Mosgoum, the Hausa, the Moudang, and the Moffou form the majority of sugar plantation and factory workers. The commercial class is composed largely of the Bamiléké and the Hausa.

The principal languages are Vouté, Ewondo, and French.

- The Meiganga Area

The native ethnic composition in the Meiganga area is almost identical to what we find in Touboro: the Baya, the Mbéré, the Fulbe, the Dourou, and the Mboum. Moreover, as we see in the boxes presenting livestock movement in Touboro and will see in more detail in the following box, a large number of the transhumant pastoralists, most of whom are Bororo, inhabit the area in the dry season. Some groups such as the Laka, the Pana, and the Kolé originate from CAR but have acquired a quasi native status. Most of the ethnic nonnatives are traders; the most numerous among those are the Hausa, the Bamiléké, and the Moudang.

The principal languages are Fulfulde, Baya, Mbéré, and French.

More specifically, ethnic composition in the 68 sites that were surveyed is summarized in Table 6.

TABLE 6
ETHNIC COMPOSITION IN 68 SITES
BY NUMERICAL IMPORTANCE

Province	Department	Arrondissement	Village/Site	Group 1	Group 2	Group 3	Group 4	Group 5
Adamawa	Mbéré	Djohong	Fada	Bororo	Fulbe	Baya		
			Madding	Baya				
		Meiganga	Bakoungue	Baya	Fulbe	Mere	Mboum	
			Gbaata	Baya	Fulbe	Bororo		
			Hori Kouni	Mere	Fulbe			
Province	**Department**	**Arrondissement**	**Village/Site**	**Group 1**	**Group 2**	**Group 3**	**Group 4**	**Group 5**
			Mbaraang	Fulbe	Baya			
			Meidougou	Baya	Fulbe	Mere	Mboum	Dourou
			Meiganga I	Baya	Bororo	Fulbe		
			Ngoa	Mere	Laka	Fulbe	Bororo	
			Sabongari	Fulbe	Baya	Kole	Laka	Moundang
	Vina	Belel	Tello	Fulbe	Mere	Baya	Pana	
Central	Haute Sanaga	Mbandjock	Biboto	Bamvele				
			Mamra II	Toupouri	Eton	Ewondo	Boulou	Bamvele
			Metsim	Baboute	Baya	Yekaba	Hausa	Bamvele
			Minkouma	Yangavok	Yanbaka	Yvane		
			Ndiore II	Eton	Bamoun			
			Ndjore	Baboute				
		Nanga Eboko	Abang I	Hausa	Fulbe	Mboum	Yekaba	Bamiléké
			Bifogo	Bavek	Bamvele			
			Bitam	Bani				
			Epegang	Bamvele	Beyouma			
			Etignang	Eton	Yenerong	Biyong	Yekaba	Yengong
			Kaa	Bavek	Eton	Bawele		
			Mendongo	Yenganga	Yebekang	Yezow	Ewondo	Boulou
			Mengang	Yekaba	Sadjom	Ebie	Yebekang	
			Meyang	Bessok	Beyouma	Ngaou	Bekobo	
			Ndjombe	Bekobong	Omvang	Bingbwa		
			Sika					
		Nkoteng	Bilone	Baboute	Yekaba	Bamileke	Eton	Toupouri
			Camp Martin	Toupouri	Mundang	Bassa	Baya	Mboum
Central (cont)	Haute Sanaga	Nkoteng	Camsuco Cite 3	Mixture				
			Mendjoui	Yampe				
			Simbane	Yezoum	Makia	Bamvele	Bamileke	Beti
	Lekie	Obala	Nkometou II	Eton				

Province	Department	Arrondissement	Village/Site	Group 1	Group 2	Group 3	Group 4	Group 5
			Nkometou III	Eton	Manguiss	Toupouri	Hausa	
		Okola	Ngoya I	Eton				
		Sa'a	Nkolngok Sa'a	Manguissa				
	Mefou	Esse	Nkoayos	Bamvele	Eton			
	Mefou Akono	Akono	Akono I	Ewondo				
			Nkolnlong I	Eton	Ewondo	Ossa		
		Mbankomo	Binguela II	Ewondo				
			Okoa	Ewondo	Eton	Bamileke		
	Mefou-Akono	Mbankomo	Angon II	Ewondo				
	Mfoundi	Yaoundé II	Nkolkoumou	Ewondo	Bamileke	Eton		
North	Mayo Rey	Touboro	Baldi	Mboum				
			Bogdibo	Mboum	Fulbe			
			Djom	Mboum	Toupouri	Fulbe	Bassa	
			Kouman	Baya	Mboum			
			Mbaiboum	Mboum	Fulbe	Hausa	Baya	
			Mbodo	Mboum				
			Sodecoton I	Yekaba	Ngambaye	Laka	Mboum	
			Sogbe-Toukoulou	Mboum				
			Touboro I	Mboum	Fulbe	Ngambaye		
			Wangtounou	Baya	Mboum			
South	Ocean	Bipindi	Maschuer-Masche	Bagyeli				
		Kribi	Bidou I	Fang	Ngoumba	Pigmy		
			Bidou II	Sakora	Mabea	Babaya	Bassa	
			Bikondo	Mabea	Pigmy			
			Bissiang	Fang	Assamfan	Yenang	Essesom	Yembi
			Ebome	Fang	Mabea			
			Ikeike	Bonamass	Batanga	Ewondo	Bamileke	
			Makoura I	Fang	Ngoumba			
			Makoura II	Fang	Ngoumba			
South (cont)	Ocean	Kribi	Mboamanga	Batanga				
			Zaire	Bassa	Fang	Hausa	Batanga	Ewondo
		Lolodorf	Ncongro Pygmies	Bakola	Ngoumba	Bassa		
			Ngovayang	Ngoumba	Boulou	Fang	Pygmy	
			Ngoyang	Kombe	Tsinga	Enoa	Bakola	
			Ngoyang+	Ewondo				

[2] The village of Ngoyang, identified in the table as Ngoyang and Ngoyang+ has been surveyed twice; the second time (Ngoyang+) in the context of a survey of the Ncongo Pygmy camp.

In the 68 village/peri-urban/urban neighborhood sites surveyed, a total of 70 ethnic groups that represent the 5 most numerous groups in each area were identified (Table 7). Not all villages

listed groups of secondary ethnic importance, however. Table 8, which shows the frequency of ethnic groups declared of second importance, shows that 19 of the villages indicated the absence of an ethnic group of secondary importance (shown as a "no second choice"). In other words, all inhabitants belonged to the same ethnic group. It is interesting to note that in the village of Ngoyang, surveyed twice at the beginning and the end of survey period (July 1 - August 20), different principal ethnic groups were reported: Kombe, Tsinga, Enoa, and Bakola in the first instance and only Ewondo in the second. This is a function of the fact that the second survey concentrated on that section of the population reported to have enduring relationships with the nearby Pygmy camp. Interestingly, the only ethnic group noted in this context, the Ewondo, is not native to the area.

TABLE 7
FREQUENCY OF ETHNIC GROUPS DECLARED OF FIRST IMPORTANCE IN 68 SITES

No.	Ethnic Group	Frequency
1	Baya	7
2	Mboum	7
3	Eton	6
4	Ewondo	6
5	Fang	5
6	Babouté	3
7	Bamvélé	3
8	Fulbé	3
9	Bavék	2
10	Mbéré	2
11	Toupouri	2
12	Yekaba	2
13	Bagyeli	1
14	Bakola	1
15	Bani	1
16	Bassa	1
17	Batanga	1
18	Bekobong	1
19	Bessok	1
20	Bonamass	1
21	Bororo	1
22	Hausa	1
23	Kombé	1
24	Mabea	1
25	Manguissa	1
26	Ngoumba	1
27	Sakora	1
28	Yampé	1
29	Yangavok	1
30	Yenganga	1
31	Yezoum	1
32	Mixture[1]	1

[3] Mixture refers to the fact that there is a variety of ethnic groups in the particular site.

TABLE 8
FREQUENCY OF ETHNIC GROUPS DECLARED OF SECOND IMPORTANCE IN 68 SITES[4]

No.	Ethnic Groups	Frequency
1	No Second Choice	19
2	Fulbe	9
3	Eton	4
4	Ngouma	4
5	Baya	3
6	Beyouma	2
7	Mabea	2
8	Mboum	2
9	Assamfan	1
10	Bamiléké	1
11	Bamoun	1
12	Bamvélé	1
13	Batanga	1
14	Bororo	1
15	Boulou	1
16	Ewondo	1
17	Fang	1
18	Laka	1
19	Makia	1
20	Manguissa	1
21	Mbéré	1
22	Mundang	1
23	Ngambayé	1
24	Omvang	1
25	Pygmy	1
26	Sadjom	1
27	Toupouri	1
28	Tsinga	1
29	Yanbaka	1
30	Yebekang	1
31	Yekaba	1
32	Yenerong	1

[4] Note that among themselves, the Pygmies distinguish between what they consider two different ethnic/linguistic groups: the Bagyeli and the Bakola.

A strong indication of the tremendous ethnic diversity existing in the area is that only 32 of the 70 ethnic groups recorded were declared as groups of first importance (Table 7) and 31 groups of second importance (Table 8). Moreover, very few of the ethnic groups, whether in groups 1 or 2, had high frequency. Only 12 out of 32 cases occurred with a higher frequency than 1 and only 5 groups where of a frequency of 5 or more. The same pattern is evident with ethnic groups of second importance.

Even more striking is the presentation in Table 9, summarizing the frequency of ethnic groups declared of both primary and secondary importance. Of the 70 ethnic groups that were recorded as among the 5 most important, only 14 were mentioned in categories 1 and 2. Of groups of first importance the highest frequency was among the Mboum and Baya with a frequency of 7 for each, followed by the Ewondo, Eton, and Fang with frequencies of 6, 6, and 5, respectively. Although the Fulbe were declared of first importance in only 3 sites, they are the most noted ethnic group of second importance. This high frequency supports their reputation for commerce and cattle trade, characteristics often synonymous with mobility.

TABLE 9
FREQUENCY OF ETHNIC GROUPS
DECLARED OF BOTH PRIMARY AND SECONDARY IMPORTANCE

No.	Group	1st. Importance	2nd. Importance
1	Mboum	7	2
2	Baya	7	3
3	Ewondo	6	1
4	Eton	6	4
5	Fang	5	1
6	Bamvélé	3	1
7	Fulbe	3	9
8	Mbéré	2	1
9	Toupouri	2	1
10	Yekaba	2	1
11	Batanga	1	1
12	Bororo	1	1
13	Mabea	1	2
14	Ngouma	1	2

b. Religion

Although only three main religions have been identified in the area— Christianity, Islam, and animism — we have noted that Christians, in general, tend to regard themselves in the context of their different sects and churches rather than simply as Christian. We have also noted that this separate identification among Christians is influenced by the presence of Muslims in the village. People are more likely to identify themselves as simply "Christian" despite the possible presence of several independent churches in an area, if there are also Muslims living in the village.

TABLE 10
FREQUENCY OF RELIGIONS/RELIGIOUS SECTS DECLARED OF PRIMARY, SECONDARY, AND TERTIARY IMPORTANCE

Religion/Sect	Frequency 1	Frequency 2	Frequency 3
Catholic	38	8	0
Christian	13	3	0
Muslim	8	9	6
Protestant	5	16	8
Adventist	3	9	6
Presbyterian	1	1	0
Animist	0	0	3
Apostle	0	1	0
Jehovah's Witnesses	0	0	4
Neo-Apostle	0	1	1
Pentecostalist	0	1	1
True Church	0	2	0

As in the rest of the country, the great majority of Cameroonians living in the study area are Christians. In the 68 village-level surveys that were conducted 38 identified the village as primarily Catholic; another 13 identified themselves as Christians. Only 8 villages identified Islam as of first importance. In none of the villages was animism declared as of first or second importance. As we shall see under "Sacred Areas," this should not distract from the strong animistic influence in Cameroon especially among Christians. Also, animism was named as of third importance in three sites. Nineteen of the sites claimed that all villagers followed only one religion; 39 others claimed the presence of two.

c. Non-Governmental Associations (NGOs) and Local Associations

The fact that very few officially recognized NGOs seem to be present in the study area, and that only one, S. A. I .L. D. (*Service d'Appui aux Initiatives Locales de Dévelopement*), which works with some of the Pygmy camps in the Lolodorf/Bipindi area, is known by the people in any of the sites that were surveyed should not force the conclusion that the area is void of formal and informal organizations.

Not only are there informal associations in just about every single settlement in the study area, in most villages there are several, often divided by membership (age and or gender), structure (more or less formal), and objective (mutual aid, sports, church activities). Moreover, most of the existing associations have NGO "functions." Two examples are church associations, organized mainly by women, and the *Associations d'Age*, very common in the southern region. The *association d'age* are age grades and age sets that are formed at two to three year

intervals and continue in existence from childhood until death. Within the ethnic group, membership in these age grades is automatic and universal, although boys and girls of the same age belong to different age grades. Members of age grades meet frequently, both formally and informally, and act as interest groups, both from within and *vis à vis* each other. For example, members provide assistance to each other in fishing, cultivation, construction of homes, etc. and will help the families of their age grade in the case of death. They also act as solid units *vis à vis* other interest groups such as other age grades.

Only 9 of the 68 sites that were surveyed did not report the presence of at least one association within the confines of the village. We suspect that among the nine that reported the non-existence of associations, only one, Sika, inhabited by a sole household, is a clear case of "no associations." We think that the other "denials" of the presence of associations is a question of misunderstanding/miscommunicating the nature of the query rather than an absolute lack of some informal organizations.

Let us take the *surga*, for example. It is a Fulfulde word that refers to an informal work group or association that brings people together to work. In the words of a young Fulbe man *surgas* are organized "*pour le travail q'on arrive pas à faire seul.*" It is an association that, under different names, also is very common at least among the Mbaya and the Mbéré. Very few villages, even those who spoke of the existence of informal associations, referred to it, however. A reason might be that a *surga* is the type of association that is formed for the occasion and dissolved after the work for which it was organized has been completed. In other words, whether they are organized to roof a house, open a field, or harvest, *surgas* normally dissolve by the end of the day's work. In a society where labor is normally not commoditized, *surgas* are a an effective way of dealing with short-term labor demands.

A person who is planning on calling a *surga* announces his intentions a few days earlier. When the prescheduled day comes, he prepares a big meal that consists normally of couscous, accompanied by some sort of a sauce, preferably with meat, and beer or palm wine if the host/guests are non-Muslim and reminds people of the occasion, normally with the aid of drums. It is important not to assume that the accompanying meal and drinks pay for the labor recruited since the reciprocal nature of a *surga* is an essential reason for its success; the respondents of today are likely to be the callers of tomorrow. A typical response to the question "what would happen to a person who keeps calling *surgas* but fails to attend any of the others himself" was, "he will end up with a fat belly since he will eat his couscous by himself."

Whether located in the southern, central, or northern regions of the country, the more modern types of associations, both formal and informal, tend to have similar types of structure, membership, and objectives: mutual aid associations that engage men and women, usually separately, in activities such as saving and rotational credit. Women's associations, often known as *groupements feminins,* also engage in activities that are considered "feminine." This

includes monetary contributions from each member for the purchase of household goods such as soap, sugar, and tea (in the north) in larger quantities, and their redistribution among the members, each in accordance with her contributions.

It was noted by many male villagers interviewed that women were much more involved in organizing themselves into associations than men. In some villages, especially in the south, many of the women's organizations had very small scale but important economic functions. In Makoura II, for example, the *association des femmes* raised sheep, goats, and poultry and founded and sponsored a small plantation that the women worked jointly.

Some of the associations are a little more formal with a name, a year of creation, a leadership, etc. The names are often reflective of villagers' views of the associations' spirit and aspirations. In Biboto, for example, a formal association with mixed membership (men and women) that was created in 1987 is called *Essayons* (Let us try). Another, in Bidou I, is CODEBI (*Comité de Dévelopement de Bidou I*). Their objectives are almost identical with all the other informal associations, however.

Other associations such as the *groupements* of workers, metal workers, fishers, herders, etc., are task oriented. An example of this type is the *association de pêche* (Fishermen's Association) in Boimanga, a peri-urban area of Kribi, which was founded in 1994 and has two female members. Villagers said that the association was created in response to the large number of fishermen who lost their lives to the ocean. One of the objectives of the association, thus, is to organize search groups to look for fishing dugout boats that do not come back after a certain specified hour. Another one, *Gabam*, is in the Pygmy camp Nkonguro (near Ngoyang, Bipindi). Gabam, whose main objective is cooperation in agricultural tasks, was created in 1994 and has 22 members of both genders and various ages. A third association of this task-oriented sort is AREF (*Amicale des Ressortissants de Fada*) in the livestock market town of Fada. AREF has a general economic, social, and cultural orientation and restricts the right of membership to Fulbe men.

In general, the more informal and "intermittent" an association is, the more "traditional" it is likely to be and, consequently, the more different in its general scope, from one area to another. For example, the *surga* seems to be confined to the Fulbe and, under different names, the Mbaya and the Mbéré. Age associations are very common in the southern region, but there are no traces of them in the central or northern regions.

Associations are so prevalent culturally in Cameroon that they are created even in migrant communities such as Camsuco Cité, a neighborhood of sugar factory and plantation workers in the town of Nkoteng. As several migrants put it, "there are many associations here with mixed membership: men, women, and children; each ethnic group has its own. It is through our

associations that we help each other in times of need: marriages, births, deaths. They also help us to maintain our traditions, to teach our native values to our children."

- The "*tontine*"

As we deliberate informal association in Cameroon, it is important to ponder what is referred to as *tontine*, a word that has become synonymous with the act of saving and with savings. Even though an association is not a *tontine* nor a *tontine* an association, when people discuss formal and informal associations, they often muse if they have any *tontine* functions. In fact, many associations declared "*tontine*," meaning "saving," to be one of their most important functions. Other associations insisted that saving is their sole function.

Essentially, a *tontine* (*njangi* in *pidgin*) is a formalized "informal" savings association. One might even call it a "popular" private savings bank with a credit option. It is believed that the practice of *tontine* started in the northwest and West Provinces (grassfields) and spread rapidly throughout the country. It is basically a membership-based organization that requires each of its members to pay a certain sum of money on a regular basis (weekly, bi-weekly, or monthly), which enters into a common savings "account." Depending on the type of *tontine* in question, these funds can be accessed in one of three ways:

1. On dues day, a member of the *tontine* borrows the entire amount accumulated up to that point or a certain portion of it; he will have to pay the amount back by the end of the year with reasonable interest. Also at the end of the year, each member of the *tontine*, after leaving in a certain agreed upon sum as capital, collects the accumulated amount of his yearly contribution and a portion of the interest that is equal to his contributions, generated by the entire sum.

2. Like the former but without the credit option. At the end of each year, each member collects from the *tontine* the amount he contributed for the entire year and a portion of the accumulated interest. This assumes, of course, that the money has been invested by a member or the members of the *tontine* or offered as credit to someone from within or outside the *tontine*.

3. Rotationally, each pay period one member receives the sum of all contributions. Depending on membership size and the frequency of contribution, a member might get one or more turns a year.

Partially due to the recent economic crisis in Cameroon, the *tontines* assumed such an important economic and financial role that there was a fear, according to some, that they might pose or are already posing a serious threat to the country's banking industry. Many people who had little faith in the banking system started taking their funds out of local banks and referring

them to their own *tontines*. A governmental attempt to tax *tontines* failed since *tontines* are "floating" organizations without fixed addresses.

d. Local Sociopolitical Organization and Structure and Settlement Patterns

Ethnic, linguistic, and agroecological diversity are only three manifestations of the tremendous contrasts among different regions of the country. Other important demonstrations of the rich diversity are local sociopolitical organizations and structures and settlement patterns, themselves, at least partially, expressions of differential agroecology and the organization of production.

- Settlement Patterns

In terms of spatial settlement patterns in rural areas, three types of villages may be distinguished:[1] the *village-rue* that predominate in forest regions and where huts sit in a row along a courtyard, a path, or a route; the *village-tas*, characteristic of the Sudano-Sahelian zone where huts sit in what looks like scattered heaps over the landscape; and the *villages-nébuleuse* (nebulous, vague, obscure), most common in the western parts of the country, especially among the Bamoun, where dwellings are spacious and relatively distant from each other (*Les Atlas de Jeune Afrique* 1973: 38). In other words, nucleated villages.

- Sociopolitical Organization

Parallel to the three agroecological zones we have identified in the context of our discussion of the physical environment, from the human environment point of view one might identify three sociopolitical or sociocultural zones sometimes referred to as *le Cameroun des villages, le Cameroun des chefferies*, and *le Cameroun des royaumes* (the Cameroon of Villages, the Cameroon of Chieftaincies, and the Cameroon of Kingdoms; for more information see Adler 1987; Barbier and Nkwi 1977; Binet 1965; Hamadjodo Abdoulaye and Mohammadou 1972; Mohammadou 1990, 1982, 1978; Nkwi 1989, 1982, 1976; Nouck Bassomb and Joseph Mboui 1986; Ombolo 1978; Tardits 1981, 1980, 1960).

- *Le Cameroun des villages*

[1]Descriptions concern "traditional" patterns of settlement. The situation that we see depicted in rural areas is the result of many factors including colonial administration policies. For example, in areas that are sufficiently densely populated (20 to 50 inhabitants per km²), villages and hamlets seem to be scattered all over the area. On the other hand, in sparsely populated areas, settlements tend to be situated along main routes. This linear settlement pattern frequently is the result of colonial action; for more effective control over the populations in remote areas, the administration forced the relocation and regrouping of many villages along the communication routes it created (Les Atlas de Jeune Afrique 1973: 38).

The sociopolitical-cultural zone referred to as *le Cameroun des villages* generally covers the Provinces of the southwest, Littoral, South, East, and Central, inhabited mainly by Bantu speakers. In other words, a large section of the proposed project's sociopolitical area of influence is part of *le Cameroun des villages*. In these areas villages tend to be small, numerous, and more or less ethnically and linguistically homogeneous; in fact, most often the inhabitants of a certain village tend to come from the same clan, even from the same family. There seems to be few food commodity exchanges among the villages since each produces pretty much the same mixture of crops. Marriages are strictly exogamous, however, forcing otherwise semi-independent villages to retain relationships with nearby villages whose inhabitants are not only from a different clan but likely a different ethnic and linguistic group.

As indicated earlier, an important trait of this zone is the fact that the extent of political organization and influence halt at the village or extended household/clan boundaries, causing some political anthropologists and colonial administrators to describe them as acephalous or anarchic societies.

Following their practice in other parts of Cameroon and Africa, the colonial administration, in an effort to streamline their control over these regions, organized the villages into *groupement* of villages and appointed chiefs of *groupement*s or even superior chiefs. To their chagrin, their efforts, at best, had mediocre results. In their focus on streamlining and efficiency, the colonial administration neglected to note that the aura surrounding chieftaincies and respect accorded to chiefs in other parts of Cameroon simply did not exist here. A chief was just another member of the village or the clan who happened to be a chief. To our question, "how do you define/recognize a great chief," a frequently repeated answer was, "great chiefs are not born, they are made (or they become)." Another frequent response was, "you can judge the deeds of a chief only after his death; that is when you know whether he was a great chief or an ordinary man."

An implication of this type of system is the greater role that local administrators such as *préfets* and *sous-préfets* might play in the political organization of these villages since submitting to or seeking the authority of a local administration does not contradict established traditional loyalties. This is a reason why, in this zone, people seem to defer much more easily than in other areas of the country to the administrative authority of the central government, represented in the region by the préfet or sous-préfet.

- *Le Cameroun des chefferies*

The zone referred to as *le Cameroun des chefferies* includes the West, with the exception of the Noun area, and the northwest provinces, mostly inhabited by semi-Bantu and semi-Sudanic peoples. The zone of influence is much larger, however, as we have seen exhibited in some areas of the Central and North Provinces.

As the name indicates, the principal political unit in these areas is that of the *chefferie* or chieftaincy, each composed of several villages or groups of villages whose inhabitants including non-natives recognize the authority of a single chief to whom they owe respect and allegiance. The chief's authority over his subjects is both temporal and spiritual. Although the power of the official local administration is recognized and might even be respected by the chiefs themselves, unlike traditional power, the application of that authority is strictly political and legal.

- *Le Cameroun des royaumes*

In addition to the Bamoun kingdom in the West Province, *le Cameroun des royaumes* includes the three northern provinces of Adamawa, North and Extreme North. Historically, the area forms an integral part of the region conquered by the West African Islamic Jihad of Usman dan Fodio and his Fulbe followers. Even where the conquered resisted converting to Islam, the political organization of the conquerors was largely adopted. The most noted example of this form of political organization in the study area is the *royaume* or kingdom of Rey Bouba, which extends over an area 32,000 km².[2] The relatively large size of the territory governed by *Rey Bouba* and other "royalty" is reinforced by the absolute power that *Alhamidou* (also known as *lamido* or *hamidou*) has over his subjects. Within the context of the modern state this form of government is a prime example of what one might call a state within a state.

Within his kingdom the *Alhamidou* is represented by what are referred to as *dougaari* at the regional level and a *djaioro* at the village level. It would be a mistake to think of these people as forming a hierarchy of power, however. In his territory, the *lamido* is the absolute ruler; the *dougaari* and *djaioro* are mere vehicles for the exercise of that power. They are his eyes, ears, *porte-parole*, and arms.

D. Administrative Structure

In terms of its administrative structure Cameroon is divided hierarchically into 10 provinces that are, in their turn, divided into 58 *départements*, subdivided into *arrondissements*, districts, and *chefferies* (Figures 1 and 2). In reference to the administrative level of *département*, people sometimes speak of the *préfecture* as if the two terms are synonymous. In fact the word *préfecture* refers more precisely to the seat or *chef-lieu* of a *département*.

A governor who acts on behalf of the president of the republic sits at the head of each of the 10 provinces in the country. In carrying out his administrative duties, each governor is assisted by *préfets* (at the level of *département*), *sous-préfets* (at the level of the arrondissement), and

[2]Rey Bouba's power surpasses that of other Alhamidous. Some of this power goes back to about 1890 when the present Alhamidou's father had the foresight of supporting the French against German control. In recognition the French reinforced his power by according him full control over an area of about 32,000 km², subsequently known as "*territoire Rey Bouba*." The territory is situated in the North Province in the Département of Mayo Rey.

district chiefs (at the level of the district). Somewhat parallel to this administrative structure lies another structure, part traditional" and part remnant of a colonial administration: the chefferie; the *canton* headed by a *chef de canton*; the *groupement* of villages, headed by a *chef de groupement*; and the village.

According to their real or perceived importance, chiefs are classed into: *chefs de premier degré, chefs de deuxieme degré*, and *chefs de troisième degré*. In urban areas, the chiefs of various degrees are paralleled by mayors.

Within the government structure these various levels of administrative divisions fall within the formal authority of the Ministry of Territorial Administration.

FIGURE 1
ORGANIZATION OF TERRITORIAL ADMINISTRATION IN CAMEROON

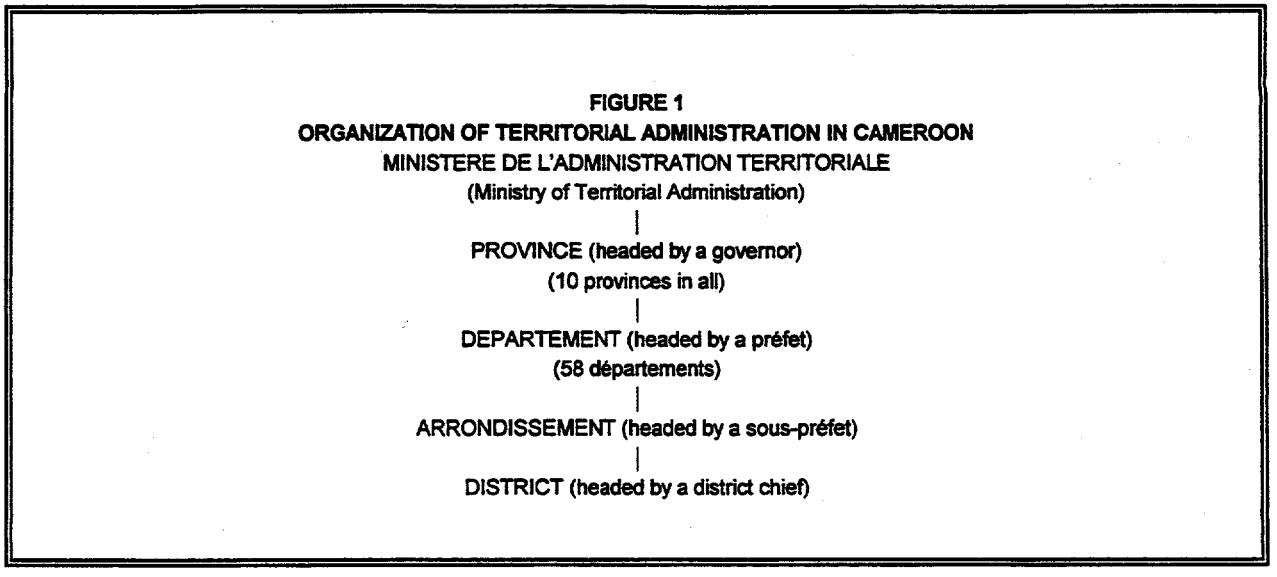
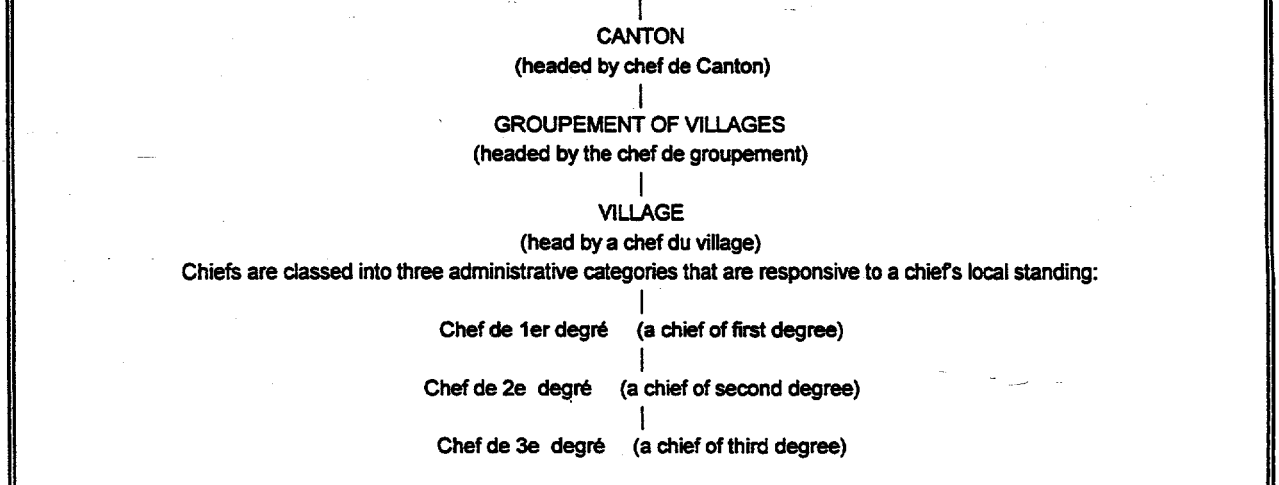


FIGURE 2
TRADITIONAL CHIEFTAINCY ORGANIZATION



IV. PRODUCTION SYSTEMS

A. Introduction

The study area is occupied by a large number of small farmers, herders, fishers, and hunters and gatherers who derive their livelihood from exploiting the resources of the area simultaneously and successively throughout the year. The groups are not homogeneous. There are ethnic, linguistic, age, gender, class, and occupational variations, to cite only a few differentiating factors. Differentiation is not restricted to that which we note among groups as there is a great deal of inter- and intra-household differentiation within groups, correlated to their differential access to land, labor, and capital resources. The agricultural, forestry, dairy products, and fish circulate among the groups through markets and formal and informal exchange relationships.

Although certain activities may be the specialty of specific groups (animal husbandry for the Bororo and Fulbe, farming for the Mboum, fishing for the Batanga, and hunting and gathering for the Pygmies, for example), most households engage in at least two to three of the activities that their region provides. Farmers keep herds and engage in fishing and hunting and gathering activities, especially in the dry season in northern areas, and herders, fishers, and hunters and gatherers engage in agriculture.

The combination of activities and the forms they take vary from region to region, season to season, and from one ethnic group to another. Even though Mboum and Mbaya women are very active in agriculture, for example, it would be unlikely for a Fulbe woman from the same village and with a similar household profile to be seen on the farm.

Side by side with the numerous small producers are the large operators, be they national, international, governmental, parastatal, or private.

B. Systems of Production

Before examining each component of the production system in the study area, we shall review briefly the agroecological characteristics of each of the four areas of socioeconomic survey – Touboro, Meiganga, Nanga Eboko and Kribi – since it is these characteristics that determine the organization of production and household allocation of resources and labor strategies.

The Kribi area, corresponding to the largely Bantu villages of Bidou I and II, Bikondo, Bissiang, Makoura I and II, Ngovayang and Ngoyang, the peri-urban areas/urban neighborhoods of Boamanga, Ebomé, Ikeiké, and Zaire, and the Pygmy camps of Maschuer-Maschuer and Ngongro, features rainfall levels that oscillate between 1,500 to 2,000 mm per annum,

considerably higher than the rest of the region. Moreover, rainfall is spread throughout the year with two highs in September and March/April and two lows in December/January and July/August. The generous rainfall pattern makes the area conducive not only to cultivation all year round of a large number of crops (tuber crops, vegetables, and a variety of fruit trees) but also to a rich mixture of production strategies: agriculture, fishing, hunting and gathering, animal husbandry, commerce, and petty trade.

Of the 14 sites surveyed in the Kribi area, 11 consider subsistence farming or the cultivation of food crops for the primary objective of household consumption (Table 11) the production system of first importance. Three, all primarily fishing villages, declared fishing the most important activity, followed by subsistence agriculture. Despite the undisputed importance of fishing in these village, the high emphasis that respondents put on fishing also could be attributed to the fact that larger scale ocean fishing is primarily a male activity while agriculture is primarily female. Hunting and gathering also is a very important component of the production system, attributed to the fact that the area abounds with dense and gallery forests and is the home of several Pygmy camps.

TABLE 11
SYSTEMS OF PRODUCTION IN THE KRIBI AREA

Village	1st Importance	2nd Importance	3rd Importance
Bidou I	Subsistence Farming	Hunting & Gathering	Animal Husbandry
Bidou II	Subsistence Farming	Hunting & Gathering	Animal Husbandry
Bikondo	Subsistence Farming	Animal Husbandry	Hunting & Gathering
Bissiang	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Boamanga	Fishing	Subsistence Farming	Animal Husbandry
Ebome	Fishing	Subsistence Farming	Cash Crop Farming
Ikeike	Fishing	Subsistence Farming	Animal Husbandry
Maschuer-Maschuer	Subsistence Farming	Hunting & Gathering	Cash Crop Farming
Makoura I	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Makoura II	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Ngongro Pygmies	Subsistence Farming	Hunting & Gathering	Cash Crop Farming
Ngovauang	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Ngoyang	Subsistence Farming	Hunting & Gathering	Animal Husbandry
Zaire	Subsistence Farming	Fishing	Commerce

The other two activities that were noted as important are commerce and petty trade and animal husbandry.

As mentioned above, in the agricultural domain, people distinguish between what they call "subsistence" and "industrial" or "plantation" crops. The term "subsistence" should not mislead us into thinking that these crops are intended strictly for household consumption. Even though the primary function of these crops is household consumption, almost everything that the

household consumes also is marketed raw, processed, or cooked, primarily by women and children. In fact it appears that most households' needs of oil, sugar, petrol, etc. are taken care of by women and are paid for primarily by this type of petty trade. When people were asked to list the 10 most important crops in their villages, cassava always was mentioned first. The other frequently mentioned crops were plantain, macabo, cacao, bananas, cocoyam, sweet potatoes, potatoes, and groundnuts (Table 12). People did not always mention fruit trees when asked about cultivation since many of the trees are considered "wild." All of the sites listed at least 8 different "cultivated" crops; several listed the requested 10.

Industrial or plantation crops refer mainly to cacao, coffee, and oil palm trees. Farms where these crops are planted are referred to by villagers as plantations, irrespective of the size. The area also is the home of large agroindustrial plantations and factories such as SOCOPALM.

Except for those who cultivate industrial crops on a somewhat larger scale, very few of the Kribi sites use agricultural inputs such as fertilizers, plant health protection products, or improved seeds. None of the sites reported the use of animal traction or agricultural machinery. As a matter of fact, very few cattle were seen in the area.

TABLE 12
CROPPING PREFERENCES IN THE KRIBI AREA

Village	1st Importance	2nd Importance	3rd Importance
Bidou I	Cassava	Macabo	Plantain
Bidou II	Cassava	Macabo	Plantain
Bikondo	Cassava	Macabo	Plantain
Bissiang	Cassava	Plantain	Macabo
Boamanga	Cassava	Plantain	Vegetables
Ebome	Cassava	Cacao	Cacao
Ikeike	Cassava	Plantain	Macabo
Maschuer-Maschuer	Cassava	Bananas	Macabo
Makoura I	Cassava	Macabo	Bananas
Makoura II	Cassava	Macabo	Bananas
Ngongro Pygmies	Cassava	Plantain	Concombre
Ngovauang	Cassava	Cacao	Macabo
Ngoyang	Cassava	Plantain	Macabo
Zaire	Cassava	Plantain	Macabo

Nanga Eboko, represented in our sample by Abang I (a Hausa neighborhood in the town of Nanga Eboko), Biboto, Bifogo, Bilone (a neighborhood in the town of Nkoteng), Bitam, Camp Martin and CAMSUCO Cité 3 (both are sugar factory neighborhoods in the town of Nkoteng), Epegang, Etignang, Kaa, Mamra II (a "native" neighborhood in the town of Mbandjock), Mendjoui, Mengang, Mendongo (a "native" neighborhood in Nanga Eboko), Metsim (a "native"

neighborhood in Mbandjock), Meyang, Minkouma, Ndjoré and Ndjoré II, Ndjombé, Nkoayos, Sika), and Simbane feature rainfall levels similar to what we have seen in the Kribi area; in other words in the lower edge of the 1,500 to 2,000 mm range per annum. As in the Kribi area, rainfall is spread throughout the year with high peaks in September and March-April, known respectively as "*la grande saison des pluies*" and "*la petite saison des pluies*".

Cropping patterns (tubers, groundnuts, vegetables, and various fruit trees cultivated all year round) and production strategies (agriculture, fishing, hunting and gathering, animal husbandry, commerce and petty trade) also are similar to what we have seen in Kribi, with more emphasis on animal husbandry/herding as a third alternative.

Of the 23 sites covered in this area, 15 considered subsistence farming their primary activity (Table 13). Five elected cash crop farming with subsistence farming as the alternative of second importance. Of the five, only CAMSUCO Cité 3, a neighborhood of sugar plantation agricultural and factory workers, seems a clear case of "industrial" crop orientation. The others are much more likely to be a gender issue or a case of misunderstanding, perhaps both. Even though women are the principal providers of household agricultural labor[3], plantation farming at any scale generally is considered a male occupation. Since community-level surveys generally were dominated by men, despite the presence of women, it is not illogical that male activities are considered and accepted by at least some of the women as more important, especially when it is the principal cash-generating activity. In this context the fact that it is subsistence farming that is taking care of most of the household's food requirements does not seem as important.

TABLE 13
SYSTEMS OF PRODUCTION IN THE NANGA EBOKO AREA

Village	1st Importance	2nd Importance	3rd Importance
Abang I	Commerce	Subsistence Farming	Cash Crop Farming
Biboto	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Bifogo	Subsistence Farming	Cash Crop Farming	Fishing
Bilone	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Bitam	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Camp Martin	Salaried	Cash Crop Farming	Subsistence Farming
CAMSUCO Cité 3	Cash Crop Farming	Salaried	Hunting & Gathering

[3]The only exception that we have encountered among populations whose main occupation is agriculture are the Fulbe. Among the Fulbe it is considered very shameful for a woman to be seen performing agricultural tasks. This could be a function of the fact that traditionally the Fulbe are herders who tended to look down at agricultural work, whether it was performed by men or women. Until recently, even sedentarized Fulbe did not have extensive direct involvement with agriculture, which was performed for them by members of other ethnic groups. The fact that the ethnic groups among whom the Fulbe live and, very often, whom they dominated through conquest, are no longer willing to provide manual labor for the Fulbe "masters," coupled with the economic hardships that the entire country is facing, forced Fulbe men to get more directly involved in cultivation. It has not yet had the same effect on Fulbe women, however.

TABLE 13
SYSTEMS OF PRODUCTION IN THE NANGA EBOKO AREA
(CONTINUED)

Village	1st Importance	2nd Importance	3rd Importance
Epegang	Cash Crop Farming	Subsistence Farming	Animal Husbandry
Etignang	Cash Crop Farming	Subsistence Farming	Animal Husbandry
Kaa	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Mamra II	Subsistence Farming	Cash Crop Farming	Fishing
Mendjoui	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Mengang	Subsistence Farming	Cash Crop Farming	Fishing
Mendongo	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Metsim	Subsistence Farming	Cash Crop Farming	Fishing
Meyang	Cash Crop Farming	Subsistence Farming	Animal Husbandry
Minkouma	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Ndjore II	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Ndjore	Cash Crop Farming	Subsistence Farming	Animal Husbandry
Ndjombe	Cash Crop Farming	Subsistence Farming	Animal Husbandry
Nkoayos	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Sika	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Simbane	Subsistence Farming	Cash Crop Farming	Animal Husbandry

Whether it is "subsistence" or cash-oriented, agriculture clearly is the most important production activity in the area. The only two exceptions in this sample were Abang I, an urban neighborhood of Hausa merchants, and Camp Martin, a factory workers' neighborhood in the town of Nkoteng.

The order of the list of crops also reflects the position of respondents, mostly male. For example, some sites declared subsistence cultivation as more important than cash crop farming, often putting coffee and cacao before cassava, even though it is the latter that is feeding the household and paying for essential needs such as sugar, salt, oil, and flour (Table 14).

TABLE 14
CROP PREFERENCES IN THE NANGA EBOKO AREA

Village	1st Importance	2nd Importance	3rd Importance
Abang I	Maize	Cassava	Groundnuts
Biboto	Cassava	Groundnuts	Maize
Bifogo	Coffee	Cacao	Plantain
Bilone	Groundnuts	Maize	Cassava
Bitam	Cacao	Coffee	Plantain
Camp Martin	Cassava	Maize	Groundnuts

TABLE 14
CROP PREFERENCES IN THE NANGA EBOKO AREA
(CONTINUED)

Village	1st Importance	2nd Importance	3rd Importance
CAMSUCO Cité 3	Sugar Cane	Cassava	Macabo
Epegang	Coffee	Groundnuts	Cassava
Etignang	Cacao	Coffee	Plantain
Kaa	Cacao	Coffee	Groundnuts
Mamra II	Cassava	Maize	Groundnuts
Mendjoui	Cacao	Maize	Groundnuts
Mengang	Plantain	Bananas	Cassava
Mendongo	Coffee	Plantain	Cacao
Metsim	Cassava	Groundnuts	Maize
Meyang	Coffee	Cacao	Groundnuts
Minkouma	Maize	Groundnuts	Sesame
Ndjore II	Cacao	Cassava	Plantain
Ndjore	Groundnuts	Maize	Cassava
Ndjombe	Cacao	Coffee	Cassava
Nkoayos	Cacao	Sweet Potatoes	Tomatoes
Sika	Cacao	Coffee	Cassava
Simbane	Groundnuts	Maize	Cassava

Meiganga, represented in the sample by Bakoungue, Fada, Gbaata, Hori Kouni, Madding, Mbaraang, Meidougou, Meiganga I (a neighborhood of the town of Meiganga), and Ngoa, forms a part of what might be called a sudano/humid tropical zone that is characterized by a long rainy season (March-November, concentrated in the period May-October) that ranges between 500 mm per annum in the extreme north of the area to around 1,500 mm in the extreme south.

Cropping patterns and production strategies are different from what were seen in the previous two areas. Cassava remains a very important crop choice (6 out of 10 sites), but maize was declared as the crop of first importance in 40 percent of cases (Table 15). Even though rarely listed as crops of second or third importance, sorghum, millet, and sesame appear as other crops of choice. Another noticeable difference is the apparent lesser importance of groundnuts (only 20 percent of sites surveyed mentioned groundnuts as a crop of third importance; one percent as a crop of first or second importance). Furthermore, the crop never appeared (not represented in table) as of fourth or fifth importance.

TABLE 15
CROP PREFERENCES IN THE MEIGANGA AREA

Village	1st Importance	2nd Importance	3rd Importance
Bakoungue	Cassava	Maize	Groundnuts
Fada	Maize	Cassava	Groundnuts
Gbaata	Cassava	Maize	Bananas
Hori Kouni	Maize	Sorghum/Millet	Cassava
Madding	Cassava	Bananas	Avocados
Mbaraang	Cassava	Maize	Macabo
Meidougou	Cassava	Maize	Cocoyams
Meiganga I	Cassava	Maize	Cocoyams
Ngoa	Maize	Cassava	Sorghum/Millet
Sabongari	Maize	Cassava	Green beans

In terms of production systems, of the 10 sites surveyed all but one, Sabongari, a Hausa word that means "new town," considered subsistence cultivation the most important part of the system; in 7 out of 9 cases, this was followed by cash crop farming (Table 16). As in the other two regions, agriculture, whether subsistence or cash-crop oriented, is considered the most important component of the production system, followed by animal husbandry. There also is more of a continuation between what is considered subsistence and cash cropping since one of the most important cash crops in the area is maize, also an essential part of household diets.

The choice in Sabongari of animal husbandry/herding, followed by commerce as the production strategies of first and second importance are logical since this urban neighborhood of Meiganga is inhabited chiefly by Fulbe herders and livestock merchants.

TABLE 16
SYSTEMS OF PRODUCTION IN THE MEIGANGA AREA

Village	1st Importance	2nd Importance	3rd Importance
Bakoungue	Subsistence Farming	Cash Crop Farming	Hunting & Gathering
Fada	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Gbaata	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Hori Kouni	Subsistence Farming	Animal Husbandry	Hunting & Gathering
Madding	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Mbaraang	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Meidougou	Subsistence Farming	Animal Husbandry	Hunting & Gathering
Meiganga I	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Ngoa	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Sabongari	Animal Husbandry	Commerce	Subsistence Farming

Touboro, represented in the sample by Baldi, Bogdibo, Djom, Kouman, Mbaiboum, Mbodo, Sogbe, Sodecoton I, Touboro I, and Wangtounou, is part of the sudano-sahelian zone,

characterized by a single rainy season that extends from about June to October, with a peak in August, and average annual rainfall of 400 mm to 700 mm as one goes from north to south.

The trend seen from south to north continues through Touboro. As in other parts of the country, mixed subsistence agriculture with a locally-marketed small surplus and the cultivation of male-dominated cash crops is the predominate mode ofproduction. Except in one site, Wangtounou, animal husbandry/herding is the third most important economic activity (Table 17).

TABLE 17
SYSTEMS OF PRODUCTION IN THE TOUBORO AREA

Village	1st Importance	2nd Importance	3rd Importance
Baldi	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Bogdibo	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Djom	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Kouman	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Mbaiboum	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Mbodo	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Sogbe	Cash Crop Farming	Subsistence Farming	Animal Husbandry
Sodecoton I	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Touboro I	Subsistence Farming	Cash Crop Farming	Animal Husbandry
Wangtounou	Subsistence Farming	Cash Crop Farming	Fishing

Even though agriculture remains the most important productive activity in all of the areas surveyed, as shown Table 17, there are important differences in cropping patterns and production strategies from one area to the next, the longer the north-south distance between two areas, the more dramatic the differences becoming.

The most noticeable difference here is the different mix of crops and the role relegated to cassava cultivation: only 2 out of 10 sites listed cassava as a crop of first importance (Table 18). Interestingly, although only 1 site, Sogbe, listed cash cropping as of first importance, 3 of the sites (Djom, Mbaiboum, and Touboro I) listed cotton first among the 10 most important crops. Other than cassava, very few other tuber crops were ever mentioned. Moreover, sesame, considered very important in the Meiganga area, was listed as of sixth or seventh preference, and only by 4 sites.

TABLE 18
CROP PREFERENCES IN THE TOUBORO AREA

Village	1st Importance	2nd Importance	3rd Importance
Baldi	Sorghum/Millet	Maize	Cotton
Bogdibo	Maize	Groundnuts	Cotton
Djom	Cotton	Sorghum/Millet	Maize

TABLE 18
CROP PREFERENCES IN THE TOUBORO AREA
(CONTINUED)

Village	1st Importance	2nd Importance	3rd Importance
Kouman	Cassava	Sorghum/Millet	Maize
Mbaiboum	Cotton	Maize	Groundnuts
Mbodo	Cassava	Cotton	Maize
Sogbe	Groundnuts	Maize	Sorghum/Millet
Sodecoton I	Maize	Groundnuts	Cassava
Touboro I	Cotton	Maize	Sorghum/Millet
Wangtounou	Maize	Groundnuts	Green beans

Even though the Yaoundé Pass, corresponding to the sites of Akono I, Angon II, Binguilla II, Ngoya I, Nkometou II, Nkometou III, Nkolnlong I, Nkolkoumou, Nkolngok Sa'a, and Okoa, is part of the same agroecological zone as the Kribi area where year long rainfall levels oscillate between 1,500 to 2,000 mm per annum, it is listed separately because of its close proximity to the capitol city of Yaoundé. This gives Yaoundé Pass some peri-urban attributes that, despite the presence of some large and important urban centers, are not as prominent in the rest of the region.

Despite the fact that all 10 sites listed subsistence farming as the most important component of the production system, the second choice is invariably cash crop farming. When we look at the mix of crops, however (Table 19), cassava is listed in only 4 out of 10 cases. The other crops are cacao (listed three times), groundnuts (listed twice), and plantain. Another feature of this community, which is not obvious in the quantitative material assembled, but was learned through qualitative data gathering, is the importance of commerce, labor migration, and the large number of non natives residing in or around the villages.

TABLE 19
CROP PREFERENCES IN THE YAOUNDÉ PASS AREA

Village	1st Importance	2nd Importance	3rd Importance
Akono 1	Cacao	Groundnuts	Cassava
Angon II	Cassava	Plantain	Macabo
Binguilla II	Groundnuts	Cassava	Macabo
Ngoya I	Cassava	Groundnuts	Macabo
Nkometou II	Cacao	Maize	Groundnuts
Nkometou III	Cacao	Cassava	Plantain
Nkolnlong I	Groundnuts	Cassava	Macabo
Nkolkoumou	Plantain	Bananas	Cassava
Nkolngok Sa'a	Cassava	Cacao	Plantain
Okoa	Cassava	Macabo	Taro

For the region as a whole (Table 20), as well as for each area separately (Tables 11-19), small scale, subsistence agriculture remains the pulse of Cameroon's rural, peri-urban, and urban economy. Of 68 sites surveyed 53 listed subsistence farming as the most important component of the production system. It is extremely important, as we mentioned earlier, not to allow the term "subsistence" to force the conclusion that what is called "subsistence farming" is strictly for household consumption. Consumption is indeed the prime objective of household production. In an economy where income earning opportunities are sparse, and where land is relatively abundant and rainfall is generous, this should not come as a surprise. Literally, everything that the household produces to eat, the household sells, however, mostly by women and children. Generally speaking, the volume of this circulation of goods is small since most families produce more or less the same mix of crops. The volume of trade increases proportionately to proximity to larger towns and urban centers and the presence of workers and others who are not primarily food growers; primarily, because given the opportunity, almost every household in Cameroon is involved in food production.

Given what we have presented above it is not surprising that cash cropping has been selected as the production component of most importance in 10 of the sites and of secondary importance in 45. Nowhere, however, has any region, village, peri-urban area, urban neighborhood, or a household indicated reliance on a single strategy, whether subsistence or cash crop farming, herding, fishing, hunting and gathering, commerce, or salaried jobs, to provide for essential household needs. Part of the reason is that, for the majority of Cameroonians, no single source of income is sufficient to take care of all needs. Farmers have to supplement their income by petty trade, animal husbandry, fishing, hunting and gathering. Herders, including the transhumant Borroro, avowed pastoralists, and the Pygmies, dedicated hunters and gatherers, increasingly are becoming involved in farming.

TABLE 20
PRODUCTION SYSTEMS OF 1ST, 2ND, AND 3RD IMPORTANCE IN STUDY AREA

Production System	1st Importance	2nd Importance	3rd Importance
Subsistence Farming	53	13	2
Cash Crop Farming	10	45	3
Fishing	3	2	7
Commerce	1	1	1
Herding	1	2	42
Salaried Jobs	1	1	0
Hunting & Gathering	0	5	14

Diversification is thus a most important survival strategy in Cameroon. As we shall see later, the necessity to diversify sources of income also is becoming increasingly a source of ethnic conflict, especially over land and cultivation rights.

C. Agriculture

Agriculture in its various forms (hoe horticulture, bush fallow, rotation bush fallow, rotation cultivation, recurrent cultivation, irrigation, cash crop farming and agroindustry) remains the single most important component of the production system. Whether we are discussing the household, the village, the region, or the nation, diversification of the sources of income lies at the crux of labor strategies in Cameroon. Animal husbandry, fishing, hunting and gathering, artisinal work, manufacturing activities, commerce, and petty trade are among the important elements in this strategy.

Slash-and-burn cultivation, also known as shifting cultivation, remains widely practiced; although population growth, migration to the area, and the resultant pressures over land use rights have decreased the efficacy of this form of cultivation. Slash-and-burn cultivation ideally is suited to, "areas having low population density, plentiful land resources, and low level of technology" (Anthony, Johnston, Jones, and Uchendu 1979: 128). As the population increases, this form of cultivation is less appropriate because of the necessity of fallowing.

Summarily, the system consists of clearing land, usually forest and savanna land, by slashing and burning vegetation, cultivating the clearing for two or three years, and abandoning the field. At times, shifting cultivation is accompanied with relocation of villages to be in closer proximity to newly cleared fields:

> "Land is prepared for crops by cutting down and burning the vegetative cover and cultivating with a hoe. Clearing exposes soils to erosion until crops are sufficiently established to provide ground cover. Intense leaching and the removal of nutrients by crops lead to rapid loss of soil fertility during the arable phase of the cropping system. Yields of successive crops decline rapidly, and land has to be rested for long periods to restore fertility; cultivation periods are customarily two to six years and fallow periods, six to twenty years" (ibid.: 122).

In addition to assuring the household of a year-round supply of consumable goods, mixed cropping, a traditional practice in all the areas surveyed, reduces the danger of soil erosion encouraged by land clearing.

The expansion of cash cropping, coupled with rapid population growth and the relocation of populations, is putting new pressures on the land. Although the exact ratio differs from one area to another, a "must" in a successful shifting cultivation operation is land abundance to

allow an adequate crop-fallow rotation. "In very fertile areas, where bananas are the staple food crop, less than twice the cropped area may need to be included in the crop-fallow rotation. But in forest areas, where a long resting period has to be provided, more than ten times the cropped area many be needed" (ibid.: 130).

Whatever the cause might be, the most frequent and immediate response to land pressure is reducing the fallow period. Invariably, as we have seen in all the areas we have surveyed, this is accompanied by declining soil fertility and lower crop yields. Paradoxically, this necessitates the expansion of farm size to compensate for lost fertility, which in turn leads to further reduced fallow periods and declined productivity. A side effect of reduced fallow periods is the reduced regrowth of fallow areas, increased soil erosion, and a progressive replacement of forests with savanna. A recurrent response to inquiry regarding the extent of forests in village vicinities and forest activities was, "we used to have big and rich forests, with many animals to hunt, fruits and herbs to collect, and fields to clear; we no longer do; all we have now is the bush."

Irrespective of agroecological and local differences, most inhabitants are subsistence farmers who produce the bulk of their food requirements as well as some cash crops. Moreover, almost invariably, a certain portion of the food crops grown mainly for household consumption are marketed. Thus, in the peasant farmer's mind, there is not a strict distinction between what is eaten and what is sold.

Staple crops change by region, subregion, and locale. In the forest zone for example, cassava, supplemented by yams, cocoyams, and sweet potatoes as other sources of starch, are the staples. These root crops often are interplanted with bananas and some minor crops including chiles, vegetables, and other green leaves, a very important component of local diet. Farmers often intercrop new coffee and cacao plantations with root crops and banana trees which serve to provide a return on newly cleared lands until cocoa and coffee plants start yielding.

In the savanna zone, cassava and other root crops are replaced by cereals such as maize, sorghum and millet, in addition to groundnuts and beans. Cassava, yams, cocoyams, and sweet potatoes, along with chile peppers and leafy vegetables, serve as supplementary crops.

1. Access to Land, Land Tenure, and Land Use

a. Kribi, Nanga Eboko, and the Yaoundé Pass

Although an appearance of "collectivity" in land ownership predominates, the nature and extent of collective rights over land differ as we move from south to north and seem to be closely correlated with what we referred to as *le Cameroun des villages*, *le Cameroun des chefferies*, and *le Cameroun de royaume*. Generally speaking, in *le Cameroun des villages*, which

corresponds to the areas of Kribi, Nanga Eboko, and the Yaoundé Pass, the land in the residential zone of each village, with some variation, is collectively owned by the living members of a founding lineage. It is there where dwellings are constructed, villages erected, ancestors buried, and main food crops cultivated.

While in principle collectively owned, the degree of a clan's joint authority over bush land outside the limits of residential zones is curtailed by the individual clan members' rights and rights of members of nearby residential zones. Land, if not previously claimed, seems to belong to the individual who first cleared it and these rights are inherited by his children after him.

Field surveys in the regions of Kribi, Nanga Eboko, and the Yaoundé Pass support the above general observations. To a question concerning access to land the invariable response was "family heritage." Each family, usually a polygynous household, has what seems to be undisputed rights to specific parcels of land that were cleared by an ancestor. In certain areas, for example Ngoya I in the Yaoundé Pass, land shortage rather than lack of land use rights might drive some family members to search for land elsewhere, preferably nearby. Access to a certain parcel remains active even if the person moves away. His parcel(s) can be cultivated in his absence but not with permanent crops since the land has to revert back to him upon his return. Theoretically, this applies even in cases of land shortage.

With some variation, "formal" land use rights are restricted to male offspring. Although women perform the bulk of agricultural work, their rights to land are exercised in the context of marriage. A mother might allocate a portion of her field to an unmarried daughter, however, to cultivate until she departs in marriage. Although marriage means more duties than rights for women, it gives them the right to cultivate and to the labor of their husbands to clear the fields.

The response in the Kribi area to the question of women's rights to "their own fields" varied within the same areas. In Ikeiké, a neighborhood of Grand Batanga, for example, the response was: "Why should my wife have her own farm? Do I give her her own house to live in? She lives in my house and she cultivates my land. She comes from another village, all wives do, and they do not have any land rights here. They are here to provide labor and feed the family." In Boamanga, another neighborhood, the response was, "Everyone in the household has the right to a piece of family land if they want to cultivate; most certainly wives and daughters since they do most of the work. Agriculture is women's work; we only help them clear the land. We men are fishermen." Most sites were more moderate in their responses, "Land belongs to the clan; more precisely to clan men; women may use the land but never acquire any property rights; marriage takes our daughters away from the villages of their fathers and brings girls from other villages to become our wives; they are strangers; we cannot give them the land that belongs to our ancestors and we cannot give it to our daughters because of their husbands; they are not part of our clan and have no rights to clan lands".

b. Meiganga

With some regional and local variations, in *le Cameroun des chefferies*, land seems to be the "property" of the superior chief who divides it among lineage, clan, and village chiefs who in turn divide it into parcels among the families that reside in their domain of authority. This ownership is more symbolic than real, however, since a chief at any level, cannot deny any man his entitlement to land. Once land is parceled out it remains in the "possession" of the lineage, clan, or household "permanently." The land reverts back to the "original" distributor only if the unit with land use rights dies out or moves out of the area permanently.

Another particular feature to this region, chiefly because of the existence of large herds of cattle either permanently or in transhumance and important livestock markets, is the careful delineation of agricultural land and rangeland. The areas reserved for agriculture, known locally by the Fulfulde term *hadondé*, are always near the village, technically on the village grounds. They are strictly forbidden to cattle grazing even after harvest and during fallow periods. In villages with two or more important ethnic groups, as in Gbaata for example, each group, in this case the Fulbe and the Baya, has its own reserve. The Bororo pastoralists do not have *hadondé* rights. They have the right to register their official objection to the *préfet* or *sous-préfet* if a *hadondé* is delineated in the path of their animals, however, cutting them off from their water sources or their summer or winter pastures.

2. Land Conflict

Facilitated by low population density and generous supplies of virgin lands (bush and forests), the "collective" ownership system of land tenure and land use, in all its forms, was extremely generous towards landless non-natives. Land was allocated rather freely and strangers welcomed, as evidenced by the presence of several "pioneer" villages in the Nanga Eboko area, for example. The swift expansion of cash cropping coupled with the dwindling of existing land resources (caused by the arrival of large scale parastatals and private sector organizations (agroindustry, forestry, etc.), population movements, and rapid population growth) is changing the nature of access to land and creating overt and covert land use conflicts between natives and non-natives, parastatals, and natives, etc.

Responding to the question whether there was conflict over land use, a typical response from *autochtones* was, "Naturally there is conflict over land; the population is increasing but the land area stays the same and the fertile areas keep shrinking. Most of the problems are with the *allogène* (non-natives), however."

In some of the southern sites such as Ikeiké, people differentiated between two types of conflict: (1) conflicts over ancestral land, and (2) conflicts over bush or forest land at some distance from

village. "The land that has been cleared by you, your father, or your ancestors belongs to you; it cannot be cultivated by another without your permission even if it stays uncultivated for years. Conflicts over this type of land usually are with brothers or among cousins, and they normally are resolved by elders (*les notables*). If they fail, it will be dealt with through local authorities who use the advice of the elders in arriving at their decisions." Conflict over bush land is more likely to be with members of other villages or non-natives. Other respondents like those in Okoa and Angon II (Yaoundé Pass) indicated the presence of conflict among natives, usually over field limits. All insisted that internal conflicts, in other words conflicts among locals, are resolved locally. In the same area a common complaint was against non-natives with money, "who deceive the native and buy the land for little money." This creates many problems because, in most cases, those who sell the land do not have the authority to sell it since it is owned collectively. Those accusations were corroborated by local authorities who said that most local court cases are over disputed land sales.

Another common accusation against non-natives was that they often cultivate the land without authorization, keep it for too long, or turn it into permanent fields by erecting plantations; in other words planting crops such as cacao, coffee, and bananas, which are considered permanent.

In areas inhabited mostly by non-natives, such as the CAMSUCO Cité in Nanga Eboko, the accusations took another direction in terms of land access. Some sugar plantation and factory workers exclaimed, "Everybody needs to grow some crops to take care of their families; we are not different from others; salaries and wages are not enough to take care of all household needs; our wives need also to work if we are going to survive, especially considering the economic crisis. Our needs are as great as those of the natives although they do not see it that way." These declarations were interrupted with an argument between new and old arrivals. The old arrivals feel that the relationships between them and the natives were much better when they first arrived. Land was given away freely and they were more respectful of native traditions and practices. New arrivals have prejudiced the natives not only against the recent comer, but also against some of the older ones. "They are becoming more quarrelsome towards us," expressed one old comer, "especially when we meet in bars and after a few drinks; especially the young people who want us to pay for their beer."

However, the access of non-natives to the land from a native's viewpoint took on a totally different shade. In the village of Kaa, also in Nanga Eboko, a village elder said, "The entire land area, from here to the station in Nanga Eboko, is our heritage. It was left to us by our ancestors and we shall leave it for our male descendants. Women have their farms but they do not have ownership rights. You never sell the land. Strangers can be granted temporary use rights; if they are good, we can leave these rights with them indefinitely. When we do not accord a stranger cultivation rights, it is not always a question of *manque de terrain* (lack of parcels). We have to approve of them first; they should come and live with us for a while; we shall give them enough land to construct a hut and start a small field to feed his family; all this time he is being

tested; we watch his words, his movements, his gestures. If we approve of him, we might give him more land." To the question of what a stranger needs to do to gain the elders' approval they responded, "He has to respect us and stand by us when we need him; *le respect, la reconaissance.*" In defining approval the elders referred to the difference between giving someone a piece of land to grow food and of making him a member of the community with rights and duties, "*pas de problème avec les cultures vivrières; mais avec les cultures de rapport c'est une autre chose.*"

This last quotation indicates that another reason why the tradition of giving land away freely is changing is because today's recipients do not feel the same degree of loyalty to the "owners" as before. This could be partly a function of the fact that land is regarded by incoming strangers as state property. "They pretend they respect us before, but once they get the land they do not show respect anymore." Strangers on the other hand use the argument, "We are all Cameroonians, we show our respect to old traditions by asking them, but when they refuse for no good reason, we do not like it." In this regard there tends to be a difference among younger and older migrants where the former are more likely to disregard local rights clinging to the "we are all Cameroonians" argument. However, the same people who use this line of argument tend to change their tone when you ask them what their response would be if the situation were reversed.

Interestingly, a common enough response in the Touboro area was, "There is no conflict at all." When pressed some added, "The land is not ours to fight over or to distribute to others; it belongs to *Alhamidou* and he can afford use rights to whomever he chooses."

Another dimension of conflict over land and forest resources is that between the ancestral rights of natives and the legal rights of the government. Among the common but somewhat guarded views on the issue was that expressed by a chief in the Kribi area, "We use the forest to cultivate and to collect firewood, we do not cut wood indiscriminately. This is our forest and we protect it; we cut the wood only if there is not enough to collect and only the more common species. Nowadays, we need the permission of the government to harvest our own forests. I do not know if they require the same of the *grands exploitants* who are destroying our forests. The wood that a family might cut in an entire year does not equal even one tree that these *exploitants* remove. They never ask our permission although these are our forests, but the government says they are not ours, they are theirs'." The chief added with a grin on his face, "The government is wise, they must be right." He continued, "The government has become *mon mari; c'est lui qui commande* (the government has become my husband; it is [him] that commands)." When this question was pursued a bit further, and he was questioned about the position of wives, the chief retorted, "*le mari est le seul chef de la famille; la femme est le ministre de l'interieur* (the husband is the only chief of his family; the wife takes the function of the Minister of Interior)."

3. Multiple Usage and Multiple Rights

An important issue that comes to mind as we discuss differential access to resources and land tenure/land use conflict is that of multiple rights to and multiple usage of the land. Officially, all unregistered land in Cameroon is the property of the government, and the government can dispose of it as it wishes. Since land registration virtually is absent in rural areas, the entire natural resource endowment in the country, including lands used for household subsistence farming, cash crop farms, and forest resources, are within the public domain. This "interpretation" of land tenure law is the one that the government embraces in all cases of small and large scale agricultural development projects, agroindustrial installations, and the granting of forest exploitation rights to parastatal organizations and international and national private sector firms.

Even in those situations, "unofficial," "traditional" rights are not overlooked totally, as compensation that is associated with the "expropriation" of these resources. To maintain its official claims to the land, however, the government is exigent in its insistence that the compensation offered to farmers are for crops on the land not for the land itself. In addition to a substantial lowering of compensation costs, this simplifies the compensation process since establishing rights to standing crops on a certain piece of land is much simpler than verifying tenure and use rights to the land itself. In these cases compensation is calculated on the basis of straightforward value sheets that specify the worth of various trees and crops according variety and age (Annex C).

Parallel to this official land ownership claim is one that is less binding in the court of law but as authentic. This is the collective "ownership" of land rights, whether exercised in the context of what we described earlier as *le Cameroun des villages*, *le Cameroun des chefferies*, or *les Cameroun des royaumes*. Within each of the above structures lie the more specific rights of clans, sub-clans, extended families, and individual households. Depending on the size of land heritage left by an ancestor and the muscle power of male members, a household might expand the size of its "ancestral" landholding by clearing "unclaimed" cultivable areas within the general domain of the lineage, the village, or the clan.

Differential access and multiple usage claim extend to the level of independent households where members are differentiated by gender, age, and economic status within the household. For example, in most of the study area women do not have the same "ownership" rights as men. In areas where marriage is exogamous, as in most of the South and Central Provinces and among the Mboum and the Baya in the northern region, the exclusion of women from property rights is justified by the fact that wives belong to other "stranger" clans, lineages, or even ethnic groups whose entitlement to land is similar to that of other strangers. They are extended cultivation privileges through their husbands; however, this "courtesy" does not give them ownership rights. The logic used to exclude wives from land "ownership" is used in

reference to daughters and other clan women, since they will be marrying men from other clans with no rights to ancestral claims.

In most of the study area women not only have cultivation rights, they are also entrusted with the responsibility of nourishing the household. Among the assets they utilize in the execution of this obligation is the labor power of their husbands who are charged with the task of clearing fields and their daughters who might be allowed to cultivate a portion of their mothers' "land" as their own in compensation for their labor efforts. If there are enough plots in a household's landholding any family member, irrespective of age or gender, has the right to an individual plot. The right to allocate and dispose of plots remains within the realm of the male household head, however.

The physical condition of a certain plot is another gender-based intrahousehold differentiating factor in land allocation. The more valued a crop is the better the plot it will be planted in. Since in general women are charged with subsistence production and men with what is referred to as "industrial" or plantation crop production and it is men who are charged with field clearing, they are likely to allot women less fertile plots, keeping the newly opened fields for themselves. Men's access to the produce of their fields is not comprehensive, however. In addition to the fact that mixed farming is the strategy of choice on virtually all subsistence plots, intercropping is a common practice on plantations, especially on newly opened fields. Normally, newly-planted cocoa plants are interplanted with various crops such as cassava, plantains, cocoyams, and bananas. Since young cocoa plants do not start producing until their third or fourth year, interplanting provides households with sustenance until the principal crops reach maturity. While the cocoa plants are likely to be the property of the male head of household, ownership and rights to harvest and proceeds of the other crops are most likely the possession of his wife or wives and some of their offspring.

Moreover, a plot that technically belongs to a specific individual, household, or clan is likely to be within the "use right" realm of another individual, household, clan, or ethnic group, depending on the time of the year and the resource base. For example, in many areas of the proposed project, a transhumant pastoralist might have customary use rights to certain harvested fields, and some groups might have gathering, small scale fishing, and trapping rights in a certain forest although they might not have cutting and clearing or cultivation rights.

4. Conflicts between Farmers and Herders

Multiple usage of productive resources is as essential for the survival of household inhabitants of the study area as diversification of sources of food and income. It is also the root of many conflicts, however. In the previous section, conflicts over land tenure and land use rights such as, (1) internal conflicts within a household, clan, or lineage, usually over property limits, and normally resolved by the village chief and/or elders; conflicts, normally internal, over lands that

are not exactly part of a familial heritage in the sense that they have not been cleared previously by an ancestor but that lie within the general domain of a village, such as forest, savanna, and bush land; (2) conflicts between "natives" and "non-natives," usually over land that is outside the limits of an ancestral heritage but within the general collective domain; and (3) conflicts between customary rights and the legal rights of the central government, a parastatal, or a private sector organization or firm were discussed.

Another type of land conflict or, more specifically, conflict over standing crops, is that which erupts regularly between farmers and herders. Due to the fact that animal husbandry is an activity of minimal importance in the southern zones (generally speaking animal husbandry in the southern region is confined to a few goats, pigs, and poultry), conflicts are small in scale and infrequent but grow in scope, magnitude, and frequency as we move northward in the country.

The difference in the intensity of animal husbandry in the southern and northern zones is reflected in villagers' responses to the question regarding conflicts between farmers and animal owners. Invariably villagers in the southern zone understood the question to mean conflicts among individuals and households from the same clans and villages over animal incursion on unharvested fields. Among the more typical responses were, "Conflicts over animal intrusion are rare, we do not have that many animals, only a few goats or pigs. Each household takes care of its animals and makes sure they do not attack a neighbor's fields," or "sometimes, when animals stray into a cultivated field, but that does not happen frequently since families do not leave their animals unattended." The only departure from this pattern was in areas of intensive animal transactions such as in some of the peri-urban areas of Yaoundé.

The scope, intensity, and regularity of conflict in the Central and North Provinces is evidenced by the formal measures taken to regulate farmer-herder interaction and to minimize conflict by careful delineation of grazing and cultivation areas as we see exemplified in what is called *hadondé* in the Meiganga area. A Fulfulde term, *hadondé* refers to village agricultural reserves that are forbidden to cattle whether they are in a cropped, harvested, or fallow state. Among the rules of the *hadondé* is that a farmer cannot block a water or grazing path with his farm.

Despite the various precautions taken there are frequent animal trespasses and ravaged crops, especially in the beginning and at the end of the transhumance periods. As a villager from Mbakoungue in the Meiganga area expressed, "There are numerous problems between us and herders, especially the Bororo. They pass by here in the months of November and December and then again in May and June. It is not that the herders are negligent, although some are; it is that they have such large numbers of cattle that some of the animals become unruly and reluctant to follow the rest of the herd. Conflicts are resolved by the chief or the *sous-préfet.* The arrested animals are not returned until the herders/owners pay for the damage. Sometimes the fields are so ravaged that we leave them to the animals." In the village of Ndioré in the

Nanga Eboko area another villager said, "We have many problems with animals but not amongst ourselves since we keep our animals tied down or in enclosures. Besides, we do not have many animals; a household might have one or two goats. Serious problems arise every year when the Peul, the Bororo, and the Mageda pass with their herds on their way to or from their summer and winter grazing areas."

5. Fallowing and Soil Fertility

Slash-and-burn shifting cultivation, the most widely practiced agricultural system in the study area requires long fallow periods to allow the soil to regenerate. For this operation to be successful, however, low population density and vast areas of cultivable land are essential. As we demonstrated earlier, the expansion of industrial crop cultivation, especially cocoa; high population growth, estimated at 3.1 percent per annum; and internal migration, coupled with an economic crisis that has haunted the nation for over 10 years, have put the squeeze on traditional generosity concerning land use, intensified the scope and intensity of land conflict, whether among farmers or between farmers and herders, reduced and in some areas eliminated fallowing, caused soil depletion of nutrients and erosion.

In the 68 sites surveyed, about two-thirds of the farmers found the soil not to be as fertile as in the past. The one-third that affirmed constant soil fertility and crop productivity indicated the main reason for continued productivity was continuation of the practice of long fallow periods to allow soil to regenerate.

In Kaa, a village in the Nanga Eboko area for example, the question of soil fertility generated the following response: "Our soils remain very fertile and we do not have much problem with soil erosion. If you treat the land with respect it returns the favor. After cultivating a plot for two or three years, we allow it to rest for at least four years before cultivating it again. Some plots we leave to regenerate for up to 10 years or more". In the village of Mendjoui, in the same area, the response was different but the meaning very similar: "Soils are fertile, but those who cultivate the same parcel of land for too long have problems. Consequently every year we have to go a little further than the year before to find a plot to cultivate (*chaque année, il faut aller un peu plus loin pour cultiver*). If you cultivate the same parcel of land two years in a row, the second year's harvest might not even equal half of what you reaped the year before. The third year might not even give you enough for seeds. We do not use fertilizers on our farms because we have to keep on shifting the location of our fields." In the village of Wangtounou in the Touboro area, villagers distinguished between fertility levels in village and "virgin" lands: "Before, lands nearer to the village were more fertile; they are in very poor condition now because of over cultivation. Year after year, we move further and further away from the village where the land is still fertile."

The continuing decline in soil fertility is becoming increasing a major issue especially in close proximity to villages. In the village of Mbaraang (Touboro), for example, the only crops grown in village plots were tuber crops; maize fields were at a distance of about 20 km because the village soil is less fertile.

6. Allocation of Resources and Division of Labor

Although resource allocation and labor patterns among sample households vary from one zone to another and are influenced by factors such as ethnicity, religion, and the socioeconomic status of the household, there are clear age and gender based differential access to resources of land, labor, and capital and division of labor in the proposed project area. Despite some ethnic variation concerning the duration of work and the degree of involvement in production activities, everywhere in the proposed project area women and children are the biggest contributors to household labor.

Survey results show that except for the Fulbe, women perform most of the tasks associated with agricultural food production while, depending on the natural resource endowment, men fish, hunt, trap, clear the forest, herd, pursue cash crop activities, and carry out various construction and craft (with wood and metals) activities. As some men expressed it: "*Les cultures vivrieres sont le travail des femmes.*" Men are more concerned "*avec la creation de plantation*".

This is not to say that women do not get involved in clearing and burning fields, fishing and trapping, or that they never engage in "industrial" crop cultivation. Since the expansion of cash cropping women are performing more tasks on their fields and those of their husbands', including burning (on household fields) and weeding, harvesting, and transport on their husbands' plantations. And, except for Fulbe women, in areas of forest and small streams women set up traps for small animals and practice what is referred to as "*la pêche de barrage*" or "dam" fishing, where a number of women block two ends of small streams and, using calabashes, empty the water from the basin created and divide the trapped fish among themselves. The catch is mostly for household consumption, but surplus normally is smoked and marketed.

In most of the areas surveyed women, whether mothers, wives, or daughters, married or unmarried, do not appear to have independent rights to household land and labor. In general women acquire and exercise these rights in the context of marriage. Marriage accords women the right to a field to cultivate and male labor to clear her fields and construct or repair her house. While men have absolute rights to the output of their wives' labor, women's right to that of their husbands' is limited. These restrictions were much more intense in the past. In Beti country, for example, "[m]uch of the meat hunted was forbidden to women, metal was only provided for agricultural tools, and bark cloth made by men was for male clothing only. By

contrast everything that the woman produced was ultimately at the disposal of her husband". (Guyer 1980: 8)

Whether we are talking about Beti country or other areas of the proposed project, women's contributions to the domestic food supply does not seem to have changed. Women have the right, a right they exercise diligently, to sell all surplus and to dispose of the income generated as they please. Food is sold in small quantities, raw, processed, and cooked. A large proportion of women's income is reinvested in the household partially because the provision of the household with food items not produced on the farm seems to remain within her domain of responsibility, and because, in many rural households, women tend to have a steadier, despite much more modest, flow of income than men. While the income of most rural men tends to be related to the marketing of a major crop and is seasonal (an exception is palm wine tapping; cocoa sales, for example, peak only four months of the year: September, October, November, and December), women's food crops are available all year round.

As evidenced by the difference in male contribution to farming in different areas with varied involvement in industrial crop production, before the expansion of "cash" cropping, men's involvement in subsistence farming was much more substantial:

> "They cleared the forest for planting, felled the trees, cut yam stakes, built enclosures against wild animals, and constructed storehouses for yams. The men even contributed to planting, particularly maize and plantains, which were grown in the newly-cleared forest fields (*esep*), because the soil was not hoed up before planting. The forest fields were associated with men even though the weeding, harvesting, and general care was women's work. By contrast, the groundnut fields, which were hoed during planting, were exclusively the preserve of the women (Guyer 1978: 9)."

Among the villages surveyed, men continue to do the heavier agricultural work, mainly clearing and burning, although they do not put in even half of the agricultural labor hours as women. Women are participating increasingly in the "burning" operation, however, and children help. Once these two operations are completed women virtually do all the rest of the work.

In the southern region men start their cocoa and coffee nurseries in the beginning of the big rainy seasons (July-August). Six to seven months later (April-May) the young plants are transplanted and staked with about 2.5 meters between plants. Palm trees require about 8 meters, while bananas need 3-4. Because of their different requirements coffee and cocoa plants are not mixed. Many farmers mix both with banana trees, however. By the time the banana trees mature and die, cocoa and coffee plants start producing. Normally, a cocoa plant starts producing after three years and remains in production between 8 and 34 years.

Around the Bipindi area we were told that each family member has his or her own farm; *women* receive their farms from their husbands. On his wives' farms, a man clears the land; "Burning she can do herself if her husband is busy with his plantations. Planting is a woman's job and she has no choice. We men do not know how to plant women's crops, especially groundnuts. We can do cassava if we need to, however." The villagers added, "*Les cultures vivrieres sont le travail des femmes.* It is our wives' harvest that is destined for household consumption; they are free to sell all surplus and do as they wish with the money. Our farms are oriented towards the market; they also serve as a reserve in case we run out of food."

As we have seen in other parts of the rural world whether Africa, Asia, or Latin America where cash-generating activities become the domain of men even if they were practiced previously by women only, industrial crop cultivation (cocoa, coffee, and oil palm) became, almost exclusively, men's work. As a result, men became increasingly reluctant to perform the jobs they once did in women's fields or to allow them to grow food crops in newly cleared and therefore very fertile fields. At the same time, not only did women lose a substantial portion of their land and labor rights, their customary obligation to weed, harvest, process, and transport was expanded to include men's newly established fields without being compensated adequately for the added labor burdens.

The situation is substantially different among the Fulbe. While the bulk of agricultural labor among the various Beti groups and among the Mboum, the Baya, and the Mbéré are performed by women, Fulbe women rarely engage in farming. In fact it is considered shameful for a Fulbe man to have his wife seen on the farm. In the past the Fulbe, whose primary responsibility was the management of their herds, hired members of other ethnic groups, usually women, to perform the bulk of agricultural work other than forest clearing, an activity they do not consider demeaning to a Fulbe male's sense of honor. The combination of the economic crisis, the reduction of Fulbe herds, and the increasing reluctance of persons of other ethnicities to engage in manual work for the Fulbe is forcing the latter to do most of the agricultural work themselves.

D. Fishing

As we have seen earlier, fishing is a major economic activity in the proposed project area, especially in the southern zone where both ocean, river, and stream fishing prevail. As a principal household activity, fishing is considered primarily a male activity. Almost everywhere respondents insisted that fishing was as much a male activity as subsistence agriculture was a female activity. Some even claimed that women have no involvement in fishing. When pressed, however, most admitted the regular involvement of women in fishing but dismissed its importance saying it was only the "pêche de barrage" and was destined for household consumption.

In fish markets, however, most fish sellers are women. They buy the fish from male fishermen who have just come back from the sea and sell it either door to door or in one of the nearby towns.

Although there does not seem to be an occupational caste system in any of the sectors of the proposed project area, certain ethnic groups are reputed to be good fishers, just as the Bororo and the Fulbe to a lesser extent are reputed to be good herders. In the Kribi area, for example, people speak of the Mabea and the Batanga when they speak of fishing, indicating what amateurs they are compared to these real professional fishermen. There also appears to be some ethnic correlations with species fished. Generally speaking women are associated with shrimp and crab fishing, but many men in the Kribi zone also engage in that sort of fishing.

Like agriculture fishing has its peak seasons and fluctuating prices depending on availability. In the Kribi region people indicated that the period between November and December is the best season for fishing. This also is the period when fish prices go down, however. In this period Kribi area restaurants will pay 100 FCFA for seven to eight good size shrimp. In the off-season, which in this area corresponds with the months of May, June, and perhaps July for sea fishing, four shrimp will fetch the same price but the quantity that a fisherman can sell is much smaller. Larger fishermen try to sell their catch of shrimp in Yaoundé where they can get about 3,500 FCFA per kilo.

Despite the prominent presence of peak and bottom periods like those in agriculture, in the southern zone fishing is an activity that goes on all year round. Ocean as well as net and line river fishing lie exclusively in the male domain. Among the fish commonly caught are: capitaine, barre (sea bass), barracuda, mackerel, and sardines. They also catch shrimp, crab, oysters, clams, calamare, and lobsters. Among the tools used are fishing nets, lines, and dugout canoes (*pirogue*). There are about 60 *pirogues* in the village of Mboimanga, for example.

Often fishing nets are cast at night and are left in the sea waters until dawn. The moment of bringing the net out is an important occasion in fishing villages. Men, women and children gather to help and observe. Those who help get a part of the catch, each in line with his effort. A single catch may bring in 200 to 400 kilo of fish. After giving out what is due to helpers and setting the household's portion (*la ration de la famille*) and the quantity to be given away as gifts, the catch is sold. Most of the catch is sold right on the beach; people know when the catch is supposed to arrive and they come between 8:00 to 13:00. Many of the people gathered are seller women who buy to resell in Kribi for small profit.

- Fish Prices

Fish usually is sold by the piece but with an eye to each fish's weight. Price is a function of the period, the quantity and quality of the catch, and types of fish and local taste. In the Kribi area,

for example, 20 or plus sardines can fetch 100 FCFA in season; in off periods the same amount is paid for 15 to 20 sardines. If the catch is really low, fishermen might even be able to sell 10 sardines for the same price. But of course, fishermen pointed out, "*on peut discuter*". In the month of July average fish prices in the Kribi market were as follows per kilo:

Barre	800 FCFA
Sardine	300 FCFA
Capitaine	400 FCFA
Shrimp	2,000 FCFA
Calamare	900 FCFA
Lobster	4,500 FCFA

As indicated earlier, women also are active fishers of freshwater shrimp, oysters, and crabs, but not from the seas. The ocean is not considered an appropriate domain for women. As elsewhere in the country, women mainly are active in "barrage" fishing, whereby they build small dams that they trap the fish in. Some even insisted that women are the sole fishers of oysters, destined for sale only. People actually were amused but grateful that some pay for oysters.

In the Nanga Eboko area fishing is mostly on the Sanaga and in small streams where women practice what we described above as the *pêche de barrage,* an activity that requires collaboration. One man expressed, "Women know how to collaborate; for this type of fishing you need at least two women working together, but you almost never see less than three or four."

In this zone the best period of fishing is the dry season when the river waters recede some. Fishing becomes more difficult and considerably more dangerous when the waters mount. In villages in close proximity to the river or a major stream, fishing is considered a major income generating activity. It also is a very important part of household diets. When people were asked if they consumed a lot of fish, the almost invariable answer was, "*bien sur*," and indicated that fish was "*la base alimentaire même.*" As in the southern zone, both nets and lines are used to fish.

Although access to fishing grounds is not as regulated as that to land, the activity has its share of access regulating mechanisms. As we have seen happening in the agricultural domain where village chiefs and household heads differentiate between granting a piece of land to a stranger to grow "household" crops and using the land for "plantation" crops, "owners" of fishing rights distinguish between artisanal or subsistence fishing and larger, market-destined fishing. Rights to fishing in certain rivers and streams are specific to certain clans, lineages, and ethnic groups. Non-members are not entitled to fish in another group's grounds without authorization.

In addition to the economic rationale the prohibition of strangers from fishing in certain streams or sections of rivers has another logic. Among fishermen certain grounds might have sacred attributes that necessitate certain dos and don'ts. Strangers are not likely to be familiar with these rituals. Other areas might be the abode of ancestors, and the presence of strangers might generate ritual pollution.

E. Hunting and Gathering

As shown earlier in this chapter (Table 20), hunting and gathering is not considered the economic activity of first importance in any of the sites surveyed, is considered the activity of second importance in only 5 of the sites, and of third importance in 14. Since diversification of sources of food and incomes is an essential household survival strategy in both rural and urban Cameroon however, hunting and gathering activities are vital components of the household production portfolio, and any reduction in their scope or magnitude without adequate compensation is bound to have adverse effects on households' abilities to meet their food and income needs.

Except for Pygmy camps that utilize both, in all of the sites surveyed hunting normally refers to trapping rather than active hunting. To the question "What hunting tools do you use?" most respondents replied "*toujour par piège* (always with traps);" some in the southern zone elaborated, "We cannot use the filet, that is the speciality of the Pygmies, *les gens de la forêt.*"

The intensity of hunting activities dwindles as we move from south to north, a reflection of the agroecology of various zones. Almost everyone, however, lamented dwindling forest resources and complained that most of the large wild animals virtually have disappeared. Almost everywhere the most common animals currently hunted include: monkeys, turtles, antelopes, gorillas, buffaloes, porcupines, hares, wild boars (*sangliers*), and snakes.

Hunting, trapping, and poaching are the only source of animal protein in many study area villages. Some animal organs serve important sacred functions in traditional rituals such as in ceremonies associated with communicating with ancestors.

There is no denial that "local" hunting adds another element to the ongoing reduction in the overall numbers and number of species of wild animals. Contrary to conventional wisdom, however, the damage incurred by locals is, to utilize a common expression, a mere drop in the bucket compared to organized intensive hunting, always with firearms and always for the "sport." Moreover, this is not an issue that people are unaware of, although they feel helpless to do anything about it. In the Nanga Eboko area, for example, people spoke of "*la chasse intensive* (intensive hunting)" whenever we discussed hunting. "People come from all over the country and Europe to hunt here; they bring firearms with them. They are very effective hunters since hunting in this fashion does not require much skill; the only thing you need to know is how

to shoot." This is not to say that local people never use guns; they do indeed, especially for hunting gorillas, buffalos, and antelopes. They are inefficient guns and not universal, however. Moreover, since hunting has become illegal in many areas, even villagers with guns are much more reluctant to use them and, where a gun is required, they might use a spear instead.

The impact of intensified hunting on the ability of the Pygmies to make a living particularly must be underlined. Traditionally dependent on forest resources for survival, organized deforestation and hunting is putting pressure on the Pygmies' basic survival needs of food and shelter and is creating for them what someone referred to as "*un problème alimentaire accenté*" (an important dietary problem).

F. Animal Husbandry

Especially in the Touboro and Meiganga areas, animal husbandry is an activity that is as important to the survival of pastoral households and the well-being of local, regional, and national economies as subsistence farming is to other households. In general, three categories of people, representing different categories of activities, engage in herding:

1. Transhumant pastoralists exemplified in the proposed project area by the Bororo for whom herding, supplemented by small scale subsistence farming and livestock trade, is the most important productive activity. The long distance movement of animals in search of grass and water between summer and winter pastures is essential for the survival of the Bororo and their herds. In general animals are moved south in the beginning of the dry season (October-November) and are moved back north to their "permanent" camps in the beginning of the rainy season (May-June). Although exact times of movement and routes followed vary from herder to herder and are influenced by factors such as originating point, number of animals in a herd, number of herders responsible for animals, number of animals destined for the market, rainfall, grass and water availability, warfare, and the presence of unharvested fields and cultivation reserves, general patterns can be identified, as indicated in Figures 3 and 4 showing livestock movements in the Touboro and Meiganga areas.

2. Livestock merchants, mostly Fulbe and Hausa, whose livelihood centers around the buying and selling of animals, especially cattle. Although the overall numbers of merchants are small, the volume of trade is very large and distances traveled long (Figure 3 and 4).

3. "Sedentarized" pastoralists, such as the Fulbe, who keep large numbers of animals which they assign to a hired herder or split amongst their own households where one or two members are in charge of all family herds while the others settle to pursue other production activities, especially agriculture and trade.

FIGURE 3
LIVESTOCK MOVEMENTS IN THE TOUBORO AREA[4]

LIVESTOCK TRADERS

FROM CHAD

There are two likely entry points from Chad into Cameroon:

1. Bessaou → Wouro Diaoro Gorguel → Cross the River Mbéré → Larmanaï → Bogdibo (in Cameroon; on the Chadian Frontier). From there, the animals might choose one of two ways:

   a. Touboro → Madinri (Rey Bouba) → Mbéré → Salasa → Padoumé → Adoumri;

   b. Touboro (by crossing the River Vina) → Mbaiboum.

2. Bessaou → Mayo (River) Bini → Baibokoum (west) → walk along or in the bed of the River Mbéré (Wouro Djodi) into Cameroon → coming out at Karang Dandjama → Touboro. From there the animals take the Touboro route indicated above.

FROM THE CENTRAL AFRICAN REPUBLIC (CAR):

After crossing the River Mbéré into Cameroon, CAR transhumants might follow one of the following likely routes:

3. Barkaï → Mbaiboum → Wouro Hamidou → Bordoro → Warang Dandjana → Touboro → Madinri (Rey Bouba) → Mbéré → Salasa → Padoumé → Adoumri.

4. Wantounou → GAWI (on the CAR borders, about 100 km NE of Meiganga)

5. Taber → Mbaiboum → Touldoro → Mbang Rey → Bélél → Gawi.

TRANSHUMANTS IN TOUBORO

Transhumant pastoralists follow much the same routes into Cameroon. Whether they begin by regrouping in Bogdibo or Wantounou, they disperse in the region in all directions in search of pasture and water. Generally the period of transhumance extends from October to May. During this period the fields (cotton, sorghum and cassava; semi-irrigated vegetable farms in inundated areas) of late harvesters (October-November) and early planters (April-May) risk being destroyed by passing animals.

In 1994, 2,280 animals (cattle) are reported to have passed through one of the two sites.

[4]The information in this section was gathered in the towns of Touboro and Mbaiboum.

FIGURE 4
LIVESTOCK MOVEMENTS IN THE MEIGANGA AREA[5]

FROM CAR: BELEL

1. Kalamba (along the river, preferably in the river bed itself, during the dry season river beds are dry but with enough humidity for the growth of grasses and herbs) → Manding → Mambaka → Ngoua → Mamberé → Mayo Goldi → Mayo Mbaraang → take the road → Mbaraang and continue as above.

2. Baboua → Mamding → Sokkandé → Laïndé Kane → Saoré-Jerem → Bassong → Dogdjon → Madjioui → Ngoaounbaka → (cross the Gouch at Bindddibo) → Mbah Bodehi → Nbah Baléou → to exit at Betara-Oya and cross the bridge over Lom.

FADA:
LIVESTOCK TRADERS

3. Yamba → Midé → Lamou → Damissou → Diel and (in Cameroon) Ngaoui (Ngawi) → Bafouk→ Fada → Ngam → Paindé → Mami → Gouigo → Dozoui → Gandinang → Alaïmo → Bata → Mbaraang → Meiganga → Lokoti → Beka → Garoua Boulaï (on foot to via Bertoua) → Yaoundé

4. Gawi (Ngawi) → Bafouk → Komb → Laka → Garoua Boulaï (on foot via Bertoua) → Yaoundé.

5. Meiganga → Kalaldi → Bordjer → Ngaoundal (by train) → Yaoundé → and/or Douala.

TRANSHUMANTS

Transhumant pastoralists follow much the same routes into Fada:

6. Gawi → Laba → Regordé-Lom → cross the Lom River → Hosséré-Tina River. They walk in or along the bed of the river until → Sabongari (cross the Hofi Nballé River) → Longué-Laka (another water course) → Garoua Boulaï → disperse in many directions.

7. Cross the Mikila River → Mayo (river) Pali → the Regordé-Kona-Goma River (another name for Lom) → Sabongari → Fada → disperse in many directions.

8. Mbarang → Dang-Hausa → Djibou → Ngouroré → Bariki → cross the Dang-Hausa River at the bottom → Lokoti → Mih → Mayo (river) Gortogal → cross the Lom at Regordé Deiyo → Nana-Moy → (to enter the road to Sabongari to the east).

[5]Information in this section was gathered in the towns of Fada and Bélél. Note that there are many variations within the suggested routes. Moreover, the routes are adjusted continuously and routinely adjusted in response to many factors such as the presence of unharvested fields, the presence of disease, or security issues. (We were told that between 800-1,000 head of cattle per week come to Fada from Gawi.)

G. Commerce and Petty Trade

Large, medium, or small scale, commerce and petty trade are essential ingredients of household production strategies. Except for livestock traders and larger *commercants* who are almost invariably ethnically different (i.e., Bamiléké, Hausa, Fulbe, and Syrian/Lebanese) from the people on whom they depend to conduct their commercial activities, the bulk of commercial activities are very small scale; more precisely, petty trade. This is not to discount the importance of such activities but to emphasize, as we have seen earlier, their importance for the survival of rural and urban families and especially for less powerful members of households: the women.

V. LIKELY PROJECT IMPACTS AND MITIGATION MEASURES

A. Introduction

The principal point to bear in mind in considering positive and negative project impacts, is that they will not be confined to the proposed export pipeline and pump station areas. In addition to the ancillary facilities of the two, including heliports or airstrips, communications facilities, parts storage, fuel treatment, storage, housing, and construction camps, there will be a wide network of enhanced infrastructure such as port facilities, bridges, railroads, and roads for the movement of approximately 500,000 tons of material over a period of four or more years and at the rate of 800 tons per day in the peak period.

The proposed project area is tremendously complex both in terms of coverage, a stretch of almost 900 km that traverses three agroecological zones with a rich mixture of production systems (subsistence and commercial farming, including state-owned and private agricultural development schemes and agroindustrial plantations, animal husbandry, hunting and gathering, fishing, commerce and trade, and industry), settlement patterns, and ethnic, religious, linguistic, and cultural diversity, along the proposed export pipeline route alone, not to mention an array of components and objectives (improved and new roads and bridges, pump stations, storage areas, marine terminal). Consequently, the potential environmentally relevant social and cultural issues involved, both direct and indirect, are numerous (e.g., involuntary resettlement, indigenous and tribal peoples, spontaneous migration, cultural property, secondary or induced growth, potential "boom and bust" effects). Accordingly, the team deemed it best to divide anticipated impacts by issues and, as feasible, to distinguish between "direct" and "indirect" effects.

B. The Pipeline Project

Before discussing specific issues, a review of the reactions of people in surveyed sites to three questions concerning the project itself is presented: (1) *Est-ce que vous avez entendu parlé du pipeline* (Have you heard anyone talking of the pipeline project)? (2) *Qu'est-ce que vous en avez entendu parlé* (What have you heard)? and (3) *Qu'est-ce que vous pensez de ce que vous avez entendu parlé* (What do you think of what you have heard)?

Reactions were as varied as the people themselves (Table 21). Answers ranged from total obliviousness to the existence of the proposed project (as we have seen in many of the sites in Touboro and Meiganga areas and among the Pygmies of the southern zone) to clear awareness. As pointed out earlier in this report, there is a positive correlation between people's awareness of the proposed project and the nature of this awareness and community, household, or individual access to radio and television; the condition of the reception of the

national radio station (good, average, bad); the degree of political importance, expressed in the frequency of formal visits, official delegations, etc., the central government accords to an area; the general level of education; proximity to an important urban center; and the frequency, level, and orientation of labor migration.

TABLE 21
INHABITANTS' AWARENESS OF PROPOSED PIPELINE PROJECT IN SURVEYED AREAS

General Area	Site	Awareness of Project
Kribi	Bidou I	Y
	Bidou II	N
	Bikondo	Y
	Bissiang	Y
	Ebome	Y
	Ikeike	Y
	Makoura I	Y
	Makoura II	Y
	Maschuer-Masche	N
	Mboamanga	Y
	Ngongro Pygmies	Y
	Ngovayang	Y
	Ngoyang	Y
	Ngoyang+	Y
	Zaire	Y
Yaoundé Pass	Ngoya I	N
	Nkolngok Sa'a	Y
	Nkometou II	Y
	Nkometou III	Y
Yaoundé Pass (cont)	Nkoayos	Y
	Akono I	Y
	Binguela II	Y
	Nkolnlong I	N
	Okoa	N
	Angon II	N
	Nkolkoumou	N
Nanga Eboko	Abang I	Y
	Biboto	Y
	Bifogo	Y
	Bilone	Y
	Bitam	Y
	Camp Martin	Y
	Camsuco Cite 3	Y
	Epegang	Y
	Etignang	N
	Kaa	Y
	Mamra II	N
	Mendjoui	Y
	Mendongo	N
	Mengang	Y

TABLE 21
INHABITANTS' AWARENESS OF PROPOSED PIPELINE PROJECT IN SURVEYED AREAS (CONTINUED)

General Area	Site	Awareness of Project
	Metsim	Y
	Meyang	N
	Minkouma	N
	Ndiore II	N
	Ndjombe	Y
	Ndjore	Y
	Sika	N
	Simbane	Y
Meiganga	Bakoungue	Y
	Fada	Y
	Gbata	Y
	Hori Kouni	N
	Madding	N
	Mbaraang	Y
	Meidougou	Y
	Meiganga I	Y
	Ngoa	Y
	Sabongari	Y
	Tello	Y
Touboro	Baldi	N
	Bogdibo	Y
	Djom	N
	Kouman	N
	Mbaiboum	Y
	Mbodo	N
	Sodecoton I	Y
	Sogbe-Toukoulou	N
	Touboro I	Y
	Wangtounou	N

As Table 21 demonstrates, there are regional differences in peoples' awareness of the proposed project although, as we shall see later, hearing by no means translates into "understanding." In the Kribi/Bipindi area for instance, only 2 of the 15 sites surveyed, including the Pygmy camp of Maschuer-Maschuer, had not heard of the proposed project.[6]

Among the more typical reactions in this zone was what we heard in the village of Mboamanga, a peri-urban area at a 2 km distance from Kribi, "Of course we heard about the project, who has not!? The authorities made a big fuss over it a few months ago; numerous delegations of *des grosses legumes* (big wigs) and festivities." Inhabitants of one of the SOCOPALM factory and plantation villages expressed similar sentiments, "We do not think there is anyone in Cameroon

[6] Another Pygmy village, near the village of Bikondo, not included in our quantitative survey, had not heard either.

who has not heard of it; we heard the news even before the authorities informed us. There were celebrations at the entire *Département d'Océan* level that lasted for two days; this was in February or March. Most of the celebrations were in the center of Kribi but there were celebrations even here. Lots of important people including the *Préfet* and the Minister of Health came; they announced the "*Pétrol du Chad*" and told us there would be about 2,000 jobs." In another village we were told, "We all went to the big feast in Kribi, but we also had celebrations at the level of the *groupement* of villages. We are thrilled about the prospects of employment and better roads. Also there will be more clients for our crops. People here do not buy food, and if they do, they pay very little since everyone grows the same thing. Workers have to eat."

Unmistakably, the high expectation of employment generation is reinforced by the government's "good will" campaign. There is a sense among the people of this zone that all "2,000 employees" will be recruited from their area and officials do not seem eager to dispel this notion.

Although expectations are exaggeratedly high and optimistic, in their general outlook, most are neither illogical nor unreasonable. In addition to employment people spoke of more buyers for their agricultural products, more people to rent houses, better roads, better social services, a better port, etc. Thus, the expectation of high levels of local employment goes hand in hand with that of numerous new buyers of goods and services. The predicted presence of strangers as consumers is welcomed by everyone; outsiders however become a threat when locals start to think of them as competitors for limited jobs. When this contradiction between strangers as consumers and as job seekers was pointed out to villagers, we received the following response, "There is severe unemployment in this area. This has been worsened by the economic crisis; our sons who had good jobs in the cities a few years ago are back in the village and have nothing to do. We have drivers, mechanics, carpenters, but no cars to drive or goods to manufacture. Bellies have to be kept full; when you have something to eat there is no problem. People start fighting when they are hungry."

Among the more amusing expectations was "the erection of oil fountains in each village" on the proposed pipeline route to enable villagers to get petrol on location!

The only site in this zone that had heard of the proposed project but did not express much interest was Bidou II, a village affected by SOCOPALM. This lack of interest could be attributed to the fact that Bidou II inhabitants do not think that they profited from the arrival and continued presence of the agroindustrial plantation: their lands were expropriated without adequate compensation, strangers were brought in for the provision of labor, and the presence of strangers created added pressure over land.

The number of persons who had no prior knowledge of the proposed project is much higher in Nanga Eboko than in Kribi. Of the 15 sites surveyed, 7 did not have a clue. Moreover, in several of the 15 sites that had heard of the proposed project, the knowledge applied only to

some of the people who were present during an interview; in several cases only 1 or 2 of those who were present had heard about the proposed project.

Expectations are very similar to those in the southern zone, employment generation being the strongest attraction. In Nkoayos, villagers heard that the proposed project will employ "about 3,000 or 4,000 persons." They were not sure what the numbers referred to in terms of where the workers might come from. "We hope they will all come from our *Département*," one villager said. Others discussed how the proposed project will serve to "*reduire la chômage dans une façon remarkable*" (reduce unemployment remarkably).

Others, such as the villagers of Mendjoui, had more specific information and were more precise in their expectations. Some were even aware of the proposed pump stations including overall numbers and approximate locations, "Yes, we have heard of the project; we know that the pipeline will go from Chad to Kribi, more precisely to Lobé. We heard it on the radio and some of us watched it on TV when we were in town. The radio and newspapers indicate that it will pass through the Département de Sanaga, more precisely, along the shore of the Sanaga River." The villagers continued, "We are very happy about the news. They [the government] promised development; they [oil companies] cannot bring about something as big and important as an oil pipeline without having to do maintenance. They will have to maintain the line in perfect working condition to prevent the disruption of production and transport." The villagers also had precise ideas of how maintenance could best be assured. "Each community or village in this area should take care of their part of the line; they (the government and oil companies] should hire people from here to maintain the line *en lien de chercher le main d'ouvre ailleur* (instead of searching for labor elsewhere)."

Others, aware that the construction phase will not last indefinitely, estimated without stating their reasons that it would take [workers] about five years before reaching Kribi, implying that they are counting on at least five years of uninterrupted employment. "This project will help many Cameroonians because there will be a lot of employment: they [the Consortium] will be here [in Nanga Eboko] for a long time, it will take about five years before reaching Kribi [the final destination]. Lots of things can happen in the course of five years." Even the workers of the agro-industrial factories expressed enthusiasm for the project. One reason was that it might open new employment opportunities. More importantly, from this non-native community's point of view, the proposed project will serve to reduce the degree of land conflict. "We await the arrival of the project impatiently; in addition to many new jobs it will open many areas, here and elsewhere, that are closed now. New forests can be opened for agriculture. Moreover, there will be newcomers who will need lodging, food, etc. There will be new shops, new roads, new development."

The number of people who did not have prior knowledge of the proposed project increased as we moved further north. Of the 10 sites surveyed in the Touboro area more than half did not

have any previous knowledge. Whether they had heard about it or not, the people in this area were largely very cautious and noncommittal in their responses. Those who expressed earnest added that *Alhamidou*'s support of the proposed project was the major reason for their enthusiasm. In the words of a respondent from a village near Touboro, "The authorities apprised the *grand sultan Lamidou,* who directed his representative to inform us. This man [Alhamidou's representative] told us to prepare lists of villagers who will be made available to work on the pipeline. We are happy because it [the project] will provide the town with jobs; mostly we are happy because the *Lamidou* thinks it is a good idea." The general expectations are not much different from the rest of the country, however. People talk about jobs, new roads, a new railway, and general development.

Contrary to our expectations for sites that are so near the capitol city about half of the 11 sites surveyed in the Yaoundé area indicated no prior awareness of the proposed project. The information of those who heard about the proposed project was relatively precise, indicating that their principal sources were television and radio rather than hearsay. Interestingly, those who had no prior knowledge did not seem very interested in the prospects. This could be due to the fact that the people needed some time to discuss it among themselves and digest it before offering opinions, especially in the presence of the *sous-préfet* and other government officials.

In summary, there are high expectations in the entire study area and throughout the country of what the proposed project will provide, especially in terms of employment generation. As we have shown in the Kribi area, these expectations are bolstered by "good will" government delegations that tour the country, headed by highly-placed officials, to announce the "good news". Numerous reconnaissance missions and feasibility, operational, and study tours affix "validity" stamps to official news, speeches, and declarations.

In addition to employment expectations, local perceptions of the effect of the proposed pipeline include:

- new/improved roads and railroads
- training
- increased sales of farm, ocean, river, and forest products and prepared foods (resulting from the presence of large numbers of outsiders)
- medical treatment (some expressed the feeling that, as a result of proposed road/pipeline construction, there will be a large number of accidents/diseases that can be treated with local herbs, tree leaves, barks and roots, and medical practices)

C. Involuntary Resettlement

1. Direct Impact

Due to the nature of settlement patterns in the study area, extremely dispersed and largely very small villages at variable distances from main and feeder roads and paths, a certain degree of involuntary resettlement may be unavoidable since, no matter what precautions are taken, the proposed pipeline almost certainly will impact some settlements directly. However, some of the villages that line many of the road networks that will be widened and upgraded to handle heavy and oversized loads also might be impacted. Should relocation prove to be necessary, the overall number of involuntary relocatees is expected to be relatively small and resettlement areas to be, if not within the vicinity of the relocated villages, very close to them.

Although no significant involuntary resettlement is expected as a result of the construction of the proposed pump stations, since they easily can be located outside settlement boundaries the associated infrastructure, especially the airstrip and runway, are likely to necessitate the relocation of some parts of villages because these services will have to be located within a certain distance from the stations themselves. Again, if relocation is necessary, the overall number of relocatees is expected to be relatively small and resettlement areas to be within the vicinity of villages of origin.

2. Indirect Impact

The team does not anticipate significant involuntary resettlement as an indirect result of any of the proposed project components.

D. Voluntary/Involuntary Resettlement

1. Direct Impact

As the World Bank notes, "Pipeline installation ... involves surveying, right-of-way (ROW) clearing, ditching, pipe stringing, welding, wrapping, coating and installing cathodic protection for corrosion control, placement in ditch (for buried pipelines), backfilling and cleanup" (1991: 32). This alone can result in temporary or permanent loss of land use due to construction (short-term), soil instability and erosion, landslides, or from the invasion of exotic plants that might out-compete native ones, making the land virtually useless. Loss of land also could result indirectly from the fact that the proposed pipeline might allow open access to areas that formerly were accessible only to local inhabitants (e.g., forests). Not only can such an access lead to the over exploitation and eventual degradation of these areas, it also can preclude local inhabitants from one of the sources of their livelihood (e.g., hunting and gathering). Since very

few Cameroonian rural households depend on a single source of income, depriving them of one source might make it very difficult for them to meet their subsistence needs from what remains, resulting perhaps in abandoning the area altogether. Coupled with the land that temporarily or permanently would be lost as a result of road upgrading and widening, pump stations (including airstrip, housing, recreational, kitchen, and laundry facilities), and construction camps, an indeterminate number of households might resort to voluntary/involuntary resettlement.

2. Indirect Impact

No indirect voluntary/involuntary resettlement is expected to result from the proposed project.

E. Indigenous Peoples/Tribes

Two groups of Pygmies, the Bakola who inhabit the forested area south of the town of Kribi in the northwestern vicinity of the Campo reserve, and the Bagyeli to the northeast of the Bakola, in the Arrondissements of Bipindi and Lolodorf, live in the study area and likely are to be impacted by it.

Traditionally hunters and gatherers, the forest and its fauna and flora resources are central to the Pygmies' production system. The expansion of commercial hunting and the intensive logging of forests and their degradation by large expatriate companies has created what is referred to by *Service d'Appui aux Initiatives Locales de Développement* (S. A. I. L. D.), a nonprofit international NGO that has been carrying out what they call *recherche-action* (action research) activities with the Pygmies in the Lolodorf and Bipindi areas since September 1994, *a "problème alimentaire accenté."*

The proposed pipeline project and associated activities are likely to influence the Pygmies at three levels:

(1) The Pygmies' forest resources would be reduced to some extent as a result of clearing associated with the construction of the pipeline (which would occur primarily in areas of degraded vegetation). For the Pygmies, this will result in agriculture becoming even more important than it is at present.

(2) The project has the potential to facilitate induced access to areas of the forest that would not be directly impacted. Induced access could result in additional hunting, logging and clearing pressures on forest utilized by the Pygmies.

(3) The potential exists that some small Pygmy villages or camps may not have been identified during route selection activities because of their small size and the air of impermanence associated with them.

F. Recruitment of Labor

Labor recruitment is the first thing to spring to many minds although it is only one among many issues that will need to be attended to in the context of project implementation. As shown in the earlier section, although respondents spoke of development, new roads, new market opportunities, etc., employment generation was the very first item on most peoples' agendas and the only one on quite a few. Labor also is the issue most stressed by official "good news bearers." In most areas people were unyielding in their insistence that, at least in their area of operation including pump station maintenance, labor should be recruited locally. Unemployed young men, the segment of the population most adversely affected by the current economic crisis, were the most vocal about this issue. Some went as far as declaring that "blood will run" without specifying whose blood it might be, if outsiders are favored in hiring practices.

With regard to the construction work force, the Consortium is faced with three possible alternatives: 1) a "permanent" work crew who would be accommodated in mobile camps and who would stay with the project from start to finish; 2) a "temporary" force that would changed completely as the work advances geographically; and 3) a mixture of "1" and "2".

Although a review of the various documents that were made available to the team dealing with this issue does not reveal an absolute commitment to any of these alternatives, some indicate a partiality towards the first one:

Pipeline and Pump Stations: Unlike field facilities (in Chad), these camps will provide accommodations for the locals due to the remoteness and mobility requirements of the camps. Both construction spreads each will have mobile camps that will accommodate approximately 1,000 people. These camps will relocate as pipeline construction progresses..... (6/9/95 memo from Eads, R. M. (Bobby) to Clayton Kaul - parentheses added).

The logistic/technical advantages of using more or less the same work crew throughout the life of the proposed project are indisputable, especially from a North American/European world view. There will be some training of the crew before the commencement of work. Most of the training will be the accumulated work experience acquired on the job, however. Moreover, in addition to improving their technical abilities, time will allow crew members to get to know one another and, if not like each other, learn to work together for better job performance. From a purely economic sense it is not rational to dismiss such a trained work force for the "privilege" of renewed labor pains of training another "novice" team every time the work advances into a new region. The potential problems to arise from such a strategy are serious, however, and

should be taken into consideration before final decisions concerning the composition of the crew are made. Among the problems anticipated are:

1. Labor Conflict

As we have seen above, there are high expectations throughout the region of the employment generation capacity of the proposed project mingled with a tremendous fear that, instead of being recruited locally, labor might be brought from the outside (other areas of Cameroon). If these lofty anticipations and deep apprehensions are not considered with great seriousness and handled with utmost delicacy, the immense enthusiasm generated by the news of the arrival of the proposed project will dissipate quickly in favor of resentment, distrust, suspicion, and anger, if the proposed project is perceived as favoring outsiders to locals. The negative feelings are likely to mount higher if a large percentage of the crew are third country nationals.

The feeling of having been "left behind" is not new to the locals of many of the regions that the proposed pipeline will traverse; the "*autochtone*" or natives have witnessed this "preferential" treatment of "outsiders" in the context of several agro-industrial projects that were launched in their midst and erected on their lands but from which they feel they have received few benefits. Several respondents from these areas expressed, "The land is not just the crop that grows on the land. Once you eat the food, it is finished. The land revives even if you leave it unattended for many years, especially if you leave it unattended for many years."

In this context many feel that the reason they lost "the last time" was because they "allowed it to happen." "We were not wise," some said, "we did not know how to fight, we did not know what our rights were, and we did not know how to agree among ourselves." Thus, many voiced their resolve not to allow the same "injustice" to re-occur. As we mentioned earlier, some expressed blatantly that "there would be blood running" if such a thing happens.

This anxiety about labor recruitment policies is not restricted to agro-industrial areas, however. It is universal, although expressed more strongly in some areas than in others. Peoples' desperation is fueled by the economic crisis of the last several years, and desperate times might induce desperate measures.

2. Labor Conflict and Implications for Further Degradation of Forests

In addition to labor conflicts, a likely consequence of bringing in outside labor is the creation or exacerbation of existing land use conflicts between the *autochtone* (natives) and the *allogène* (strangers; non-natives). The apparent ready availability of fertile land is somewhat deceiving. The existence of a lush vegetation cover in a certain area should not lead to the presumption that the soils are fertile. In most of the areas visited, without the application of fertilizers, whether chemical or manure, soils lose their fertility in a very short time and, after one or two

seasons of cultivation, have to be left fallow for three to five years to regain their fertility. Even with that, after several cultivation/fallow cycles, productivity seems to decline drastically, evidenced by the fact that villages abandon old fields and seek new ones further and further away from the homestead. In the village of Mbaraang (about 30 km north of Meiganga), for example, some of the fields are between 15 to 20 km away and can be reached only on foot.

In terms of the allocation of land to non-natives, farmers differentiate between extending a stranger enough land to erect a house and cultivate a field to feed his family and cultivation to market. What different people mean by marketing varies, however. Most *autochtones* allow petty trade in food commodities; this is very important since almost everything that is produced for home consumption is also offered on the market in one form or another, usually at a very small and limited scale. The current economic crisis, coupled with other types of resentments that are bound to arise between locals and strangers is likely to induce even the most generous people to re-evaluate what is considered "reasonable marketing" of food commodities.

The normally unspoken understanding between a native and a non-native, when the former allows the latter to cultivate a piece of the native's own ancestral land, is that the field in question reverts back to the "owner" afterwards; since the nature of farming in the area (slash-and-burn with long fallow periods) necessitates that the land is left fallow after a season or two, this is normally conducted as a matter of fact. The picture changes with the incoming of "more sophisticated" outsiders whose familiarity with fertilizers, for example, might enable them to cultivate a parcel for a much longer period of time or claim it "permanently." This is bound to create tension between the two groups, with each feeling they are being used. The stranger's logic, sometimes supported by the government's action as well as words, is that the land is untitled and therefore belongs to the state. In other words, within certain limits, to all Cameroonians. From the villager's viewpoint, again supported by the governmnet's action, the land is theirs and their ancestors. In cases of land conflict that cannot be resolved by the village chief or elders, local government authorities are beseeched. In making their decision they, in turn, turn back to the village chief and elders to substantiate whose ancestors had cleared/cultivated the parcels in dispute.

Finally, at least in certain areas, locals are strongly opposed to extending land to certain ethnic groups, believing "you give them a foot, they take a mile."

3. Social Conflict and Conflict Over Women

As evidenced by what we have seen happening in other parts of Cameroon where agricultural industry imported or attracted large numbers of migrant workers, "foreign" laborers, despite their low salaries, tend to engage, as evidenced by their spending patterns, in a display of wealth beyond the means of most local men. Consequently, many local women, including some married ones, start regarding these "outsiders" as "affluent" and, therefore, more desirable than

local men. From the local men's point of view, migrants are not only taking away their land and jobs but also their women. As resentments mount, they are likely to express themselves in violence against those perceived as intruders. As evidenced by what we have seen happening elsewhere under similar situations, other social pressures/conflicts, including increased violence and drunkenness, marital infidelity, divorce, and increased accusations of witchcraft are likely to arise.

4. Religious Conflicts

Not unrelated to the social problems discussed above are religious conflicts that are likely to arise between Muslims and Christians, among Christians of various sects, and between either Muslims or Christians and animists. Other matters that could eventuate religious conflicts are questions of sacred areas, which will be discussed under a separate heading, schools and schooling, diet and dietary rules and prohibitions, and marriage norms and practices.

5. AIDS and Sexually Transmitted Diseases

Sexually transmitted diseases (STDs) are fairly common in the entire study area. A familiar response to the question of whether there were STDs in a certain village was a shrug and "where you have young people you have STDs." No HIV positive or AIDS cases were made aware to us, however. Operation of the proposed project will bring in strangers, not only from other parts of Cameroon, but from neighboring countries such as the CAR and the Congo where the spread of AIDS presents a serious health hazard and severe social and economic problems. Given the ease with which people seem to engage in sexual liaisons and the probability that at least some of the arrivals will include prostitutes and be HIV positive, if appropriate precautions (information and prevention campaigns) are not taken, AIDS and other STDs could spread.

6. Increased Demands on Local Facilities and Services

Given the likelihood that large numbers of migrants (job seekers, entrepreneurs, goods and services traders) from within Cameroon and from neighboring countries will be attracted to the area, demands on local facilities and services will increase.

G. Changing Land Values

Land in the vicinity of the pump stations and in close proximity to improved roads and bridges will acquire a much greater value than at present. This will affect, at several levels, the nature of land use and the current relatively easy access to land. For a number of reasons, the effects are expected to be more severe in the north than elsewhere in the proposed study area. The

north is the home of the proposed paved road (from Ngaoundéré to Komé, via Touboro and Baibokoum). It is also the area most centralized; from the viewpoint of the inhabitants as well as that of the Master himself, practically the entire land surface area is the private property of *Alhamidou*, also known as the *sultan*, and as *Rey Bouba* to dispense with as he pleases. Farmers have use rights only with his permission (usually through his *djairo*s (village chiefs) and representatives (*dougaris*)).

Evidenced by what we have seen happen in other parts of Africa and elsewhere where use rights and "tenure" rights lie in different hands, all land parcels that increase in value are likely to be "repossessed" by *Alhamidou*. Coupled with the swelling scarcity of cultivable land, a most likely effect of such a measure is leaving many present cultivating farm household virtually landless.

Due to the nature of land access and distribution in the entire study area, even in the absence of a centripetal realm of power and authority as we see in the Rey Bouba area, changing land values in close proximity to better roads is likely to change the nature of access to land. More acreage is likely to be devoted to crops that are considered more valuable: cacoa, coffee, and oil palms. Even though there are women who practice what is referred to locally as "plantation" agriculture, cultivation among most ethnic groups (they are few in numbers, tend to be older women, and the acreage they control tends to be very small), the norm for the great majority of the areas interviewed is for men to pursue the cultivation of more lucrative "industrial" crops and for women to be in charge of household subsistence needs.

Even though the role of rural women as "providers" preceded "industrial crop" cultivation, before the expansion of the latter men were much more involved in subsistence agriculture and performed important tasks on women's fields. As men devote more and more time to their plantations, the nourishment of the family is becoming increasingly the wife's responsibility with the husband helping when he can tear himself away from his cocoa, coffee, or oil palm plantation.

The additional focus on "industrial crops" that the new infrastructure upgrades associated with the proposed project will generate would increase the work of already over-burdened women in at least two areas. Increasingly men will be reluctant to work on the wife's (effectively the family's) fields, since men are still charged with the responsibility of clearing new fields and since soil fertility declines dramatically after two to three seasons of continuous cultivation. They are likely to be inclined to keep the more productive new fields for their industrial crops leaving the more tired fields and consequently more work and less production, for their wives. Since petty trade is a very important part of women's work and

household economy (women market all surplus, cooked or raw; the cash generated pays for various household needs such as food items such as oil, flour, sugar, and salt) lessened agricultural productivity will mean a lessened degree of petty trade activities for women and, consequently, less cash. This will have adverse effects on the nutritional status of the family at large, with serious health and disease implications, and is likely to have a negative impact on the status of women within their households that equals the decline in their economic contribution.

Due to the nature of land access and distribution in the entire project area, even in the absence of a centripetal realm of power and authority as we see in the Rey Bouba area, changing land values in close proximity to better roads is likely to change the nature of access to land. More acreage is likely to be devoted to crops that are considered more valuable: cacoa, coffee, and oil palms.

H. Shifting Markets and Relocation of Villages

Another likely consequence of new and upgraded roads and bridges is the virtual disappearance of entire villages whose economic wellbeing was a direct outcome of proximity to an important market road, or their transformation into ghost towns. Other villages might decide to relocate to be in closer proximity to the improved roads which, in addition to economic implications, will intensify the pressure over land ownership and land use. This in turn might encourage some groups to open new lands, with serious deforestation implications.

Relocation to the vicinity of new or improved roads also is likely to be the response of some markets. This might result in serious negative economic impacts on the satellite villages and hinterlands. Another likely impact is the eruption of new markets along the newly upgraded roads.

I. Secondary Growth of Settlements

In response to real or perceived economic opportunities created by the various components of the proposed project, important secondary growth of settlements and infrastructure can be expected. Often referred to as "induced development" or "boomtown" effects, this indirect effect of the proposed project will contribute to the more direct environmental (opening up of new forests for agriculture), social, and health and disease impacts discussed earlier.

J. The *Rey Bouba* Issue, including the Mbaiboum Market

A large portion of the study area (North Province, 32,000 km²; the area is almost the same size as Belgium and larger than Rwanda) operates as the private property of a very powerful *Alhamidou*, also known as the *Rey Bouba*. The *Rey Bouba* controls the area through a series of village chiefs and special representatives known as *dougari*, who answer to him and to him only. Anything that enters the area, whether a small shop or a large enterprise requires the *Rey Bouba's* sanction.

This is an issue that Exxon will have to come to terms with and which might present some problems. In some of the villages that were surveyed in the Touboro area, the team gained the impression that not only did the villagers know about the pipeline, but they were instructed by the *Rey Bouba* to prepare lists of persons who will be employed by the project. Those who were in favor of the project indicated that the *Rey Bouba's* pleasure with the project was the main reason for their own support.

Among the issues that holding negotiations with the Rey Bouba might introduce in terms of equity concerns is that the entire land area in the "kingdom" is considered his; people are allowed to use it but he is the ultimate master. As "master" of the land, especially when the master is an individual with such power, many of the negotiations for land acquisition in the area would have to be held with him or with those he designates as his representatives. Families that are now and have been for generations the beneficiaries of the land and would be the direct losers from any reduction of land area are not likely to be considered at all let alone involved in the negotiation process. Thus, unless compensation money is paid directly to the actual loser of the use value of lost property, they are not likely to see any of it.

Publicly, especially in the presence of government officials and the master's "eyes" residents acknowledge their limited rights as mere "users" and seem to be reconciled to the fact. In private they talk about the land having been in their possession for generations, having been handed down from father to son. Besides the equity issues involved, the bitterness and resentment that are likely to arise if farmers in this area do not feel they have been adequately compensated (or not compensated at all) for their land probably will be at the scale that would be generated if the labor recruitment process is perceived as favoring outsiders over locals by natives.

K. Sacred Areas

Although most of the villagers profess to be Christian or Muslim, animism, expressed in the power of ancestors and their physical remains which are buried beside the main dwelling (in

many villages, cemeteries are reserved for the burial of "strangers"), remains strong. Ancestral remains may be removed to another site, but this process has to be accompanied by certain rituals and performed by the descendants themselves.

There are other areas than ancestral remains that are considered sacred or merit "special handling." In a fishing village in the peri-urban area of Kribi, for example, we heard of a water spirit that needs to be appeased before being disturbed. In other places, there was talk of forest spirits that frighten people away frequenting certain areas, of a hill (near Makaou II) with a "mysterious" lion that attacks anyone who might dare to disturb its grounds.

The appeasement of spirits will involve certain essential rituals performed by the local "*notables.*" Many people, especially in the southern and central zone believe that projects that do not pay enough respect to spirits or do "what is necessary" if these spirits are to be disturbed, are doomed to fail.

An implication of this sort of belief is that if these rituals are not performed in the manner considered adequate by the local knowhow, project-related accidents, no matter how minor, are likely to be attributed to spirits that are "taking revenge" on those who showed them disrespect.

It is essential to note that most sacred areas are neither clearly marked nor easily identifiable. In fact, they might be known only to the very small groups that perform their rituals there; it is therefore important to verify the presence of such places in each area. As mentioned earlier, an incident that can be explained logically might not be perceived as such by local inhabitants. It is estimated that half of the labor force may refuse to work if accidents are attributed to the violation of certain rituals, especially if they feel physically or spiritually threatened. It is important to note that this is an area where people believe in sorcery and the evil eye; very few deaths are considered natural, there is always a super-natural explanation.

L. Conflicts Between Herders and Farmers

Large numbers of transhumant cattle herds coming from the Extreme North Province, Chad, and the CAR traverse large portions of the study area (the North and Adamawa provinces) in the dry season (May/June-October/November), and scores stay for the duration of the season, creating myriads of conflict between herders and farmers over cattle encroachment on unharvested fields. Unless serious precautions are taken to incorporate tranhumance movements (times and duration) into construction schedules, the conflicts between farmers

and herders are likely to grow in both intensity and frequency. Attention also should be paid to the considerable numbers of animals that move through the area regularly on their way to livestock markets.

M. The Forest near Mbaraang

In looking for the precise location of the site of Taii where (a now superseded) pump station site was proposed to be located (often the names that appeared on maps have little to do with on-the-ground location of villages; this was true of Taii, which was totally unfamiliar to the local inhabitants), a section of a forest with extremely valuable medicinal herbs and trees came to our attention. The section is known as *Loggéré*, a Fulfulde word that means a "ditch" or a "hole," since it lies at the bottom land of a depression. A small stream called Mayo (river) Golmbi crosses the *Loggéré*, which is situated about 17 km northeast of the village of Mbaarang in the Meiganga area. The existence of this forest was brought to the attention of the biology team who were referred to the young Fulbe who brought the forest to our attention in the first place.

VI. MITIGATION

After careful consideration of the issues involved, the social science team estimates that the proposed project offers the country important benefits at the national, regional, and local levels. Minimally, the proposed project will generate desperately needed revenues, improve the road network, and provide employment. With sound planning, careful implementation, and effective ongoing monitoring and evaluation, the proposed project could be an important vehicle for the development of the country. For maximum effectiveness, this should be approached at two integrated levels and through direct and indirect means.

In addition to direct compensation of land, crops, and other types of personal property, the Consortium should consider sponsoring a number of projects that aim at compensating communities for lost or diminished access to certain productive resources. Projects should be small scale, labor rather than capital intensive, and directed by and oriented towards local populations. For maximum effectiveness the launching of such projects should go hand in hand with extensive health, education, and human resources development programs. Not only will such development interventions be beneficial to the country, but they will provide the development organizations that operate in Cameroon with the incentive to follow suit.

Whether the concern is direct cash compensations or community development, the Consortium needs to consider and address the various issues raised in this report. For added emphasis, some of the more relevant issues are recast below.

A. Indigenous Populations: the Pygmies

As mentioned earlier, agriculture is increasingly becoming an important production strategy for the Pygmies, and the proposed project might intensify the need to rely more heavily on cultivation. Therefore, in addition to compensating affected Pygmy populations for land and/or crops lost, the Consortium might entertain small scale agricultural projects to compensate the Pygmy indigenous population for possible loss of use rights of, or unfair competition over, their principal sources of livelihood.

At present, cultivation among the Pygmies is small scale and virtually restricted to food crops such as plantains, macabo, groundnuts, cassava, and *concombre*. Cacao, which along with game and some medicinal plants are virtually the only sources of cash revenues, is cultivated by some individuals at an even smaller scale. Marketing is carried out through the intermediary of neighboring Bantu villages with whom the Pygmies also have direct barter relationships. In this fashion, Bantu villages and villagers are the Pygmies' most important and sometimes the only conduits to the outside world. Normally, the terms of exchange

between Pygmies and Bantus are unfavorable to the former; the prices they receive are extremely low. Sometimes the Pygmies are cheated out of even the previously agreed upon low prices, receiving instead small amounts of food commodities such as cassava and other tuber crops, or palm wine, cigarettes, matches, and local beer.

Despite this lopsided nature of Pygmy-Bantu relationship, persons who have been working with some of the Pygmy camps in the Bipindi area argue that in order to achieve a degree of success and sustainability, it is advisable that projects targeted towards the Pygmies minimally should use encapsulating Bantu villages as their "*portes d'entrer*" (entry gates). Preferably, encapsulating villages should have a vested interest in the success of the proposed projects, achievable only if the projects are regarded as benefiting them as well. Jealousies and strong feelings of resentment, which might lead at least some Bantu villagers to try to prejudice the Pygmies against the interventions or even to sabotage them are likely to erupt if such an inclusive strategy is not pursued.

Residents of nearby Bantu villages, especially those with the closest relationships with the Pygmies, tend to have a great deal of influence on the latter. In the words of a S.A.I.L.D. social worker, "these are the people they see all the time; they [the Pygmies] are more likely to believe what these people might say to them than you and me; we are just outsiders. Besides, outsiders are here today, gone tomorrow and the Pygmies know that; the Bantu villagers, on the other hand, are permanent fixtures." Consequently, development strategies that target the Pygmies must involve villagers as well, a situation that is somewhat parallel to the settler/host population dynamic that prevails in involuntary resettlement projects.

Another type of intervention with both immediate and long-term benefits to Pygmy communities is more accessible schools for Pygmy children. Theoretically, Pygmy children are free and even encouraged to attend the same village schools as Bantu children. Frequently, schools are at distances greater than 10 km. Normally, village school-aged children stay for the duration of the school term with relatives who live in closer proximity to the schools. For obvious reasons, this is an option that is rarely available to Pygmy children. The problem of distance is compounded by the fact that, from the Pygmies' point of view, normal school curriculum is too esoteric and distant from their way of life and thus, on top of other hardships, provides Pygmy children and their families little incentive to continue the pursuit of education.

The issues of distance and relevance might be addressed by the establishement, at least during the first two or three school years, of "mobile" schools that are modeled after the "bare-foot doctor" principle. This approach was tried successfully among some pastoral

communities in the Sahel. Pygmy children could be taught to read, write, and count through media that are familiar to them by teachers who would be attached to their camps.

B. Land Compensation

A few points should be kept in mind as land and crop compensation measures are established:

- At any given time households tend to have several active plots at various distances (5-20 km) from the homestead. This is partially a function of the agricultural system (shifting cultivation) that prevails in the study area and the fact that all able household members are likely to be active farmers.

- Virtually none of the cultivated land is titled. However, whether in crop or fallow, all previously cleared land "belongs" to an individual, a family, a clan, a village, or an ethnic group, and this "ownership" is acknowledged by the communities and the local authorities.

- Not all plots of equal size are equal in value. The value of a certain plot is measured by its distance from the homestead, soil fertility, and the kind of crops grown. "Permanent" crops such as trees are more valuable than annual crops.

- Even though each cultivated or cultivable plot will have an "owner," this acknowledged owner is not necessarily the person with use rights to the plot. Moreover, most plots have multiple usage and are subjected to multiple rights. For example, the cocoa plants on a plantation might be the property of the husband, the intercropped banana trees might belong to a son, while the cassava and other crops mixed with the two above to a wife or wives. Multiple rights could even apply to the same crop where the person who has the right to the cassava, for example, may not be the person who has rights to the stalks and leaves.

- Forests belong to the government, but they also belong to villages or groups of villages. However, the fact that a forest might be "public" does not necessarily apply to what is in the forest. Certain families, villages, or clans might have virtual ownership of specific trees, especially those with important medicinal functions such as the Bidou tree in the southern region (several of the villages in the area are named after this tree, giving rise to such villages as Bidou I, Bidou II, and Bidou III) whose bark, leaves, and fruit are used for the treatment of various diseases including malaria.

C. Sacred Areas

Although most of the villagers profess to be Christian or Muslim, animism, as expressed in the power of ancestors and their physical remains (buried in household compounds; in most villages, cemeteries are reserved for the burial of "strangers"), continues to have a strong hold on peoples' lives and destinies, and there is a strong prohibition against the disturbance of those remains. If absolutely necessary, ancestral remains may be moved to another site, however. This has to be carried out in close consultation with the owners of the remains and be accompanied by certain rituals, including sacrifices, that should performed by the descendants themselves.

Besides ancestral remains, many areas are considered sacred or merit "special handling." In a fishing village in the peri-urban area of Kribi, for example, we heard of a water spirit that needs regular appeasement. In other areas we heard of forest spirits that frighten people from certain areas and cast their curses on the few brave individuals who might try to dare the spirits, of a hill (near Makaou II). The appeasement of spirits involves certain essential rituals that are performed by the local "*notables*." In most of the "spirit culture" areas, locals believe that projects that do not do "what is necessary" are doomed to fail. If these rituals are not performed in the manner considered adequate by the local know how, project-related accidents are likely to be blamed on such failure.

D. Labor Recruitment

It is essential that labor recruitment policies and practices are perceived as adequately equitable by inhabitants of the areas traversed by the pipeline. The Consortium might want to consider two options: (1) The Consortium distinguishes between technical and "manual" labor crews, with the former needing more specialized and long-term training than the latter. The "technical" crew would be recruited nationally on the basis of qualifications and competence to do the job but with a serious endeavor toward geographic and ethnic representativeness. Having predefined, in close consultation with national, regional, and local officials and traditional authorities the boundaries of each "region," the "manual" labor crew would be recruited from each region and, as the work advances, replaced by another crew. (2) The recruitment of the technical crew would be carried out in the same manner as option 1. To maximize the logistics advantage of working with the same "manual labor" crew throughout the duration of the construction phase, the Consortium would determine the size of the total manual labor force and would recruit this labor proportionally from each of the affected areas. Within each area, the various ethnic groups should be represented. Women should be hired to perform the jobs that are within their traditional domain.

E. Land Conflicts

The presence of large numbers of strangers, especially those taking jobs that locals may regard as their legitimate right, will create strong resentments on part of the local population against newcomers. The fact that some of the strangers will arrive with families that will require land for subsistence cultivation is likely to create land and social conflict. If land scarcity is not an issue, agricultural land normally can be accessed by asking the village or clan chief or household head. The request should be renewed on an annual basis. The generosity of village chiefs reaches a limit when fertile land is scarce, when there are too many strangers with too many demands, which brings us back to the issue of land scarcity, and when strangers proceed to clear, without asking, land that the villagers consider theirs. The stranger's logic, sometimes supported by the government's action if not words, is that the land is untitled and therefore public. In other words, within certain limits, all Cameroonians who are willing to work hard have equal rights to it. From the villager's viewpoint, again supported with government's action, the land is theirs and their ancestors.

This problem might be mitigated by anticipating, in each area, the amounts of land that will be required for cultivation and, in consultation with lineage, clan, and village elders, delineating a certain area that would be subdivided into parcels and "lent" to strangers for the cultivation of annual crops.

F. Health and Disease Implications

In addition to an array of diseases that might be introduced or spread in the area by incoming labor, there is a serious risk that STDs that already are fairly common in the entire study area will spread more widely and with serious consequences. As mentioned earlier, we were not made aware of any AIDS or HIV positive cases. This does not mean it does not exist, however. AIDS could exist and not be recognized as AIDS, or people might be reluctant to talk about to anybody, let alone to total strangers.

Whether the disease exists or not, the proposed project is likely to contribute to its introduction or intensification. Indisputably, the operation of the proposed project will attract strangers, including prostitutes, from Cameroon and neighboring countries some of which are acknowledged to have a serious AIDS problem. Undoubtedly, some of the comers will be infected by the virus. Given the ease with which people seem to engage in sexual liaisons, unless a serious campaign that targets both workers and receiving local communities is launched ahead of the arrival of the construction crew and others, AIDS could spread rapidly.

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VIII. ANNEXES

A. Annex I: Village/Community Survey

B. Annex II: Household Survey

C. Annex III: Official Government of Cameroon Crop Valuation Sheets

A. Annex I: Village/Community Survey

DONNEES DE BASE: VILLAGE/PERIURBAIN

Date: _____ Enq.: _____ Département: _____
Arrondissement: _____ Village: _____ Age de village: _____
Pop. du village: _____ Nbr. ménages: _____ Nbr. migrants: _____
Pop. origine de: 1. _____ 2. _____ 3. _____

EAU POTABLE: Sources Principales par ordre d'importance: (a) _ (b) _ (c) _ (d) _ (e) _

ELECTRICITE: Oui ___ Non ___

SOURCES PRINCIPALES D'ENERGIES/CHAUFFAGE: (a) ___ (b) ___ (c) ___ (d) ___ (e) .

ROUTE: routes principales reliant le village à d'autres localités (bitumée; latéritique; piste):

	Destination	Directions	Type de voie
a			
b			
c			
d			

1. **Chef(s) du village et ethnie:**

   Nom: _____ Ethnie: _____
   Nom: _____ Ethnie: _____

   Comment est-ce que le chef du village est choisi? **[Qualitatif]**

   _____
   _____
   _____

2. **Ethnies par ordre d' importance**: a. _____ b. _____ c. _____

   Autres groupes ethnies: _____

3. **Langues parlées** par ordre d'importance: a. _____ b. _____
   c. _____ d. _____ e. _____ f. _

4. **Religions** par ordre d'importance: a. _____ b. _____ c. ___
   d. _____ e. _____ f. _____
   g. _____

   A. Y a-til des endroits considérés comme sacrés ici? Oui: _____ Non: _____

B. Si oui, lesquels? Quels types? Où sont-ils localisés? **[Qualitatif]**

C. Que fait-on à ces endroits? **[Qualitatif]**

D. Qu'est-ce qu'on ne doit pas faire à ces endroits? **[Qualitatif]**

E. Y a-t-il un maître ou un gardien de chaque endroit (qui les contrôle)? Oui: _ Non: _

F. Où enterre t-on les morts ici?

a. Devant/derrière la maison: _____ b. cimetière: _____
c. brousse:_____ d. arbre, préciser: _____

Pourquoi? **[Qualitatif]**

G. Où s'trouvent les cimetières? **[Qualitatif]**

5. **MARRIAGE** (entre/dehors clan, village, etc.): **[Qualitatif]**

6. **SYSTEMES DE PRODUCTION**: par ordres d'importance, quels sont les six systèmes de production les plus suivis?
   a. _____ b. _____ c. _____
   d. _____ e. _____ f. _____

   Saison Agricole: a. _____ b. _____
   c. _____ autre: _____

   A. Par ordre d'importance, qu'est-ce qu'on cultive dans ce village/campagne:

Culture	Saison	Culture	Saison

   B. Modes d'attribution de terres **[Qualitatif]**:

   C. Est-ce qu'il-y-a des conflits fonciers? Comment? **[Qualitatif]**

   D. S'il-y-en-a, mode d'irrigation: Puits de surface: _____ forage: _____
   fleuve: _____ marigot: _____ autre: _____

   E. Qui s'occupe avec l'agriculture (des hommes, des femmes, des enfants, des ethnies)?
   a. _____ b. _____
   c. _____ d. _____
   e. _____ f. _____

   (j=jamais; s=souvent; r=rarement; p=périodiquement; h=habituellement)

7. Est-ce que les fermiers du village utilisent:

engrais	produits phytosanitaires	machines agricoles	semences améliorées	crédit agr.

8. Y a-t-il un **service de vulgarisation agricole** au village? Oui: _____ Non: ____

9. Comment les agriculteurs ont-ils l'habitude d'assurer la **conservation de grains? [Qualitatif]**

_____

_____

_____

10. Une grande quantité de ces grains est-elle perdue annuellement pour mauvaises conditions de stockage? [j r s p h] [_____]

11. **Causes de prévarication** des grains?
a. insectes: _____ b. rongeurs: _____ c. mildiou: _____ d. autres (spécifiez): ____

12. Pour éviter les difficultés de stockage les agriculteurs du village vendent-ils leurs grain aussitôt après la récolte? [j r s p h] [_____]

13. Est-ce que les terres sont toujours aussi fertiles? Problèmes d'érosion? Ponts, digues, qui les entretiennent? **[Qualitatif]**

_____

_____

_____

ELEVAGE:

14. Par Ordere d'importance, quel type d'**animaux** domestiques y a t il au village?

a. _____ Nos. ____ b. _____ Nos. ____
c. _____ Nos. ____ d. _____ Nos. ____
e. _____ Nos. ____ f. _____ Nos. ____

A. Où est-ce q'on garde les animaux domestiques? _____

B. Qui s'occupe d'eux (ethnie, age, sexe): a. _____ b. _____
c. _____ d. _____ e. _____

C. Est-ce q'il-y-a **des conflits entre agriculteurs et éleveurs**? Si oui, lesquels: **[Qualitatif]**

15. Y a-t-il un **service vétérinaire** dans le village? Oui ___ Non: ___

FORETS:

16. Y-a-til **des forêts** près du village? Oui: ___ Non: ___

Utilisations principales des forêts:

a. _____ b. _____ c. _____
d. _____ e. _____ f. _____

Par qui (ethnie, sexe, age, etc.) **[Qualitatif]**:

a. Est-ce que d'autre personnes (étrangers) utilisent la forêt? Comment? **[Qualitatif]**

b. Qu'est-ce qu'on fait avec les zones des forêts dégagés? **[Qualitatif]**

c. Types d'animaux sauvages chassés? Pestes (i.e., qui ménace les champs) **[Qualitatif]**

PECHE:

17. Est-ce qu'il-y-a des pêcheurs dans le villages?: Oui _____ Non: _____

Lieu de pêche: a. _____ b. _____ c. _____
Ethnie de pêcheurs: a. _____ b. _____ c. _____

Sexe at age de pêcheurs: a. _____ b. _____ c. _____
Espèces de poissons: a. _____ b. _____ c. _____
d. _____ e. _____ f. _____
Période de pêche: _____

Quantité approx. par pêcheur: _____

Utilisation par ordre d'importance (autoconsommation; dons; échange; vente):

a. _____ b. _____ c. _____ d. _____

Lieu de vendre: a. _____ b. _____ c. _____

18. **BOUTIQUES/MARCHES**: Combien de boutiques y a-t-il dans le village? [____]

Par ordre d'importance quels sont les 10-15 produits les plus vendus:

1.	2.	3.	4.	5.
6.	7.	8.	9.	10.
11.	12.	13.	14.	15.

19. **ACTIVITES MANUFACTURIERES**: Lesquelles existent dans le village? Combien?

entreprises							
nombre							

20. **TRANSPORT**: Quels sont les moyens de transport disponibles au village:

21. **SERVICES**:

Administr.						
Sociaux						
Education						
Santé						
Communic.						

22. **Conditions réception de radio nationale**: bonne ___ médiocre ___ mauvaise ___

23. SANTE

Quelle sont les principales maladies (par ordre d'importance) qui menacent les gens ici?

No.	Maladies	Commentaires
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		

24. Quant les gens sont malades, comment se soignent-ils? Où vont-ils si le traitement n'est pas satisfaisant? **[Qualitatif]**

25. **MIGRATION: [Qualitatif] (qui, où, pour quoi faire, etc.)**

26. **ONG/ASSOCIATIONS** (pour chaque ONG/ASS.)

Type de groupe (ONG/Associations): _____ Date de création: _____
Genre de membres et nombres: (a) Femmes: ___ (b) Homme: ___ (c) Mixte: _____

Objectifs de l'Association/ONG: **[Qualitatif]**

ACTIVITIES DES ONGs/ASSOCIATIONS:

Activités	Oui/Non	Observations
Cotisation d'argent		
Epargne		
Emprunt		
Cotisation de savon		
Cotisation d'alimente		
Causeries éducatives		
Activités génératices de revenues		
Travaux champêtres		
Autres		

27. **PIPELINE**

A. Est-ce que vous avez entendu parlé du pipeline? Oui: _____ Non: _____

B. Qu'est-ce que vous en avez entendu? **[Qualitatif]**

C. Qu'est-ce que vous pensez de ce que vous avez entendu? **[Qualitatif]**

28. Autre Commentaires: **[Qualitatif]**

B. Annex II: Household Survey

RECENSEMENT DES MENAGES DE L'ECHANTILLON
Ruraux et periurbains

CODE DU MENAGE: [_____]

1. Enquêteur: _____ 2. Date: _____ 3. Village:_____
4. Arrondissemment: _____ 5. Département: _____
6. Nom du chef du ménage: _____ 7. Ethnie: _____
8. Titre (Chef de village, Conseiller, etc.): _____
9. Caste/Strate/Etc.: _____ 10. Occupation Principale: _____
11. Autres activités remunératives: a. _____ b. _____

c. _____ d. _____

12. Membres salariés du ménage? ____ 13. Membres bénéficiaires d'une pension? _____
14. Membres artisans? __ 15. Membres en migration? Oui: _____ Non: _____
16. Où sont les membres en migration? **[Qualitatif]**

_____
_____
_____
_____

17. Est-ce qu'il ya des membres migrants envoyant de l'argent? Oui: _____ Non: _____
18. Si oui, combien d'argent et avec quel fréquence? **[Qualitatif]**

_____
_____
_____
_____
_____

19. Composition du Ménage (Liste des membres Présents/Absents):

Noms	Age	Sexe	P/A	Res.pr[7]	TI[8]	NI[9]	P[10]	Act. Princ.[11]

I. ACCES A LA TERRE

a. Combien de champs appartient au ménage? _____ b. A qui: _____
c. Statut foncier: _____
d. Mode d'access: _____
e. Superficie en ha de chaque champ: _____
f. Lieu: 1. _____ 2. _____ 3. _____

[7]Résidence Principale.

[8]Type d'Instruction.

[9]Niveau d'Instruction en Années d'études.

[10]Liens de Parenté au chef du ménage.

[11] Activité (métier/fonction) principale au lieu principal de résidence: ex: Agriculture, Commerce, Pêche, Artisanat, Elève, etc.

Produits et Utilisation (un seul produit peut avoir plusiers utilisations)

Produit	Saison	Utilisation	Marché?	Par qui	M/transport	Frequence	Distance

II. ACCES AU BETAIL

Espèces	Approprié et géré par le ménage			Approprié et confié par le ménage			Confié au ménage		
	M	F	Tot.	M	F	Tot.	M	F	Tot.
Bovins									
Ovins									
Caprins									
Porc									
Vollailles									

III. ACCES A D'AUTRES FORMES DE CAPITAL (incluant les pièce de maison)

N.B.: Nb: Nombre; E.U.: En état d'utilisation; H.E.U.: Hors d'Etat d'Utilisation. Pour E.U. et H.E.U. on donne le nombre concerné.

Catégories	Nb	E.U.	H.E.U.	Catégories	Nb	E.U.	H.E.U.

C. Annex III: Official Government of Cameroon Crop Valuation Sheets

C. Official Government of Cameroon Crop Valuation Sheets

DECREE No. 58/MINAGRI[12]
amending the rate of indemnification to pay to landowners
for fruit tree or food-producing cultures destruction.

The Minister of Agriculture,

Whereas:

1. The Constitution of June 2, 1972, as amended and completed by Laws number 75/1, dated May 9, 1975, and number 79/2, dated June 29, 1979.
2. Decree number 79/473, dated November 15, 1979, amending the reorganization of the Republic of Cameroon.
3. Decree number 80/721, dated July 17, 1980, giving the list of the members of Government.
4. Decree number 76/256, dated July 1, 1976, amending the reorganization of the Ministry of Agriculture.

RULES THAT:

Article 1: Any fruit tree or food producing culture destruction will entail the payment of a compensation to the landowner. The indemnification will be paid by the party responsible for the damages, based on the following rate:

I-YEARLY CULTURES:

Leguminous plant: groundnut, vouandzou, soya, bean, etc...	
Young	30F/m2
Adult	50F/m2
Cereals: corn, millet, sorgho, rice, etc...	
Young	30F/m2
Adult	50F/m2
Banana (*"plantain"*):	
Young	350F/plant
Adult	600F/plant
Banana (*sweet*):	
Young	200F/plant
Adult	350F/plant
Pineapple:	
Young	100F/plant
Adult	180F/plant

[12]Amounts reflect prices before devaluation.

Tuber: yam, macabo, taro, potatoes, manioc, etc...	
Young	50F/plant
Adult	80F/plant
Truck farming:	1500F/m2
Cotton plant:	
Young	30F/m2
Adult	50F/m2
Tobacco plant:	
Young	30F/m2
Adult	50F/m2
Sugar cane:	
Young	25F/plant
Adult	40F/plant

II-PERPETUATED CULTURES:

II-1) FRUIT TREE

Citrus fruits: lemon tree, orange tree, mandarin tree, grapefruit, etc...	
Young	1250F/plant
Adult	3500F/plant
Mango tree, avocado tree:	
Young	1250F/plant
Adult	3500F/plant
Pawpaw tree:	
Young	150F/plant
Adult	560F/plant
Kola tree and Safoutier:	
Young	1250F/plant
Adult	3500F/plant
Any other tree fruit:	
Young	575F/plant
Adult	1751F/plant

II-2) INDUSTRIAL CULTURES

Cacao and coffee tree:	
under 5 years	600F/plant
between 8 and 15 years	1500F/plant
25 years and over	1200F/plant
Palm oil tree and coconut palm:	
under 8 years	575F/plant
between 8 and 15 years	1150F/plant

25 years and over	1725F/plant
Palm tree (rafia):	500F/plant
Hevea:	
Young	300F/plant
Adult	850F/plant
Tea tree:	
Young	120F/m2
Adult	160F/m2

II-3) MEDICINAL PLANTS

Cinchona:	
Young	75F/m2
Adult	200F/m2
Voapange:	
Young	600F/m2
Adult	1200F/m2
Pigpum and Yohimbe:	
Young	500F/plant
Adult	1000F/plant

II-4) SHADE TREE

Young	500F/plant
Adult	1000F/plant

II-5) OTHER CULTIVATED TREE

under 5 years	1000F/plant
over 5 years	2000F/plant

Article 2: The number of damaged plants taken into account for calculating the compensation could not be more than the maximum number defined by the plantation densities given here below:

Banana ("plantain")	1880 plant/ha
Banana ("sweet")	1600 plant/ha
Yam, macabo, taro, potatoes, manioc	1200 plant/ha
Orange tree, lemon tree	250 plant/ha
Grapefruit	250 plant/ha
Mandarin tree	250 plant/ha
Mango tree	250 plant/ha
Avocado tree	150 plant/ha

Palm oil tree	150 plant/ha
Coconut palm	150 plant/ha
Cacao tree	1600 plant/ha
Coffee tree	1600 plant/ha
Hevea	600 plant/ha
Cinchona	10000 plant/ha
Pineapple	65000 plant/ha

Article 3: The rates defined in Article 1 apply only in case of damages associated with a project of Public Interest. For any other cause of destruction, the expert evaluation Committee has power to make a broader appreciation of the damages and to grant a lump sum, in addition of the fixed rates defined, to account for the real loss suffered by the landowner.

Article 4: This decree replaces all the previous texts, which might be in contradiction with the present one and are therefore abrogated.

Article 5: This decree will be filed, published, and communicated wherever it will be needed.

APPENDIX C

COASTAL ENVIRONMENT

TABLE OF CONTENTS

1.0 DESCRIPTION OF COASTAL CHARACTERISTICS

1.1 INTRODUCTION

A series of base maps of the coastal area between Campo on the Cameroon/Equatorial Guinea border and the Cameroon Estuary have been prepared to depict coastal land uses, vegetation types, wildlife/reserve areas, and various shoreline features and characteristics (Figures C-1(a) - (e) and C-2(a) - (e)). These maps are based on recent aerial photography, augmented with other maps and limited data sources and documents. The aerial photography, consisting of five 1:50,000 scale photomosaics, was flown along the coastline in January 1995 and served as the primary source of mapping information. The principal supplementary data sources were the Vegetation Study of Cameroon by Letouzey (1985), topographic maps (Cameroon at 1:200,000, Mouanko and Kribi sheets, 1977), and the Dames & Moore Terrain Analysis and Land Use Mapping Report (Dames & Moore 1994). It should be noted that with the exception of the coastline between Londji and Grand Batanga, the information on Figures C-1(a) - (e) and C-2(a) - (e) have not been groundtruthed.

Ideally, both coastal characteristics and shoreline features (Figures C-1(a) - (e)) and coastal land use and vegetation types (Figures C-2(a) - (e)) would be compiled onto one base map. However, due to the large amount of data, it was determined that presenting this information into map data sets would allow for an easier interpretation of the data. It should be noted that map sets for a given shoreline area should be reviewed together in order to gain a full understanding of the complexity of a particular coastal area.

1.2 DESCRIPTION OF COASTAL ZONE

Approximately 200 km of the Cameroon coastline was mapped, extending from the Cameroon/Equatorial Guinea border at the mouth of the Ntem River to Point Souelaba at the mouth of the Cameroon Estuary.

The northern section of coast between the Cameroon Estuary and the town of Londji consists of relatively low-lying terrain. The backbeach zone just landward of the shoreline is comprised of low coastal sand ridges which closely parallel the shore. Wide sand beaches lie seaward of the sand ridges which, except for the mouths of the Sanaga, Nyong, and Lokoundje rivers, stretch continuously between Point Souelaba and Londji. Expansive deltaic/estuarine wetlands occur around the mouths and in the deltas of these three rivers. Mangroves grow extensively in the brackish deltaic wetlands, but the sand ridges and alluvial

plains further inland are colonized mostly by relatively undisturbed Atlantic littoral evergreen forest. Although the entire remote coastal zone north of the Nyong River is within the Douala-Edea Wildlife Reserve, a few isolated villages are found along the coastline. Road access to this section of coastline is limited to one road which leads from the town of Mouanko to coastal villages just north of the Sanaga River delta.

The middle section of coast from Londji south, past Kribi, to the village of Eboundja is characterized by a gently undulating coastal plain with many low rocky headlands jutting out along the shoreline. These rocky headlands have crescent shaped sand beaches and sandy coves between them. However, a long stretch of sand beach does occur just north of Eboundja. This part of the coast is relatively well developed with frequent villages and larger towns connected by a primary paved road in close proximity to the shoreline, including the town of Kribi and its port facility at the mouth of the Kienke River. Agriculture and plantations are widespread and the Atlantic Littoral Evergreen forest extending inland from the backbeach zone is generally disturbed, particularly near roads and populated areas. Roads or trails provide beach access from the several villages and towns located near the shore along the coast road.

Along the southern section of coast, from the village of Eboundja south to the town of Campo near the mouth of the Ntem River, the coastal topography is rougher, comprised mostly of low hills. The shoreline is characterized by numerous rocky headlands with small coves separated by sandy beaches. Generally, the headlands appear higher, with more exposed rock than in the middle section of the coast. In some places, relatively steep slopes lead down to the beaches, and offshore rocky outcrops are common. This section of the coast is entirely within the mapped extent of the Campo Wildlife Reserve, although a few villages and associated areas of forest agriculture are located along the coastal road. The Atlantic Littoral Evergreen forest which dominates this section of coast is disturbed along the road and near villages, but for the most part the forest, extending inland from the shoreline, is dense. In isolated areas along the coast the forest forms a substantial barrier to beach access, and only a few trails lead through the forest down to the shore from the coastal road and villages. Just south of Campo, near the mouth of the Ntem River, the terrain is flatter and the area more developed. There is both an airfield and a port facility located at Ipano, a short distance upriver on the edge of the Ntem River delta. The delta is comprised of extensive deltaic/estuarine wetlands and mangroves.

1.3 BASE MAP DEVELOPMENT

The scale and resolution of the aerial photography and the scale and reliability of the supplementary maps and other information permitted the identification, interpretation, classification, and description of coastal data. Hydrographic and place names were taken from Cameroon 1:200,000 topographic maps. Three types of base map information were interpreted from the aerial photography. These include:

- Towns and Villages–aerial extent of buildup and common use areas for all photo identifiable villages and towns along the coastal zone.

- Coastal Hydrography–all principal drainage mappable from the photography.

- Roads and Trails–primary roads and all photo identifiable secondary roads and tracks providing beach access.

Coastal Characteristics and Shoreline Features–The following classifications were developed to map shoreline types and coastal landform characteristics. These features are presented on Figures C-1(a) - (e) and are discussed below.

- Sand Beaches–the unvegetated sand deposits, depicted to scale, comprising the strip between the waterline and backbeach line as recorded on the photo images.

- Headlands–the points of land jutting out along the coastline. Some headlands appear to have narrow sand or gravel beaches at the point, particularly along the middle section of coast. Rock at the point is more apparent, and the headlands are noticeably higher along the southern section of coast.

- Offshore Rocks–exposed and underwater rock visible in the aerial photography.

- Coastal Sand Ridges–a significant background landform comprising low coastal sand dunes/accumulations stabilized by vegetation. These features occur in the backbeach zone along the low-lying northern section of coast and at the seaward margin of the deltaic mangrove swamps.

- Coastal Plains–a principal background land form comprising a belt of flat to gently undulated lowland plains which lie along the Atlantic coast. These features occur along

the middle section of coastline and around the mouth of the Ntem River along the Equatorial Guinea border.

- Sand Bars–exposed and unexposed deposits which form in and around the mouths of the principal rivers and streams.

- Low Hills–a principal background landform comprising the relatively hilly terrain along the southern section of coast.

- Deltaic/Estuarine Wetlands–an extensive sedimentary environment comprised of low sand bars and alluvial mud flats interrupted by a dense network of meandering brackish creeks and channels. These wetlands are found in estuarine and deltaic settings seaward of the alluvial plains on the landward margin of coastal sand ridges. They occur extensively on deltas and near river mouths along the low-lying northern section of coast and in the south on the Ntem River Delta. A few small wetlands also occur within low-lying areas along the southern section of coast.

- Waterfalls–only found upstream of the mouth of the Lobe River, a few kilometers south of Kribi.

- Harbor/Port Facilities–located at Kribi in the mouth of the Kienke River and south of Campo at Ipono on the Ntem River. Anchorage for smaller vessels such as fishing boats may also be possible at villages along the mouth of the Sanaga River and about 10 km upriver at the town of Mouanko.

- Estuary/River Mouths–water passages at or near the mouth of the rivers subject to tidal influence

- Inlets–narrow water passages from the sea through sandy beaches and backbeach areas, into small inland water courses. Some are closed during low tide. These features occur sporadically along the entire coastline.

- Alluvial Plain–a principal background landform comprising low-lying alluvial flats and bars with intermittent creeks and swampy depressions. Occurs along the low-lying northern section of coast, landward of the coastal sand ridges and deltaic/estuarine wetlands.

Coastal Land Use and Vegetation–The following classifications were established to map coastal land use and vegetation. These features are presented on Figures C-2(a) - (e) and are discussed below.

- Agriculture Areas–the aerial extent of zones of traditional agriculture including recent fallows. Scattered forest agriculture is most common around the remote villages along the northern and southern sections of coast. Agriculture is more intensive around the villages and towns along the middle section of coast. Where villages are close to the shore, agricultural plots commonly extend into the backbeach zone or areas near the shore.

- Plantations–areas of commercial/mechanized farming. Occurs only in the middle section of coast around Kribi.

- Forests–comprises littoral evergreen forest of the Atlantic Evergreen zone. The coastal plain, coastal sand ridges, and low hills are all colonized by this forest which is found along the entire coastline. The forest ranges from disturbed around populated places and along roads to very dense in the remote areas along the northern and southern sections of coast.

- Mangroves–comprises the red mangrove on clayey muds usually near the seaward margin of the swamps, the white mangrove on sandier soils and the other smaller mangrove species which colonize the brackish wetlands. Occurs in the river deltas and in smaller low-lying settings along the northern and southern sections of coast.

- Shrubby Vegetation–comprises littoral shrubs and grasses which colonize the exposed seaward edge of the backbeach zone. This usually very narrow vegetation strip running along the entire coastline is broken along the shore in front of Kribi. Only the few wider strips have been mapped due to scale limitations.

- Degraded/Eroded Areas–highly disturbed areas or areas of scant natural vegetation.

- Unvegetated Areas–the sand beaches and rocky areas generally between the high and low waterlines as visible in the photography. Occurs along the entire coastline.

- Wildlife Reserves–designated wildlife reserves as determined from the supplementary data sources. Large wildlife reserves extend inland from the shoreline and include large areas of the coastal zone along the northern and southern sections of coast.

- Wildlife Concentration Areas--primary wildlife feeding/breeding habitats centered around the estuarine and mangrove ecosystems along the northern and southern sections of coast.

2.0 CAMEROON COASTLINE ENVIRONMENTAL SENSITIVITY INDEX CLASSIFICATION SYSTEM

2.1 INTRODUCTION

An approximate 200 km segment of the Cameroon coastline, from its southern border with Equatorial Guinea north to the Cameroon Estuary, was mapped to identify coastal shoreline features and characteristics, land use and vegetation types (see Section 1.0). Based upon the information presented on these maps, an environmental sensitivity index (ESI) classification for this portion of the coastline was established. The ESI classification system for this portion of the Cameroon coastline was developed based upon previous ESI classification systems developed for other coastlines in Africa and elsewhere in the world (Pavia et. al., 1995; Baker et. al., 1995; Gundlach et. al., 1985; and, Webb, Caroline L., 1985).

The objective and purpose of the ESI classification system is to develop detailed environmental mapping of the shoreline for use in oil spill response planning, and to assign priorities for shoreline protection and cleanup in the event an oil spill reaches shore.

2.2 DESCRIPTION OF ESI CLASSIFICATION SYSTEM

A 10-point ESI classification system was developed that best represents the general characteristics of the 200 km segment of Cameroon coastline based upon the information presented in Section 1.0. The ESI classification system is numerically arranged in a 10-point scale according to a particular shoreline type's sensitivity to potential oiling, with No. 1 being the least sensitive and No. 10 being the most sensitive. The numerical order was established for individual shoreline segments based upon their potential biological resource value, potential economical and/or recreational use value, and relative ease of cleanup in the event it becomes oiled. The ESI classification system developed for this portion of the Cameroon coastline is presented below.

1. Rocky headlands
2. Manmade structures (includes sea wall or pier)
3. Sand beach
4. Mixed sand and gravel beach
5. Gravel beach (includes porous structures such as riprap)
6. Stabilized sand dunes
7. Vegetation, shrubs and trees
8. Tourist/recreational beach

9. Sheltered tidal flats and mud flats
10. Estuary, wetlands, inland water courses, mangroves and wildlife concentration areas.

This 10-point scale is based on the original index of Gundlach and Hayes (1978), and follows the basic principles that a particular shoreline's sensitivity to oil increases with increasing shelter from wave action, penetration of oil into the substrate, natural oil retention times on the shore, and the biological productivity of shore organisms. However, the numbers on the scale do not represent actual quantified sensitivity. For example, a shoreline that is assigned an ESI 5 is not five times as sensitive as a shoreline that is assigned an ESI 1.

The ESI classifications for this portion of Cameroon shoreline are shown on Figures C-3(a) - (d) and Figures C-4(a) - (d). It should be noted that every ESI classification listed above is not necessarily represented on the figures.

As part of the oil spill response planning efforts, a series of oil spill simulations were developed by Applied Science Associates (ASA, 1996) using the OIL MAP modeling system. This trajectory modeling used selected wind and current data for this portion of the Cameroon coastline. Two seasonal sets of simulations were run (summer and winter). The modeling scenarios included hypothetical 500 barrel and 51,000 barrel spills, both originating at the FSO location. The 500 barrel spill would be representative of the results of a hose rupture during the transfer of oil from the FSO to a receiving tanker, and the 51,000 barrel spill scenario results from a hypothetical tanker collision with the FSO. Each of the two release scenarios were modeled using a southerly current flow and a northerly current flow during both the winter and summer seasons. An oil type (Bunker C) similar in characteristics to that produced from the oil fields in Chad was used in the simulations.

The simulations were run for a 15 day period and assumed that no offshore oil spill containment and cleanup actions were implemented during the spill event. This assumption would represent a worst-case event, in that if an oil spill did occur at the FSO, oil spill containment and cleanup actions consistent with an Oil Spill Response Plan prepared specifically for this project would be implemented (see Appendix A for an outline of this document). Furthermore, using this assumption facilitates planning efforts by the identification of sections of shoreline that would be prioritized for protection in the unexpected event of a large oil spill.

The results of this modeling, with additional analysis, will be used to develop the project's Oil Spill Response Plan. The modeling indicated:

- Northerly current flow during both the winter and summer seasons produced very similar results
- Southerly current flow during both the winter and summer seasons produced very similar results
- Prevailing winds which blow toward the shore would need to be present during and after a spill for the surface oil to be pushed ashore
- Prevailing currents and tides could tend to move the surface oil parallel to the shore rather than toward the shore
- Oil could possibly contact the shoreline 2 to 4 days after a spill release occurs
- During both the winter and summer scenarios, over a 15 day period, approximately 4 percent would evaporate and the remainder would need to be addressed using oil spill response containment and removal, protection and/or clean-up techniques.

Based on these results, should a large oil spill occur with a northerly current flow, sensitive areas of the shoreline approximately 20 km either side of the Nyong River Delta would be considered priority areas for protection (Figures C-3(a) - (d)). Should a large oil spill occur with a southerly current flow, the results of this analysis indicate that the sensitive areas of the shoreline between Bousabelka and the southern border of Cameroon would be considered priority areas for protection (Figures C-4(a) - (d)).

3.0 REFERENCES

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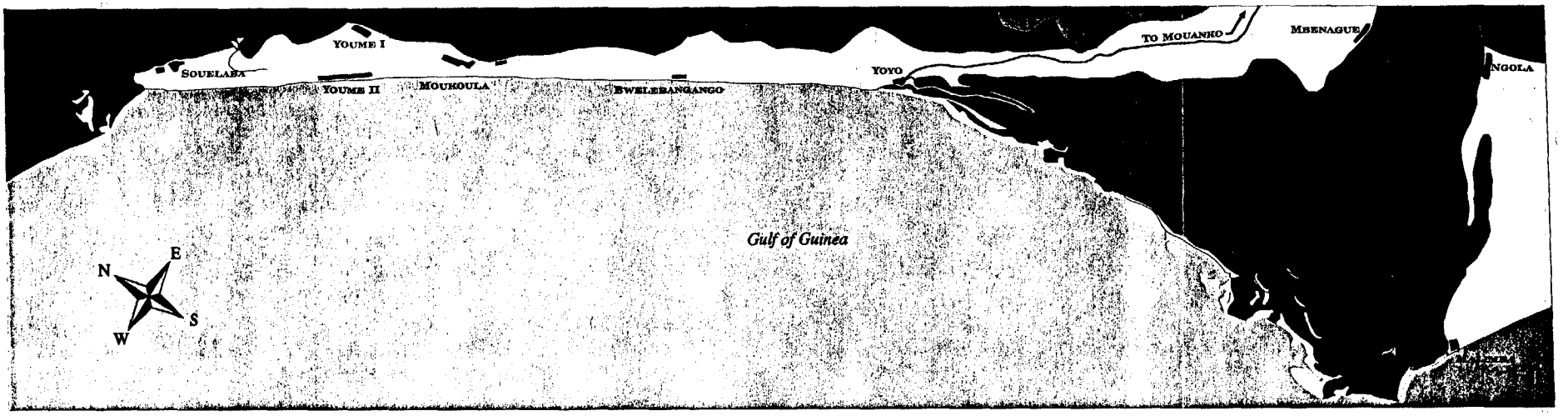

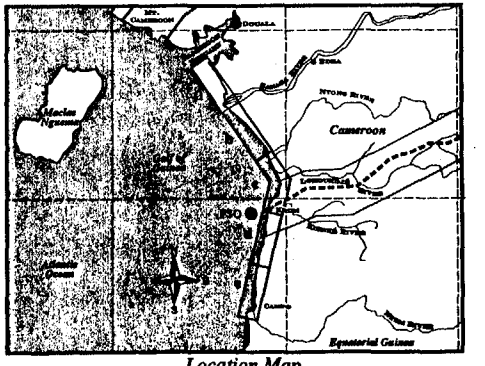

Location Map

0 1 2 3 4 5 Kilometers

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Characteristics and Shoreline Types

- Sand Beach
- Coastal Sand Ridges
- Sand Bar
- Deltaic/Estuarine Wetlands
- Inlet
- Estuary / River Mouth
- Alluvial Plain
- Water
- Villages and Towns
- Access Roads and Tracks
- Coastal Hydrography

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COASTAL CHARACTERISTICS AND SHORELINE TYPES

DAMES & MOORE
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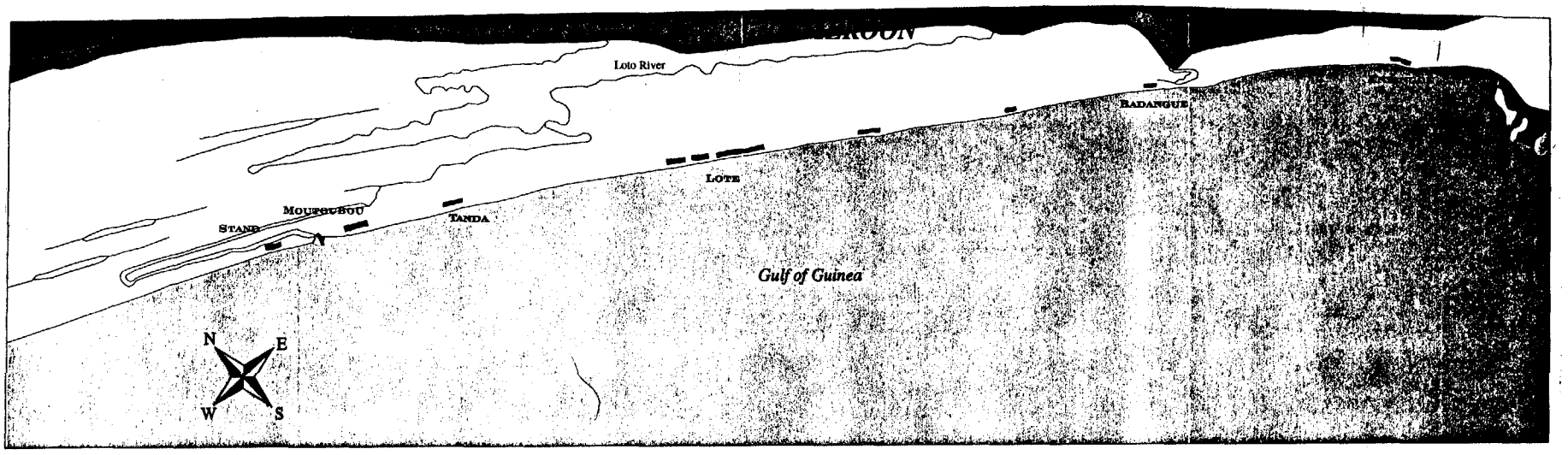
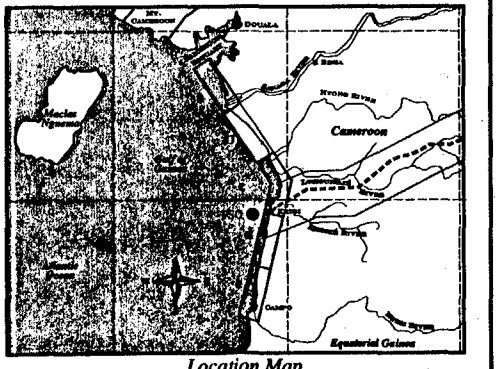
FIGURE C-1(a)





Location Map

0 1 2 3 4 5 Kilometers

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Characteristics and Shoreline Types

- Sand Beach
- Coastal Sand Ridges
- Sand Bar
- Inlet
- Estuary / River Mouth
- Alluvial Plain
- Water
- Villages and Towns
- Coastal Hydrography

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COASTAL CHARACTERISTICS AND SHORELINE TYPES

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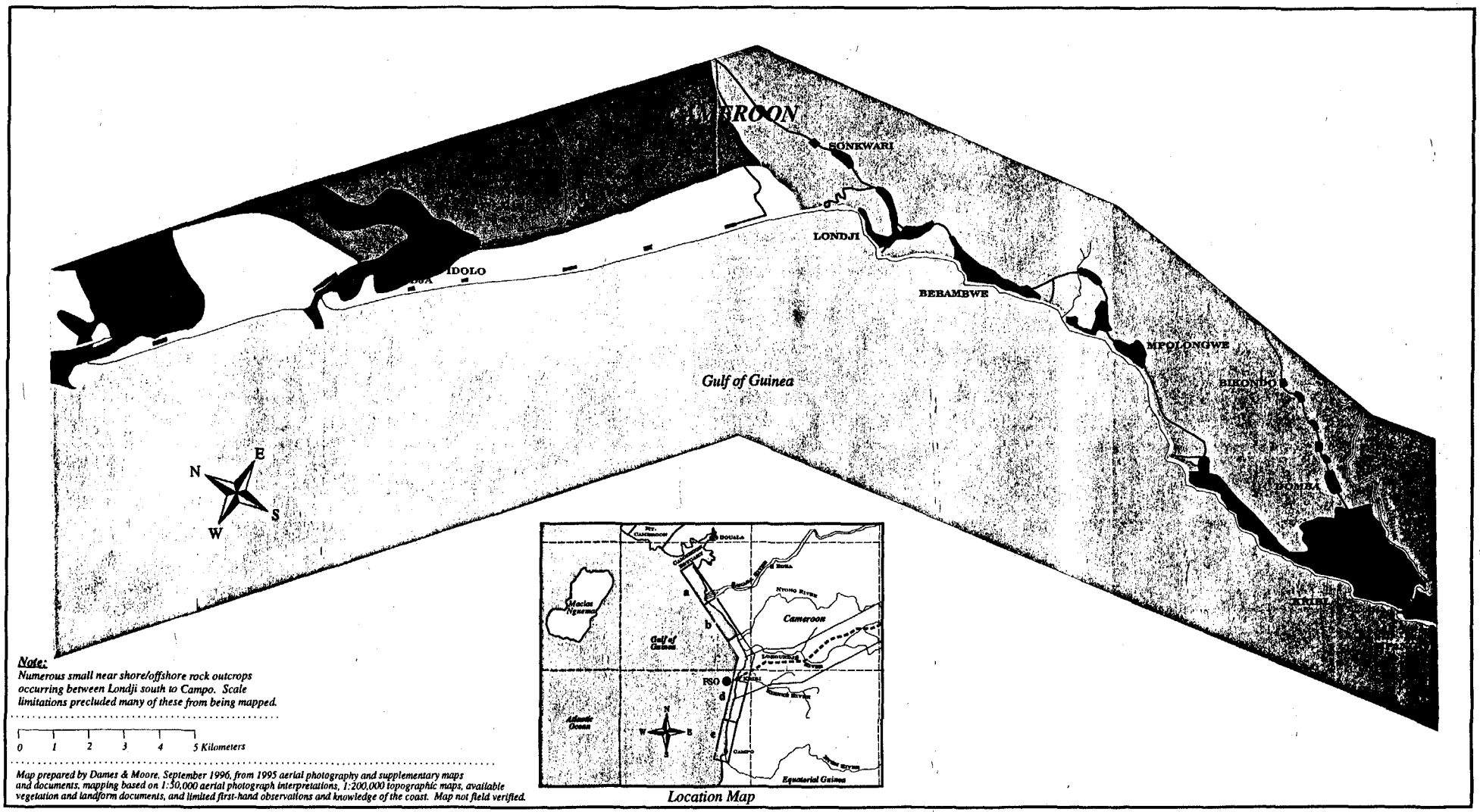
FIGURE C-1(b)



LEGEND: Coastal Characteristics and Shoreline Types

Sand Beach	Sand Bar	Alluvial Plain
Headland	Deltaic/Estuarine Wetlands	Water
Offshore Rock	Harbor	Villages and Towns
Coastal Sand Ridges	Inlet	Access Roads and Tracks
Coastal Plain	Estuary / River Mouth	Coastal Hydrography

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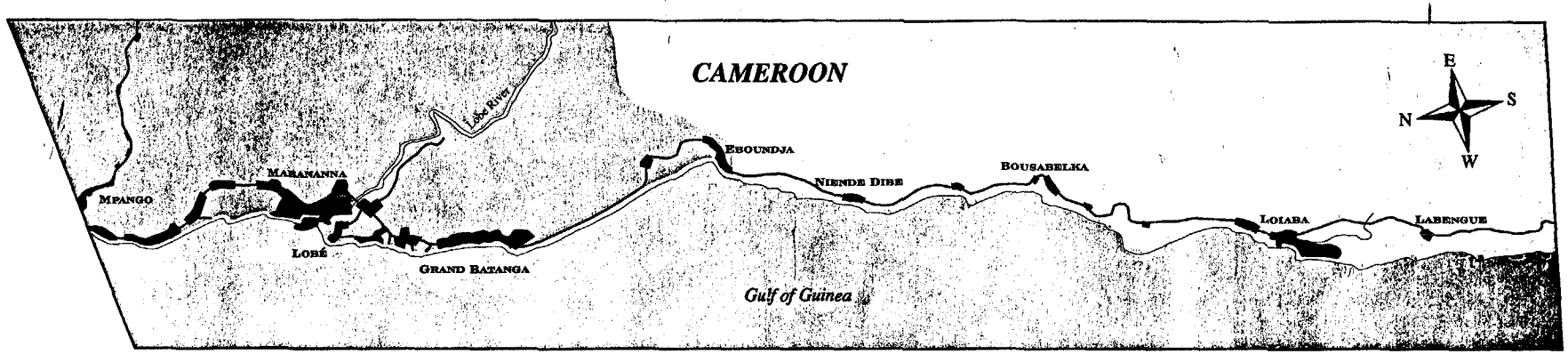
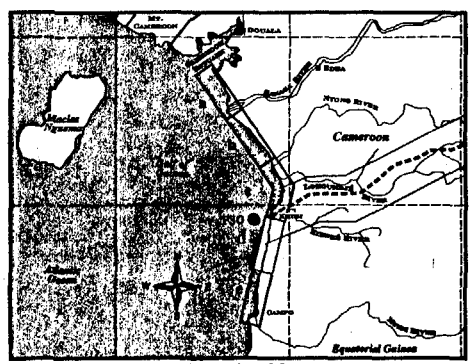
COASTAL CHARACTERISTICS AND SHORELINE TYPES

DAMES & MOORE

FIGURE C-1(c)





Location Map

Note:
Numerous small near shore/offshore rock outcrops occurring between Londji south to Campo. Scale limitations precluded many of these from being mapped.

0 1 2 3 4 5 Kilometers

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Characteristics and Shoreline Types

- Sand Beach
- Sand Bar
- Water
- Headland
- Deltaic/Estuarine Wetlands
- Villages and Towns
- Offshore Rock
- Low Hills
- Access Roads and Tracks
- Falls
- Inlet
- Coastal Hydrography
- Coastal Plain

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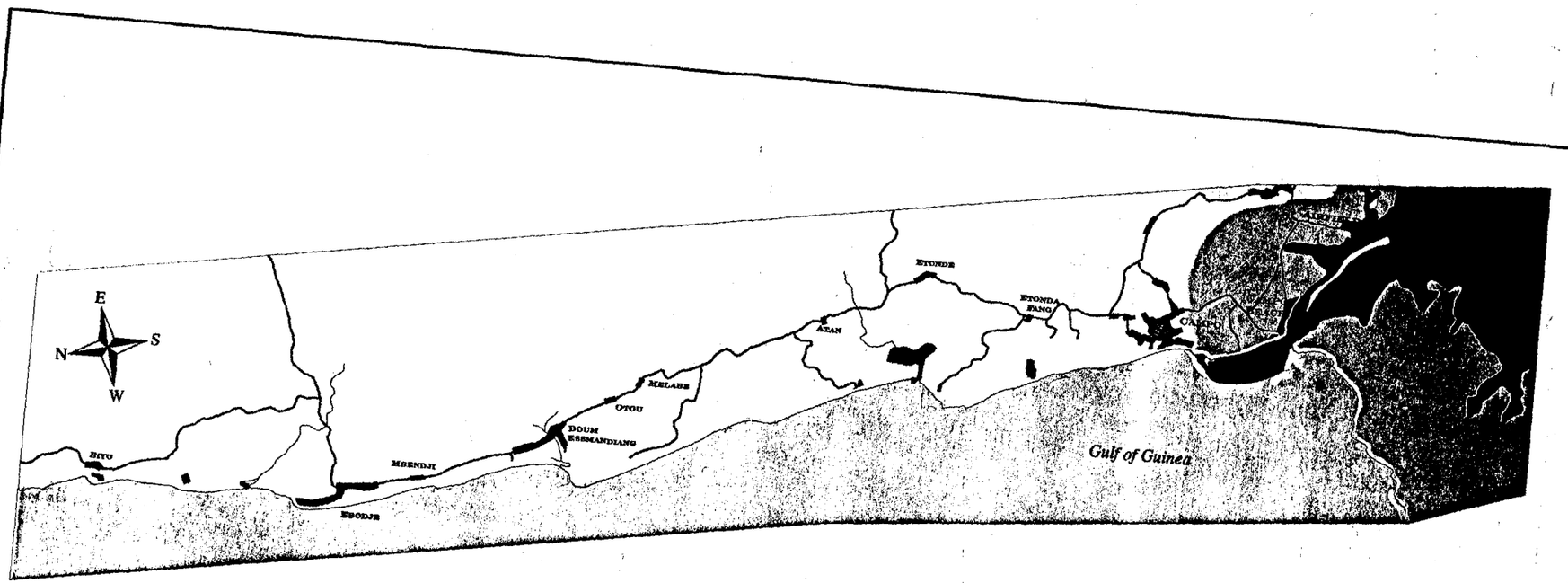
COASTAL CHARACTERISTICS AND SHORELINE TYPES

DAMES & MOORE

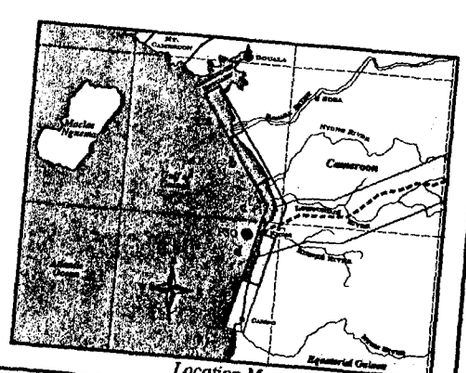
FIGURE C-1(d)



Note:
Numerous small near shore/offshore rock outcrops occurring between Londji south to Campo. Scale limitations precluded many of these from being mapped.

0 1 2 3 4 5 Kilometers

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.



Location Map

LEGEND: Coastal Characteristics and Shoreline Types

- Sand Beach
- Headland
- Offshore Rock
- Low Hills
- Coastal Plain
- Sand Bar
- Deltaic/Estuarine Wetlands
- Harbor
- Inlet
- Estuary / River Mouth
- Water
- Villages and Towns
- Access Roads and Tracks
- Coastal Hydrography

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COASTAL CHARACTERISTICS AND SHORELINE TYPES

DAMES & MOORE
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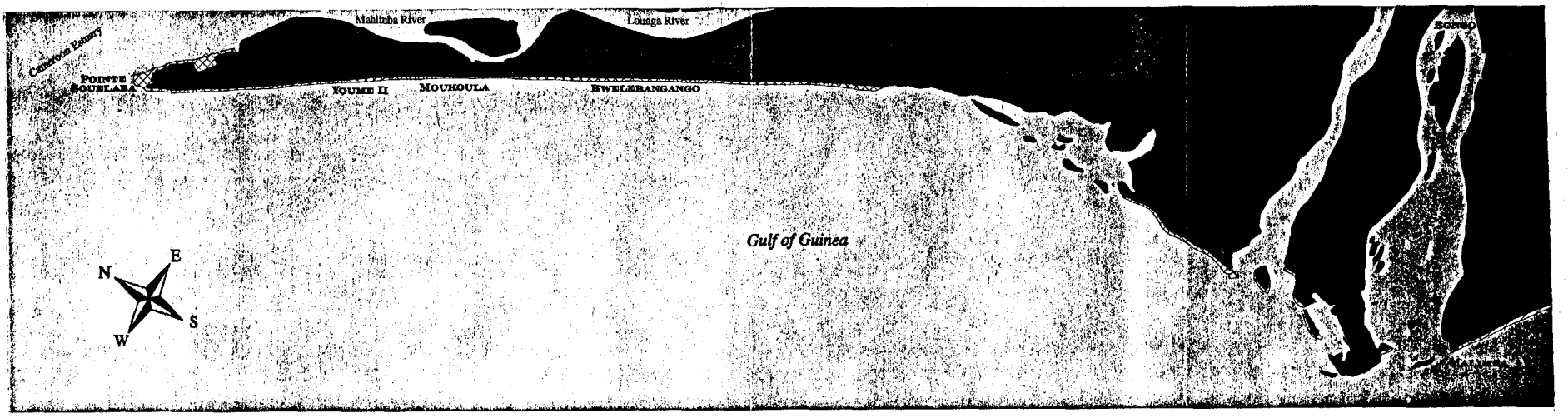
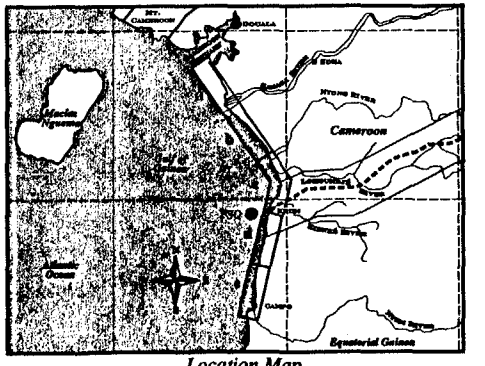
FIGURE C-1(e)





Location Map

0 1 2 3 4 5 Kilometers

Map prepared by Dames & Moore, September 1995, from 1995 aerial photography and supplementary maps and documents; mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas

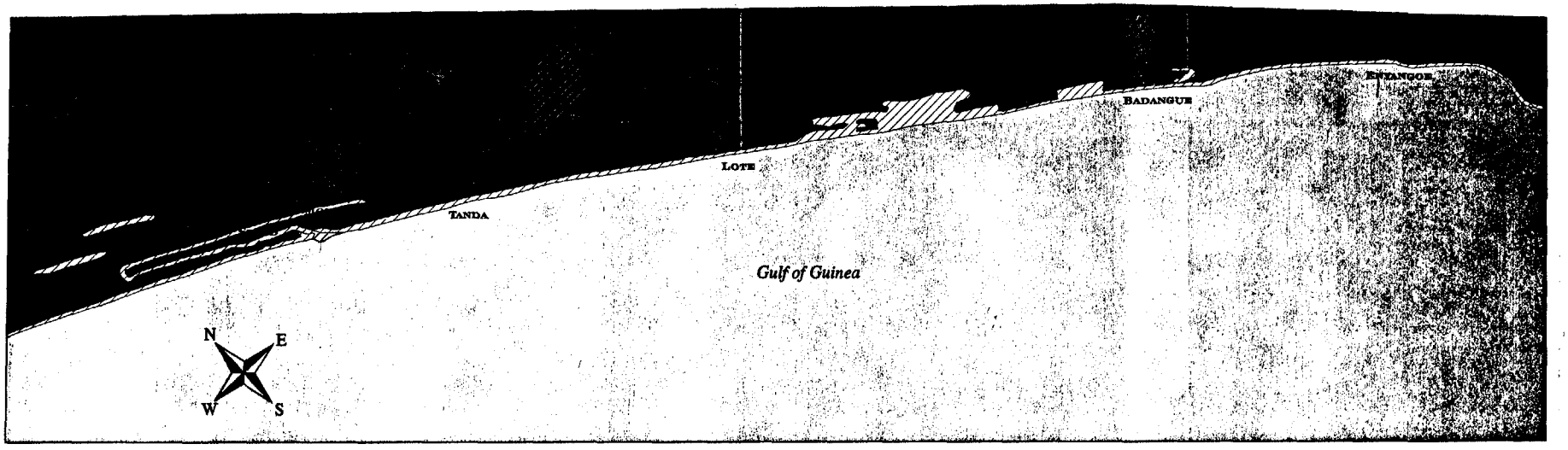
- Agriculture
- Forest
- Mangrove
- Shrubby Vegetation
- Water
- Villages and Towns
- // Wildlife Reserve
- \\ Wildlife Concentration Area
- Unvegetated Coastline
- — Access Roads and Tracks
- — Coastal Hydrography

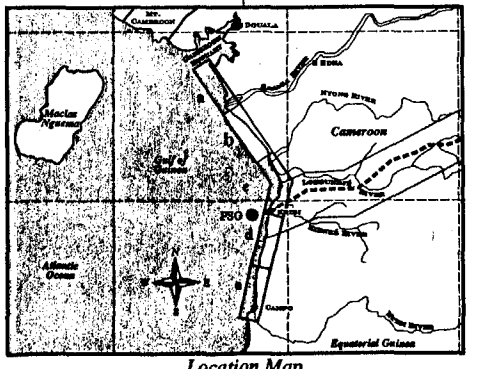
ESSO Exploration and Production Chad Inc.

COASTAL LAND USE, VEGETATION AND WILDLIFE AREAS

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE C-2(a)





Location Map

0 1 2 3 4 5 Kilometers

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas

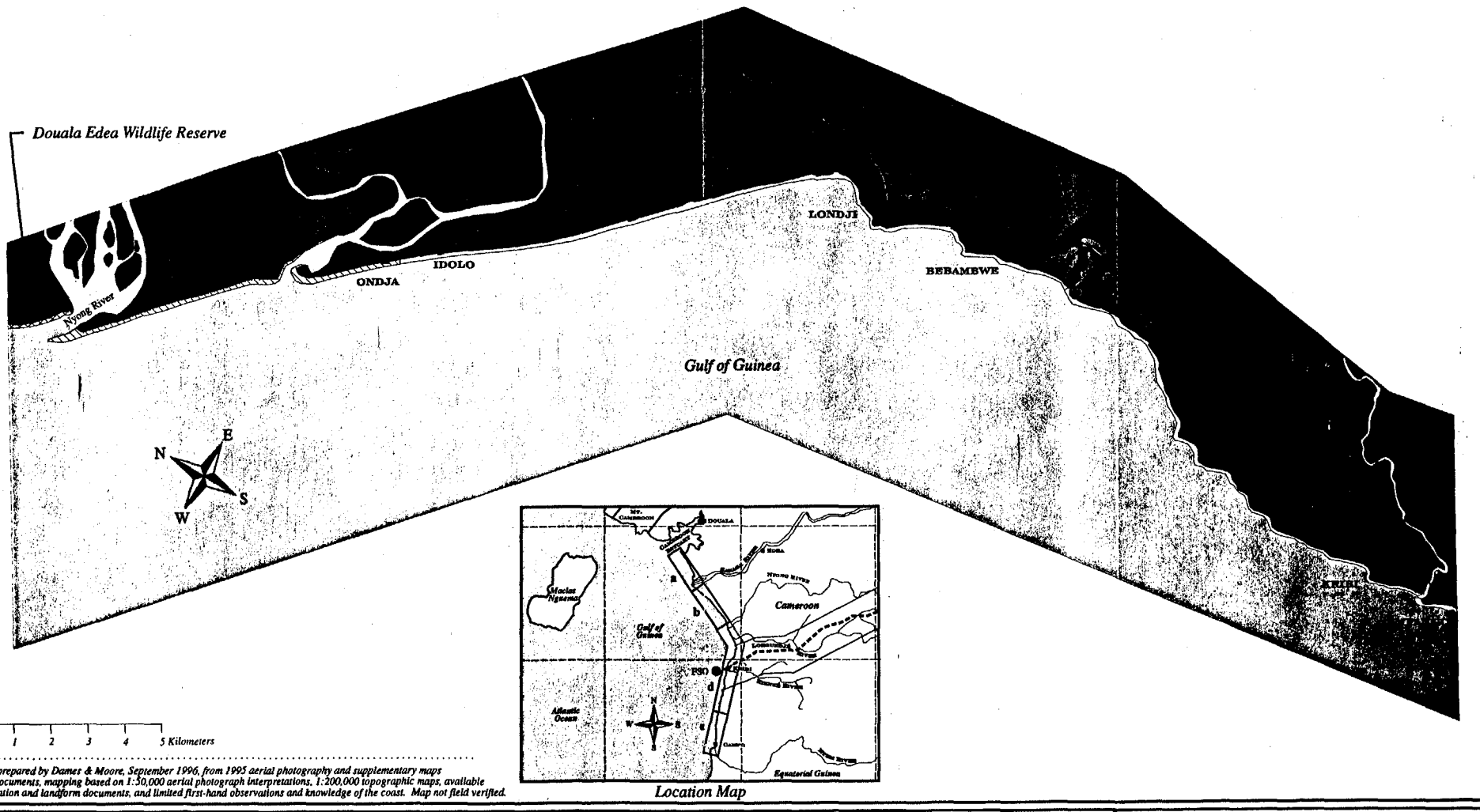
- Agriculture
- Forest
- Shrubby Vegetation
- Unvegetated Coastline
- Water
- Villages and Towns
- Wildlife Reserve
- Wildlife Concentration Area
- Coastal Hydrography

ESSO Exploration and Production Chad Inc.

COASTAL LAND USE, VEGETATION AND WILDLIFE AREAS

DAMES & MOORE

FIGURE C-2(b)



Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas.

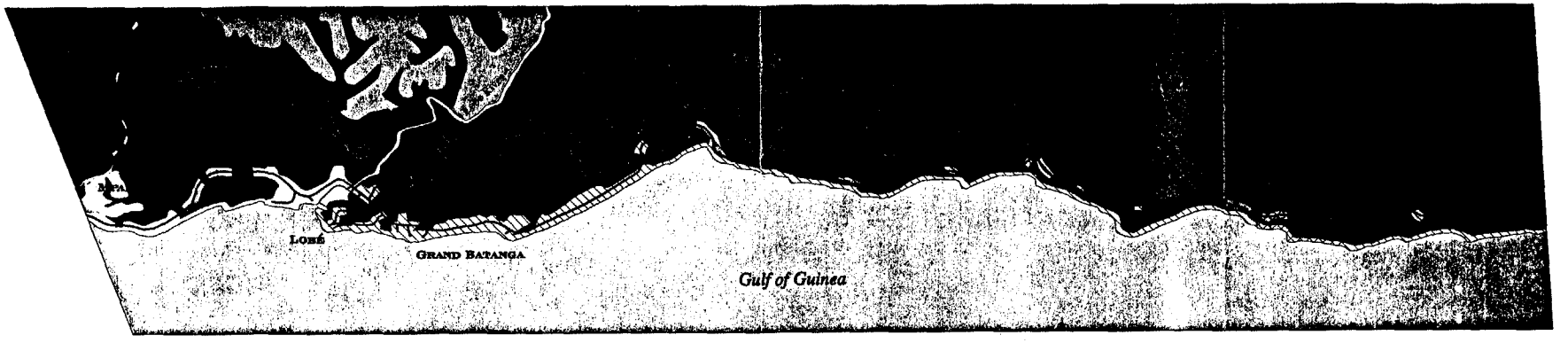
- Agriculture
- Forest
- Mangrove
- Plantation
- Degraded / Eroded
- Unvegetated Coastline
- Tourist / Recreational Beach
- Water
- Villages and Towns
- // Wildlife Reserve
- \\ Wildlife Concentration Area
- — Access Roads and Tracks
- — Coastal Hydrography

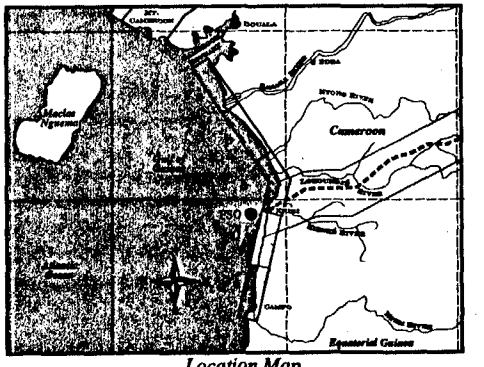
ESSO Exploration and Production Chad Inc.

COASTAL LAND USE, VEGETATION AND WILDLIFE AREAS

DAMES & MOORE

FIGURE C-2(c)





Location Map

0 1 2 3 4 5 Kilometers

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas

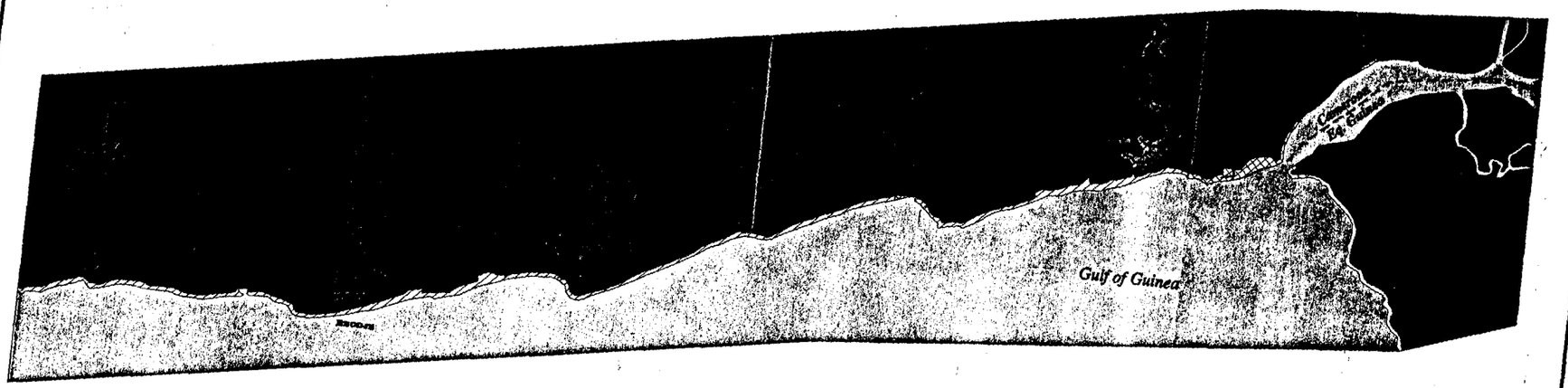
Agriculture	Shrubby Vegetation	\\ Wildlife Reserve
Forest	Unvegetated Coastline	// Wildlife Concentration Area
Mangrove	Tourist / Recreational Beach	— Access Roads and Tracks
Plantation	Water	— Coastal Hydrography
Degraded / Eroded	Villages and Towns	

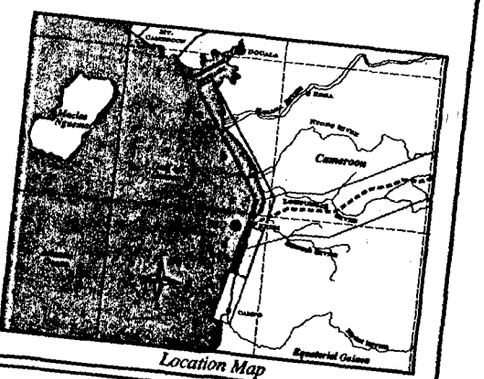
ESSO Exploration and Production Chad Inc.

COASTAL LAND USE, VEGETATION AND WILDLIFE AREAS

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE C-2(d)





Location Map

0 1 2 3 4 5 Kilometers

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas

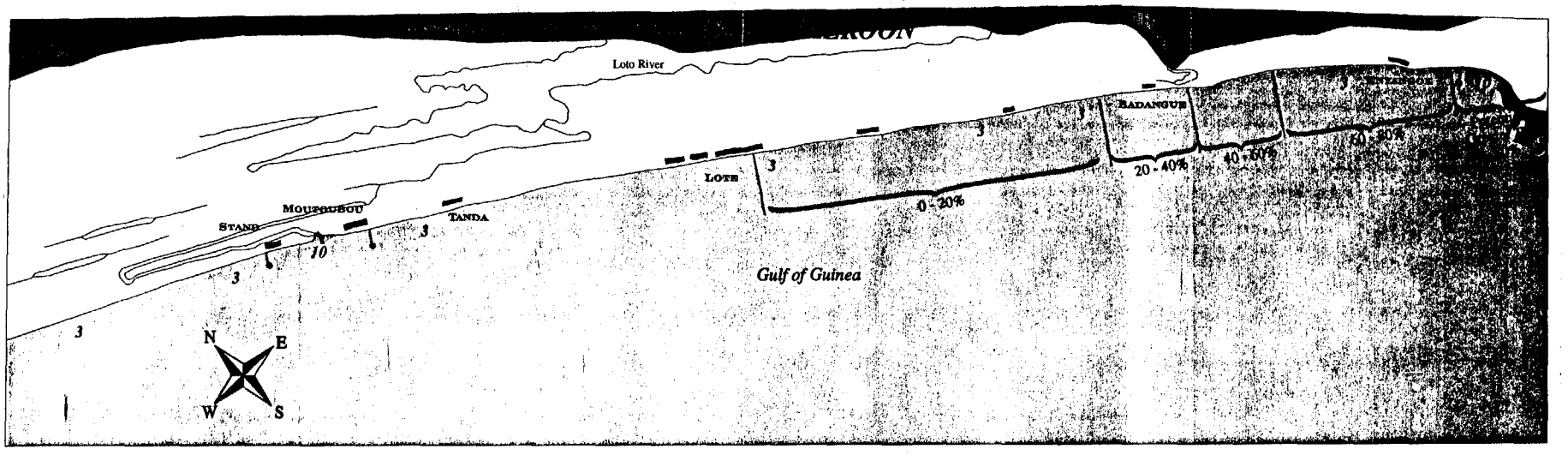
- Agriculture
- Forest
- Mangrove
- Shrubby Vegetation
- Unvegetated Coastline
- Water
- Villages and Towns
- Wildlife Reserve
- Wildlife Concentration Area
- Access Roads and Tracks
- Coastal Hydrography

ESSO Exploration and Production Chad Inc.

COASTAL LAND USE, VEGETATION AND WILDLIFE AREAS

DAMES & MOORE

FIGURE C-2(e)



0 1 2 3 4 5 Kilometers

Priority Areas for Shoreline Protection

The probabilities shown on this drawing were developed by ASA (1996) based on a 51,000 barrel instantaneous release from FSO and assumes no containment and recovery from spill, within a 15 day time period. These data, with additional analysis, is input to the project oil spill response plan. All data interpreted for represenation on base maps by Dames & Moore.

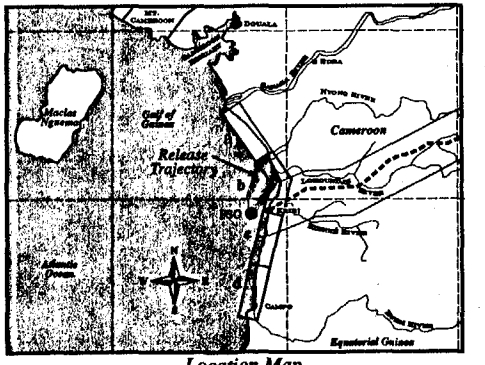
Environmental Sensitivity Index (ESI)

Coastal Sensitivity Classifications

1 *Rocky Headland*
2 *Manmade Structures (includes sea wall or pier)*
3 *Sand Beach*
4 *Mixed Sand and Gravel Beach*
5 *Gravel Beach (includes porous structures such as riprap)*
6 *Stabilized Sand Dunes*
7 *Vegetation, Shrubs and Trees*
8 *Tourist / Recreational Beach*
9 *Sheltered Tidal Flats and Mud Flats*
10 *Estuary, Wetlands, Inland Watercourses, Mangrove and Wildlife Concentration Areas*
Interpreted Boundaries Between Classifications

Coastal sensitivity classifications were developed by Dames & Moore to indicate the relative sensitivity of shoreline types to oil spills. See Section 2.0 of Appendix C, Chad Export Project Environmental Assessment - Cameroon Portion

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.



Location Map

LEGEND: Coastal Characteristics and Shoreline Types

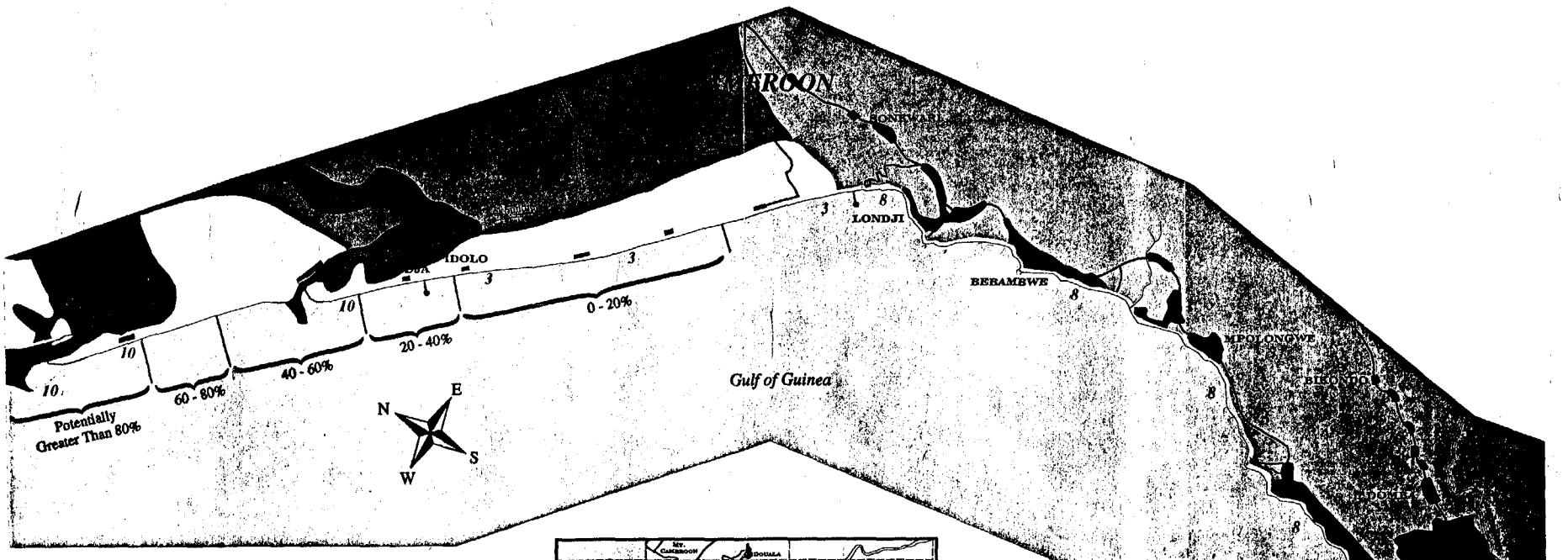
- Sand Beach
- Coastal Sand Ridges
- Sand Bar
- Inlet
- Estuary / River Mouth
- Alluvial Plain
- Water
- Villages and Towns
- Coastal Hydrography
- Potential Probability for Shoreline Oiling

ESSO Exploration and Production Chad Inc.

OIL SPILL RESPONSE PLANNING
Priority Areas for Shoreline Protection
for
Winter / Summer Season with North Current Flow
(Coastal Characteristics and Shoreline Types)

DAMES & MOORE

FIGURE C-3(a)



Priority Areas for Shoreline Protection

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Environmental Sensitivity Index (ESI)

Coastal Sensitivity Classifications

1 Rocky Headland
2 Manmade Structures (includes sea wall or pier)
3 Sand Beach
4 Mixed Sand and Gravel Beach
5 Gravel Beach (includes porous structures such as riprap)
6 Stabilized Sand Dunes
7 Vegetation, Shrubs and Trees
8 Tourist / Recreational Beach
9 Sheltered Tidal Flats and Mud Flats
10 Estuary, Wetlands, Inland Watercourses, Mangrove and Wildlife Concentration Areas
Interpreted Boundaries Between Classifications

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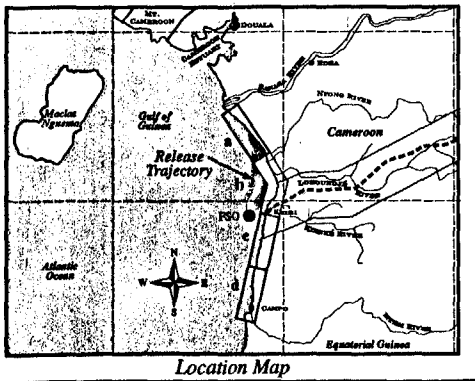


Location Map

Note:

Numerous small near shore/offshore rock outcrops occurring between Londji south to Campo. Scale limitations precluded many of these from being mapped.

0 1 2 3 4 5 Kilometers

LEGEND: Coastal Characteristics and Shoreline Types

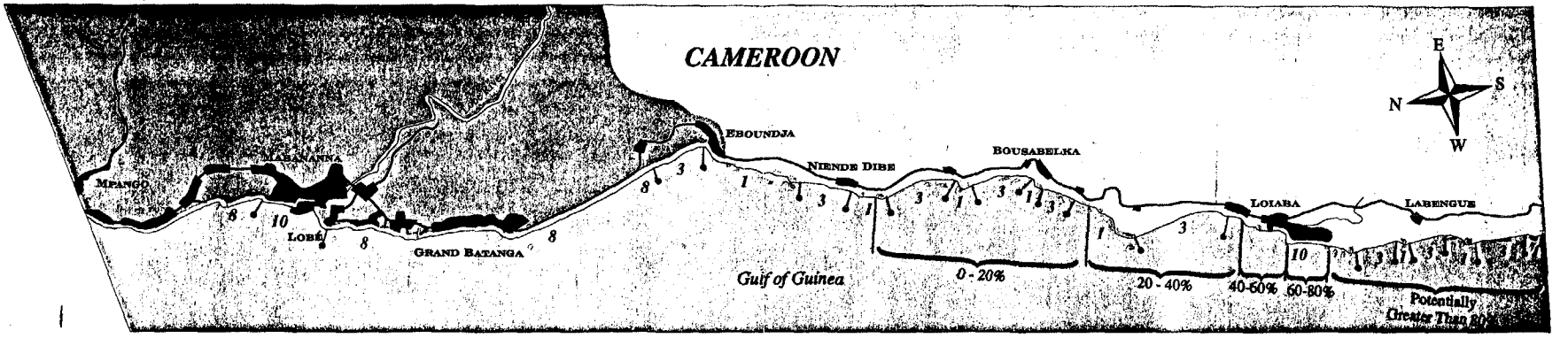
- Sand Beach
- Headland
- Offshore Rock
- Coastal Sand Ridges
- Coastal Plain
- Sand Bar
- Deltaic/Estuarine Wetlands
- Harbor
- Inlet
- Estuary / River Mouth
- Alluvial Plain
- Water
- Villages and Towns
- Access Roads and Tracks
- Coastal Hydrography
- Potential Probability for Shoreline Oiling

ESSO Exploration and Production Chad Inc.

OIL SPILL RESPONSE PLANNING
Priority Areas for Shoreline Protection
for
Winter / Summer Season with North Current Flow
(Coastal Characteristics and Shoreline Types)

DAMES & MOORE

FIGURE C-3(b)



Note:
Numerous small near shore/offshore rock outcrops occurring between Londji south to Campo. Scale limitations precluded many of these from being mapped.

0 1 2 3 4 5 Kilometers

Priority Areas for Shoreline Protection

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Environmental Sensitivity Index (ESI)

Coastal Sensitivity Classifications

1 Rocky Headland
2 Manmade Structures (includes sea wall or pier)
3 Sand Beach
4 Mixed Sand and Gravel Beach
5 Gravel Beach (includes porous structures such as riprap)
6 Stabilized Sand Dunes
7 Vegetation, Shrubs and Trees
8 Tourist / Recreational Beach
9 Sheltered Tidal Flats and Mud Flats
10 Estuary, Wetlands, Inland Watercourses, Mangrove and Wildlife Concentration Areas
Interpreted Boundaries Between Classifications

Coastal sensitivity classifications were developed by Dames & Moore to indicate the relative sensitivity of shoreline types to oil spills. See Section 2.0 of Appendix C, Chad Export Project Environmental Assessment - Cameroon Portion

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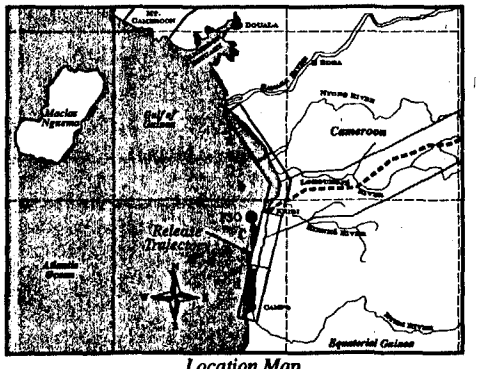


Location Map

LEGEND: Coastal Characteristics and Shoreline Types

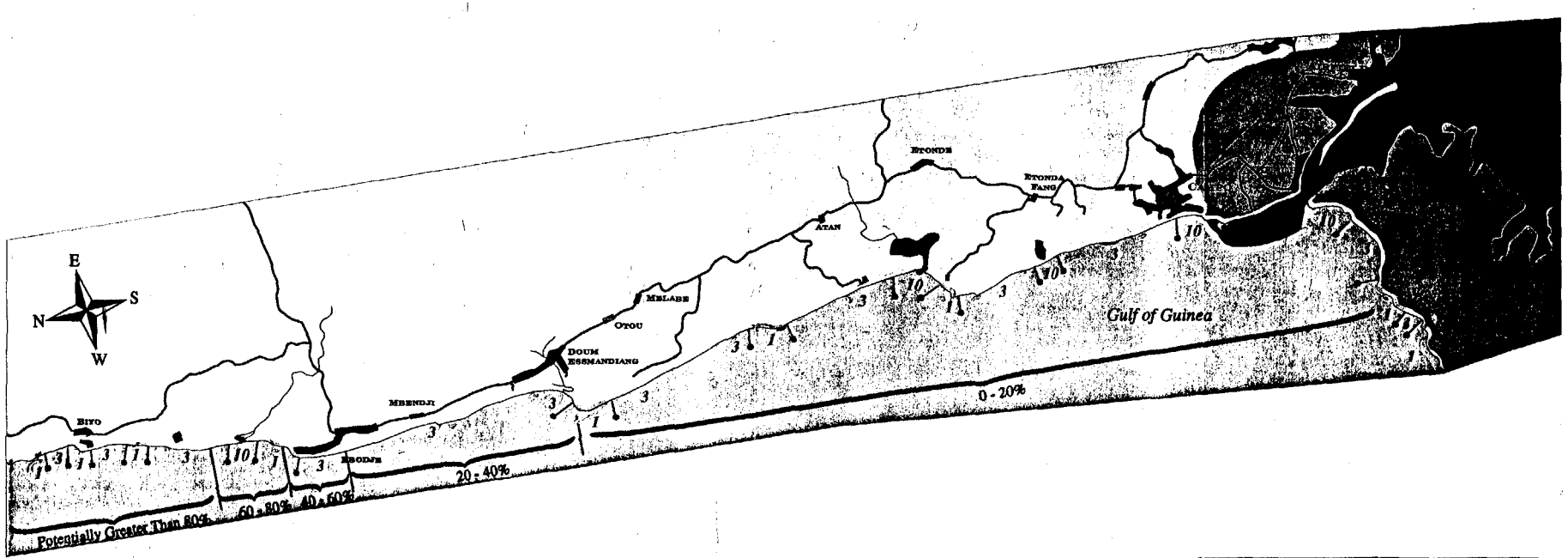
- Sand Beach
- Sand Bar
- Water
- Headland
- Deltaic/Estuarine Wetlands
- Villages and Towns
- Offshore Rock
- Low Hills
- Access Roads and Tracks
- Falls
- Inlet
- Coastal Hydrography
- Coastal Plain
- Potential Probability for Shoreline Oiling

ESSO Exploration and Production Chad Inc.

OIL SPILL RESPONSE PLANNING
Priority Areas for Shoreline Protection
for
Winter / Summer Season with South Current Flow
(Coastal Characteristics and Shoreline Types)

DAMES & MOORE

FIGURE C-3(c)



Priority Areas for Shoreline Protection

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Environmental Sensitivity Index (ESI)

Coastal Sensitivity Classifications

1 *Rocky Headland*
2 *Manmade Structures (includes sea wall or pier)*
3 *Sand Beach*
4 *Mixed Sand and Gravel Beach*
5 *Gravel Beach (includes porous structures such as riprap)*
6 *Stabilized Sand Dunes*
7 *Vegetation, Shrubs and Trees*
8 *Tourist / Recreational Beach*
9 *Sheltered Tidal Flats and Mud Flats*
10 *Estuary, Wetlands, Inland Watercourses, Mangrove and Wildlife Concentration Areas*
Interpreted Boundaries Between Classifications

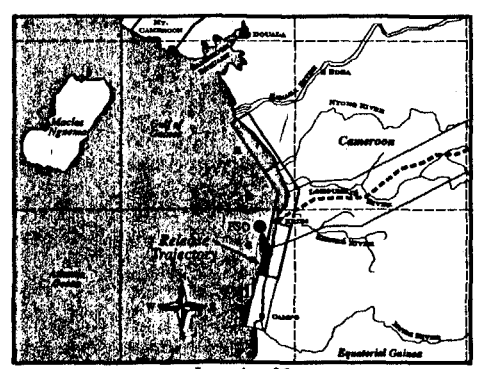
Coastal sensitivity classifications were developed by Dames & Moore to indicate the relative sensitivity of shoreline types to oil spills. See Section 2.0 of Appendix C, Chad Export Project Environmental Assessment - Cameroon Portion

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

Note:

Numerous small near shore/offshore rock outcrops occurring between Londji south to Campo. Scale limitations precluded many of these from being mapped.

0 1 2 3 4 5 Kilometers



Location Map

LEGEND: Coastal Characteristics and Shoreline Types

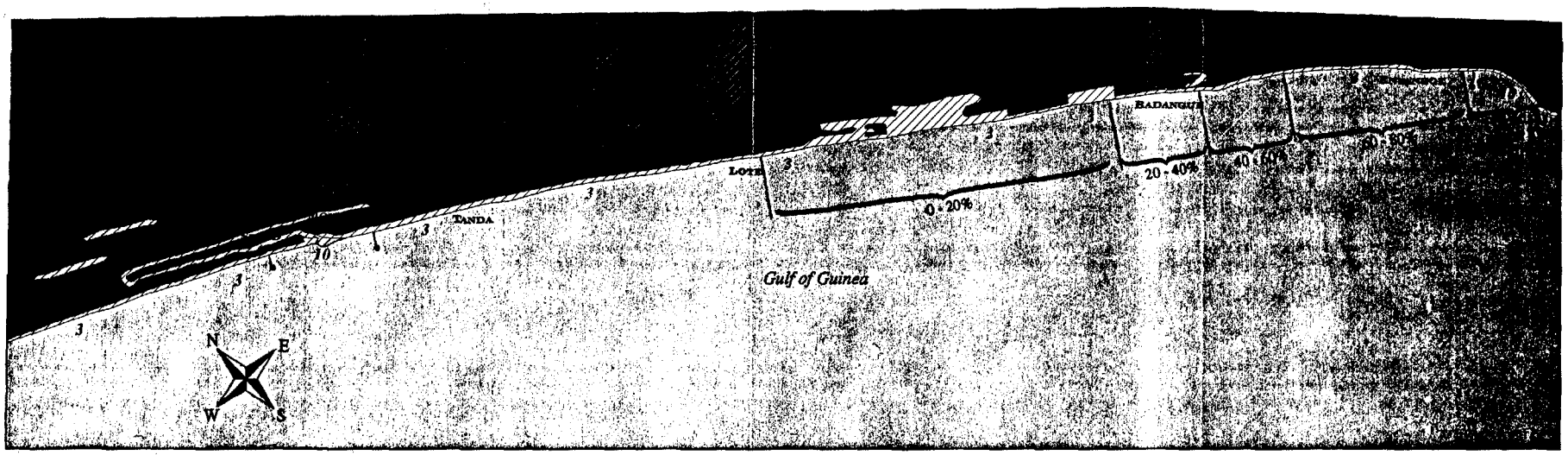
- Sand Beach
- Sand Bar
- Water
- Headland
- Deltaic/Estuarine Wetlands
- Villages and Towns
- Offshore Rock
- Harbor
- Access Roads and Tracks
- Low Hills
- Inlet
- Coastal Hydrography
- Coastal Plain
- Estuary / River Mouth
- Potential Probability for Shoreline Oiling

ESSO Exploration and Production Chad Inc.

OIL SPILL RESPONSE PLANNING
Priority Areas for Shoreline Protection
for
Winter / Summer Season with South Current Flow
(Coastal Characteristics and Shoreline Types)

DAMES & MOORE

FIGURE C-3(d)



0 1 2 3 4 5 Kilometers

Priority Areas for Shoreline Protection

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Environmental Sensitivity Index (ESI)

Coastal Sensitivity Classifications

1 Rocky Headland
2 Manmade Structures (includes sea wall or pier)
3 Sand Beach
4 Mixed Sand and Gravel Beach
5 Gravel Beach (includes porous structures such as riprap)
6 Stabilized Sand Dunes
7 Vegetation, Shrubs and Trees
8 Tourist / Recreational Beach
9 Sheltered Tidal Flats and Mud Flats
10 Estuary, Wetlands, Inland Watercourses, Mangrove and Wildlife Concentration Areas
Interpreted Boundaries Between Classifications

Coastal sensitivity classifications were developed by Dames & Moore to indicate the relative sensitivity of shoreline types to oil spills. See Section 2.0 of Appendix C, Chad Export Project Environmental Assessment - Cameroon Portion

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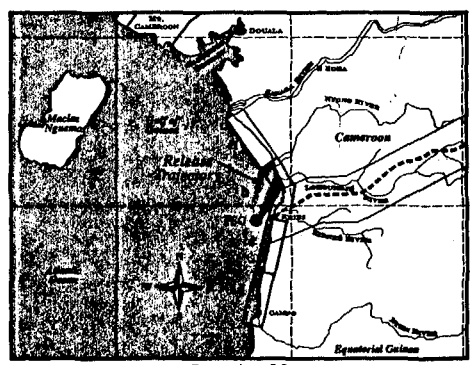


Location Map

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas

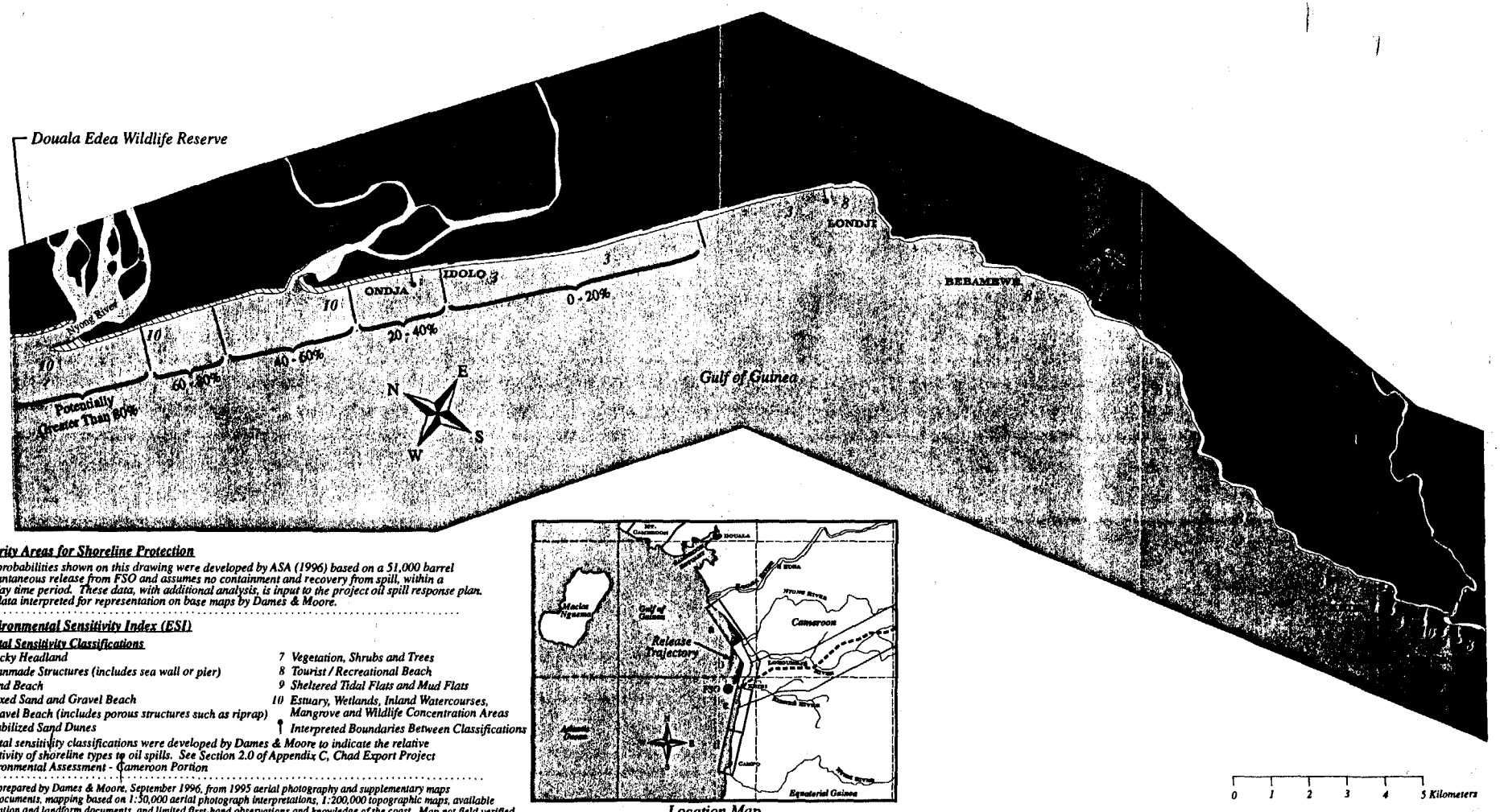
- Agriculture
- Forest
- Shrubby Vegetation
- Unvegetated Coastline
- Water
- Villages and Towns
- // Wildlife Reserve
- \\ Wildlife Concentration Area
- — Coastal Hydrography
- Potential Probability for Shoreline Oiling

ESSO Exploration and Production Chad Inc.

OIL SPILL RESPONSE PLANNING
Priority Areas for Shoreline Protection
for
Winter / Summer Season with North Current Flow
(Coastal Land Use, Vegetation and Wildlife Areas)

DAMES & MOORE

FIGURE C-4(a)



Priority Areas for Shoreline Protection

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Environmental Sensitivity Index (ESI)

Coastal Sensitivity Classifications

1 *Rocky Headland*
2 *Manmade Structures (includes sea wall or pier)*
3 *Sand Beach*
4 *Mixed Sand and Gravel Beach*
5 *Gravel Beach (includes porous structures such as riprap)*
6 *Stabilized Sand Dunes*
7 *Vegetation, Shrubs and Trees*
8 *Tourist / Recreational Beach*
9 *Sheltered Tidal Flats and Mud Flats*
10 *Estuary, Wetlands, Inland Watercourses, Mangrove and Wildlife Concentration Areas*
Interpreted Boundaries Between Classifications

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Location Map

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas

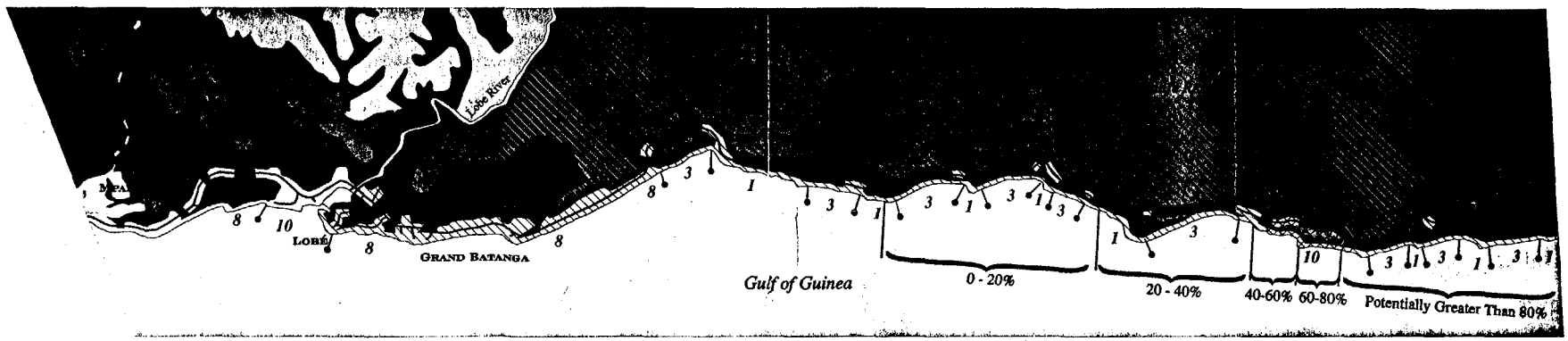
Agriculture	Unvegetated Coastline	// Wildlife Reserve
Forest	Tourist / Recreational Beach	\\ Wildlife Concentration Area
Mangrove	Water	— Access Roads and Tracks
Plantation	Villages and Towns	— Coastal Hydrography
Degraded / Eroded		Potential Probability for Shoreline Oiling

ESSO Exploration and Production Chad Inc.

OIL SPILL RESPONSE PLANNING
Priority Areas for Shoreline Protection
for
Winter / Summer Season with North Current Flow
(Coastal Land Use, Vegetation and Wildlife Areas)

DAMES & MOORE

FIGURE C-4(b)



0 1 2 3 4 5 Kilometers

Priority Areas for Shoreline Protection

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Environmental Sensitivity Index (ESI)

Coastal Sensitivity Classifications

1 Rocky Headland
2 Manmade Structures (includes sea wall or pier)
3 Sand Beach
4 Mixed Sand and Gravel Beach
5 Gravel Beach (includes porous structures such as riprap)
6 Stabilized Sand Dunes
7 Vegetation, Shrubs and Trees
8 Tourist / Recreational Beach
9 Sheltered Tidal Flats and Mud Flats
10 Estuary, Wetlands, Inland Watercourses, Mangrove and Wildlife Concentration Areas
Interpreted Boundaries Between Classifications

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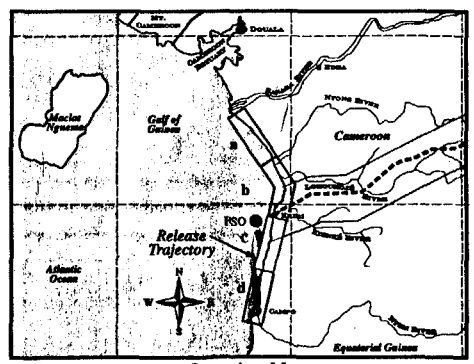


Location Map

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas

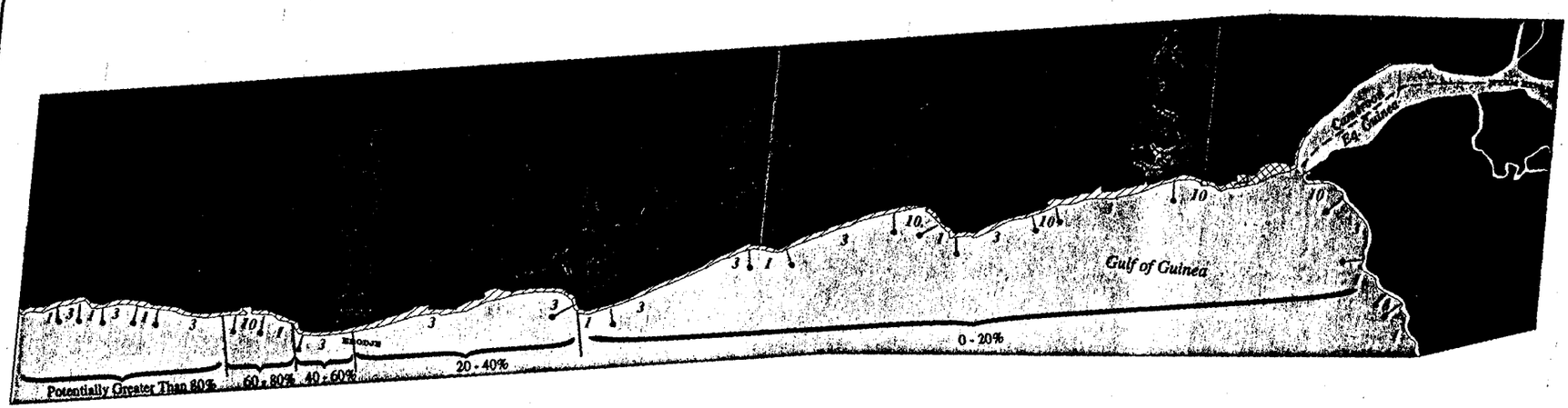
- Agriculture
- Forest
- Mangrove
- Plantation
- Degraded / Eroded
- Shrubby Vegetation
- Unvegetated Coastline
- Tourist / Recreational Beach
- Water
- Villages and Towns
- Wildlife Reserve
- Wildlife Concentration Area
- Access Roads and Tracks
- Coastal Hydrography
- Potential Probability for Shoreline Oiling

ESSO Exploration and Production Chad Inc.

OIL SPILL RESPONSE PLANNING
Priority Areas for Shoreline Protection
for
Winter / Summer Season with South Current Flow
(Coastal Land Use, Vegetation and Wildlife Areas)

DAMES & MOORE

FIGURE C-4(c)



Priority Areas for Shoreline Protection

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Environmental Sensitivity Index (ESI)

Coastal Sensitivity Classifications

1 Rocky Headland
2 Manmade Structures (includes sea wall or pier)
3 Sand Beach
4 Mixed Sand and Gravel Beach
5 Gravel Beach (includes porous structures such as riprap)
6 Stabilized Sand Dunes
7 Vegetation, Shrubs and Trees
8 Tourist / Recreational Beach
9 Sheltered Tidal Flats and Mud Flats
10 Estuary, Wetlands, Inland Watercourses, Mangrove and Wildlife Concentration Areas

Interpreted Boundaries Between Classifications

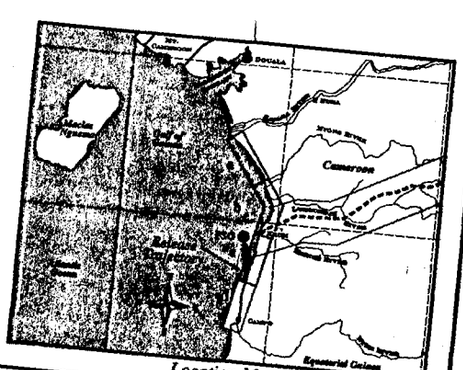
Coastal sensitivity classifications were developed by Dames & Moore to indicate the relative sensitivity of shoreline types to oil spills. See Section 2.0 of Appendix C, Chad Export Project Environmental Assessment - Cameroon Portion

Map prepared by Dames & Moore, September 1996, from 1995 aerial photography and supplementary maps and documents, mapping based on 1:50,000 aerial photograph interpretations, 1:200,000 topographic maps, available vegetation and landform documents, and limited first-hand observations and knowledge of the coast. Map not field verified.

LEGEND: Coastal Land Use, Vegetation and Wildlife Areas

- Agriculture
- Forest
- Mangrove
- Shrubby Vegetation
- Unvegetated Coastline
- Water
- Villages and Towns
- Wildlife Reserve
- Wildlife Concentration Area
- Access Roads and Tracks
- Coastal Hydrography
- Potential Probability for Shoreline Oiling

0 1 2 3 4 5 Kilometers



Location Map

ESSO Exploration and Production Chad Inc.

OIL SPILL RESPONSE PLANNING
Priority Areas for Shoreline Protection
for
Winter / Summer Season with South Current Flow
(Coastal Land Use, Vegetation and Wildlife Areas)

DAMES & MOORE

FIGURE C-4(d)

APPENDIX D
PUBLIC HEALTH
CAMEROON

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PUBLIC HEALTH APPENDIX – CAMEROON

1.0 INTRODUCTION

Discussions of current health status, nutritional status, illness status, disease rate, and the current health care delivery system are contained in this appendix. The organizing principle of this health assessment is that a geographic distribution of diseases is present in Cameroon. Identification of the disease distribution is critical because many of the most significant diseases have either discrete foci or are more regionally distributed as a function of climate and terrain. Disease distribution is generally covariate with the nature, type and distribution of reservoirs, e.g., human, insect, animal, and transmission patterns, e.g. person-to-person, animal-to-person, insect-to-person. The variety and magnitude of the reservoirs and transmission patterns are substantial; nevertheless, discrete geographically based disease patterns are present and are discussed in this analysis.

The initial health status of Cameroon can be analyzed by examining overall health morbidity and mortality statistics within the country. These statistics are a general reflection of the aggregate health situation in the country and can be compared with Sub-Saharan Africa (SSA), and with other low income regions. Key demographic characteristics and disease rates are also compared to Established Market Economies (EME) so that Cameroonian values can be placed in perspective. A major project such as the Chad Export Project has the potential to both positively and negatively impact the aggregate health care status in Cameroon. This section discusses the health data currently available and relevant to the project. The linkages between health, the environment, and the project are explored in Section 7.0 of the EA. An overview of mitigation strategies is presented in Section 8.0 of the EA. Detailed environmental management plans are presented in a separate comprehensive document.

2.0 PROJECT SETTING

The Cameroon portion of the project traverses the country and travels through areas that are associated with major disease reservoirs and vectors. Section 6.2.3 of the EA provides a brief description of the project geographical setting (Figures D-1 through D-4). Cameroon can be divided into four general geographic/climatic regions that encompass the ten defined provinces. From a disease distribution perspective, the physical setting of each of the four main geographic regions in Cameroon is a major predictor of the nature and type of disease reservoirs and transmission patterns because of the differences in annual temperature and

rainfall patterns. Some diseases, e.g. malaria, have transmission patterns that are very sensitive to temperature, rainfall and altitude. Hence, it is appropriate to first consider the overall biophysical setting:

- Northern region of the country - rolling sub-arid savanna which slopes downward north toward the Lake Chad Basin (Province: Extreme). This region is the Tropical Climatic Zone and covers the entire area north of about 6°N latitude. The Tropical Climate Zone is divided into the Sahara and Sudan Climatic region. The Saharan region includes the Extreme-North and the northernmost portion of the North Province. The Sudan region includes most of the North and the Adamaoua Province. The latter is also included in the Central Region. The direct course of the pipeline is associated with the most south-eastern area of this region (Province: North).

- Central region - extensive savanna-covered plateau (Adamaoua) with an average elevation of approximately 1,400 meters (4,500 feet). The project provinces include: Adamaoua, Central, and East. Two of these Provinces, Central and East, are also considered to be part of the Equatorial Climatic Zone which includes the area South of 6°N latitude. The Equatorial Zone is subdivided into two climatic regions, the Guinea (Central, East and South) and the Cameroon Climatic or Western regions.

- Southern region - extends from the Sanaga River to the southern border and consists of coastal plains and a densely forested plateau with an average elevation of slightly less than 300 meter (1,000 feet). Province: South.

- Western region - an area of mountainous forests that is also home to Mount Cameroon, a volcano that has been active four times during the century and has an elevation of 4,050 meters (13,350 feet) above sea level. This region is unaffected by the project. Prefectures: West, Northwest, Littoral, Southwest.

There are substantial variations in the climatic conditions across the regions that are strong predicators of many of the important indigenous infectious diseases. This regional configuration is arbitrary. Other sources of geographic information, particularly French, frequently present only three geographic regions:

- Sahélien North - Provinces: Adamaoua, North, Extreme - North. This is a region of savannas and steppes. Except for Adamaoua where the climate is relatively temperate, the rest of the region is quite hot and relatively limited in precipitation.

- High plateaus of the West - Provinces: West and Northwest. The average altitude is 1,100 meter (3,400 feet).

- South Forest - Provinces: Central, East, Littoral, South and Southwest. This area is equatorial and is characterized by dense vegetation with a hot and humid and wet climate.

Temperatures

Overall, Cameroon has a hot tropical climate with regional variations:

- Southern Coastal Region has a constant mean daily minimum temperature of 26°C (79°F), and 85-90 percent humidity.

- East and south of Yaoundé, the capital of Cameroon and an area associated with the project, there is relatively little fluctuation in temperature or humidity. The mean daily maximum temperature is 28°C (82°F) and the mean daily minimum is 22°C (72°F).

- Central plateau has a pattern similar to the Yaoundé area; however, there are slightly cooler temperatures in the higher elevations.

- Northern plains are hot and dry. In the Extreme North Province, out of the project area, maximum daily temperatures often exceed 47°C (116°F).

Precipitation

Rainfall in Cameroon has marked regional and seasonal variation:

- Average annual rainfall in the southern coastal region ranges between 2,500 mm (100 in.) and 4,010 mm (160 in.). The western slope of Mt. Cameroon (Province: Southwest) has one of the highest annual rainfalls (6,100 mm (240 in.) to 9,100 mm (360 in.)) in the world.

- There are two dry seasons, mid-November through mid-March and mid-June through mid-August interspersed with two rainy seasons (Figure D-4).

- Mean annual rainfall is between 1,500 mm (60 in.) and 2,500 mm (100 in.).

- The northern plains receive less than 600 mm (24 in.) during the May-September rainy seasons.

The physical geography and climatology are critical factors that affect the pattern and distribution of numerous infectious diseases. Since the project corridor in Cameroon is located in distinct regions, within a specific corridor, it is appropriate to concentrate on the disease distribution in these discrete provincial areas. The potential local labor force for the project is anticipated to be derived from a relatively restricted geographic pool. Therefore, whenever possible, the focus of the geographic distribution of diseases is examined across each of the regions associated with the pipeline and its supporting facilities.

Administratively, Cameroon is divided into 10 provinces that are further subdivided into 58 départements (See also Section 6.2.4 of the EA). Within some geographic regions associated with the project, there is marked variability; however, there is enough homogeneity so that provincial level assumptions regarding disease incidence and prevalence can be reasonably made for many of the most critical diseases, e.g. malaria, tuberculosis, HIV/AIDS. For other diseases (e.g. onchocerciasis, schistosomiasis) there is detailed mapping data available that can be compared to the pipeline corridor. As will be presented, differences in the geographic distribution of diseases is quite striking between the different provinces. The implications for this observation for the project will be discussed in subsequent sections.

2.1 SOURCES OF INFORMATION

Existing disease rate data were obtained from a variety of published sources:

- World Health Organization (WHO)
- World Bank
- Published scientific literature, including extensive in-country studies sponsored by a wide variety of major international research organizations
- Cameroonian Ministry of Public Health (MOPH) documents.
- U.S. Peace Corps

In general, the published rates for various disease and demographic variables are well correlated. A more detailed description of the nature and type of data (e.g., disease incidence, disease prevalence, case studies) are discussed in subsequent sections. In addition, the temporality, comparability, and implications of the disease rate data for the project are analyzed in Section 4.0. The presented data should be viewed as a "snapshot in time" since disease rates in both Cameroon and SSA fluctuate as a function of:

- Directed intervention programs (e.g., onchocerciasis, schistosomiasis programs)
- Political and financial stability
- Climactic changes
- Internal funding of community-based health care delivery
- Impact of Acquired Immune Deficiency Syndrome (AIDS) and its secondary disease effects (e.g., tuberculosis, and other opportunistic infections).

However, for some diseases, malaria, sexually transmitted diseases (STDs)/AIDS, onchocerciasis, schistosomiasis, there is substantial multi-year data.

A USAID-funded countrywide Demographic and Health Survey (DHS) was completed in 1991 and published in 1992 (Macro International, 1992). In the published literature, the Cameroon DHS is frequently cited as "DHS, 1991" although the actual study was formally published in 1992 rather than 1991. This survey provides detailed data based upon a standardized and well-tested survey instrument and will be presented in subsequent sections. In addition, a detailed Staff Appraisal Report for a proposed Health, Fertility and Nutrition Project was published by the World Bank in 1995 (World Bank, 1995). Overall, the scientific disease data base in Cameroon is quite detailed and extensive. The overwhelming majority of studies cited in this appendix were published within the last 10 to 15 years in peer-reviewed journals and confirm the overall disease morbidity and mortality data released by the Cameroonian MOPH.

2.2 DISEASE DATA AND THE WORLD BANK'S BRIDGING ENVIRONMENTAL HEALTH GAPS

The World Bank has issued recent (June 1996) guidelines for the performance of public health evaluations associated with infrastructure projects in SSA. These guidelines are clearly focused on prevention and remediation through engineering design measures. Nevertheless, the traditional disease-specific approach has merit, and it is appropriate for analyzing the prevalence and incidence rates of diseases in the project area so that the appropriate preventive and remedial measures can be designed and initiated. Available disease data provide an indication of the location and magnitude of disease distribution. The analysis of these data will direct remediation strategies and provide an overall picture so that potential short- and long-term project impacts can be appropriately assessed. As mentioned above, disease data have been obtained from a variety of standard sources; however, each of the major studies provides somewhat different insight into the disease situation in Cameroon in general and the project corridor in particular. The intent of this analysis is not to provide a static disease map for governmental health policy but rather to facilitate the

analysis of potential impacts to the project and to assist in the development of appropriate project-specific prevention and/or mitigation strategies.

2.3 DISEASE CONTROL PRIORITIES IN DEVELOPING COUNTRIES

In the World Bank's *Disease Control Priorities in Developing Countries* (Jamison, 1993), the problem that has occurred in many developing countries known as "health transition" is discussed. Health transition, according to Jamison, is the "change from a pretransition environment dominated by high fertility, high mortality, infectious disease and malnutrition to a low-mortality, low-fertility environment with a disease profile that increasingly emphasizes noncommunicable conditions of adults and the elderly." Under this paradigm, health transition is associated with two phases, a demographic and an epidemiologic transition. These two phases and their relationship to each other are illustrated in Figure D-5.

The transition state of a country is crucial because, according to Jamison, conclusions concerning the relative attractiveness of various intervention strategies can vary quite substantially depending upon where a country is on the health transition continuum. For example, most SSA countries are fundamentally still in a pretransition environment characterized by high fertility, mortality, and infectious disease rates, particularly the communicable childhood diseases (CCD). The likelihood of positive health transition is significantly reduced as long as there are substantial levels of CCD and high fertility rates. Section 3.0 will present the overall Cameroonian demographic and disease-specific rates on both a countrywide and a province-specific basis. In addition, these rates will be compared to overall SSA and EME levels so that an adequate comparison can be made. As these data will clearly demonstrate, Cameroon, along with the majority of SSA, is in a pretransition state. This observation has important ramifications for assessing the potential impacts and benefits of the project.

2.4 STRATEGIES FOR PUBLIC HEALTH INTERVENTION

As part of the overall public health evaluation in the EA, a determination of potential impacts due to the project will be assessed. In general, these impacts will be related to a series of "interventions" that the project will produce. Interventions, in this sense, are used to denote actions or consequences that the project could produce at either the individual or population level that affect the risk, duration, or severity of a health condition. Interventions are the proximal causes of changes in risks, duration, or severity. Interventions are broadly divided into two groups: Public Health Interventions and Clinical Interventions.

Public Health Interventions–sought or directed toward entire populations or population subgroups (e.g. work force). These interventions are divided into five categories:

- Change of personal behavior
- Control of environmental hazards
- Immunization
- Mass chemoprophylaxis
- Screening and referral.

Changes in personal behavior are critical because behavioral modification potentially influences many intervention strategies, i.e. effective immunization, mass chemotherapy or screening and referral activities cannot be effectively instigated unless treatment seeking behaviors are adequately understood. Therefore, Knowledge, Attitudes and Practices (KAP) survey data are critical and will be used in the development of project-specific outreach programs including HIV/AIDS intervention strategies.

Clinical Interventions–activities provided at facilities, usually to individuals at various levels:

- Community
- Work-based
- School-based
- District hospital
- Referral hospital.

The overall objectives of interventions can be structured into five categories that form the framework for preventive medicine:

- Primary prevention–reduce the risk of a condition occurring by lowering the level of risk factors to forestall or prevent the condition

- Secondary preventions–reduce the duration of a condition or physiological risk factor in order to prevent development of a more adverse condition

- Cure–remove its causes and restore function to an appropriate premorbid condition

- Rehabilitation–restore (fully or partially) functions resulting from a previous or chronic condition

- Palliation–reduce pain and suffering from a condition for which no means of cure or rehabilitation is currently available.

In contrast to interventions, "instruments of policy" encourage, discourage, or undertake interventions. Instruments of policy are usually activities that are undertaken or significantly directed by governments. Five major instruments of policy are:

- Use of information, education, and communication to improve knowledge of individuals or groups about the consequences of their choices (This instrument can also be performed by employees and NGOs.)

- Use of taxes and subsidies on various commodities, services, and pollutants to effect appropriate behavioral response

- Use of regulation and legislation on certain commodities and practices and rules governing finance and provision of health services

- Use of direct expenditures to provide or finance selected interventions (e.g., primary prevention via immunization)

- Undertaking research and development so that the range of interventions is expanded and made more available.

The demographic, health, and disease-specific data will be used to set an overall health context for the project. The potential beneficial and/or significant impacts of the project will be assessed within this context so that the appropriate opportunities for intervention and/or instruments of policy are carefully delineated to distinguish between the appropriate functions of a commercial consortium and a sovereign government. The Ministry of Health (MOH) national policy is based on a decentralized system of primary health care (PHC) implemented at the district level. This will be further discussed in Section 3.4.1.

3.0 DEMOGRAPHIC DATA

The Sub-Saharan Africa (SSA) effort to overcome illness and disease of the last 25 years has had mixed results (*Better Health in Africa [BHA]*, 1995). SSA as a generic description excludes Eritrea and Namibia (due to lack of data), La Réunion, and South Africa (due to differences from other SSA countries). Overall, infant mortality is 55 percent higher, and average life expectancy is 11 years less in SSA than in the rest of the world's low-income, developing countries. Maternal mortality, at 700 women per 100,000 live births, is almost

double that of other low- and middle-income developing countries and, according to World Bank estimates, more than forty times greater than in the EMEs (BHA, 1995). Clearly, SSA has not yet made the demographic transition described in Section 2.3. In order to understand the magnitude of the problem, it is useful to develop a set of key indicators. Table 1 presents a brief definition of some of the most important demographic terms. These definitions are standard in the literature and are abstracted from the World Bank's *Better Health in Africa* (BHA, 1995). These terms are also used in data presented in the 1991 Cameroon Demographic Health Survey (CDHS) cited in this analysis. A series of demographic data sections will be presented next. These sections focus on Cameroon and the project areas in Cameroon; in addition, a series of selected comparative rates for SSA and EME are also presented so that the Cameroonian statistics can be placed in perspective.

3.1 POPULATION

Overall, Cameroon has shifted from a low annual growth rate of 1.6 percent (1950-55) to a current rate of almost 3.0 percent. This shift is due, in part, to a significant decline of approximately 30 percent in the crude death rate from 1976 to 1987. Table 2 presents basic demographic data for the entire country. More detailed data from the 1976 and 1987 Cameroonian census is shown in Table 3 along with 1991 data from the 1991 Demographic Health Survey. Table 4 presents the population distribution and density data for each of the 10 provinces. The average population density in Cameroon is only 25 inhabitants per square kilometer; however, there are significant variations across provinces. The southeast portions of Adamaoua Province and the contiguous Northeastern section of the Central Province are very sparsely populated. This area is frequently called the "vast empty space." By design, a substantial portion of the pipeline corridor passes through this empty space. In general, the proposed pipeline generally does not traverse the most densely populated areas with the exception of the Mefou department where Yaoundé is located. The Age Population Pyramid is shown in Figure D-6.

The 1991 Demographic and Health Survey (DHS) found that women give birth to an average of 5.8 children during their lifetimes, which represents a 10 percent decline since 1978. This figure masks a significant urban/rural differential: average parity for women in Yaoundé and Douala is estimated at 4.4 children, while for rural women it is 6.3. Knowledge of modern methods of contraception has increased from 29 percent to 66 percent of women in union during the period 1978-1991, but the 1991 DHS found that only 4.3 percent of these women were using a defined contraceptive method.

If current demographic indicators remain constant, Cameroon's population will reach 15.5 million by the year 2000 and 21 million by the year 2010. However, using alternative population growth scenarios prepared by the Futures Group these results are projected (World Bank, 1995):

- Projection A: Fertility declines to 4.0 by the year 2010 and reaches 3.0 in 2025 with corresponding populations of 17.9 million in 2010 and 24 million in 2025

- Projection B: Fertility declines to 3.0 in 2010 and 2.2 in 2025 with corresponding populations of 16.3 million in 2010 and 20 million in 2025.

If mortality rates continue to decline and emphasis is not placed on reducing fertility, Cameroon's population will double every 22 years, with corresponding increases in the demand for social services, including health and education. Figure D-7 presents population projections for Cameroon as a whole and the two largest cities, Yaoundé and Douala, in particular.

As illustrated by the Yaoundé and Douala projections, the rate of urbanization is also increasing from 28.5 percent in 1976, to 37.8 percent in 1987, to an estimated 42 percent in 1991. If the current rate of urbanization continues, the Government estimates that 50 percent of all Cameroonians will live in cities by the year 2000. The major cities of Douala (1,094,100 inhabitants) and Yaoundé (955,300 inhabitants) are growing at rates of 5 and 6 percent per year respectively, due to the influx of young Cameroonians (under 25 years of age) seeking education and employment opportunities. By the year 2000, Yaoundé and Douala will each have about 1.5 million inhabitants.

3.2 COMPARATIVE DEMOGRAPHIC DATA

There are significant differences in key health indicators between SSA and other countries. Table 5 shows a comparison between Cameroon, SSA, and high-, middle-, and low-income countries for life expectancy, infant mortality, and maternal mortality. As this table illustrates, Cameroon has a significantly better performance relative to SSA for infant mortality and maternal mortality; in addition, overall life expectancy is slightly higher than the SSA level.

Table 6 is a comparison of multiple core demographic statistics. In general, Cameroon performs at or better than the SSA average in most categories. There are subtle, probably insignificant, differences in the various rates as a function of source (i.e., World Bank estimate, UN population estimates).

3.3 GENERAL HEALTH PARAMETERS

Data in this section is derived directly from the 1991 DHS published in 1992 and presented in the 1995 World Bank Staff Appraisal Report for a major Nutrition, Fertility and Health Project.

3.3.1 Maternal Health

As shown in Tables 5 and 6, Cameroon has a high maternal mortality rate, 430 per 100,000 live births. This rate indicates that there is a problem associated with women of child bearing age. The main causes of this elevation in maternal mortality are obstetric hemorrhage and sepsis (infection), both of which can be complicated by prevalent conditions such as malaria and anemia (World Bank, 1995). Nationally, 64 percent of all deliveries occurring in the five years before the 1991 DHS survey took place in health facilities. Twenty-one percent of deliveries were assisted by friends or relatives, 12 percent were assisted by traditional birth attendants, and 4 percent were unassisted.

The level of maternal health varies significantly among provinces and between urban and rural areas. Provincial level data on maternal mortality range from 900 per 100,000 live births in Maroua (Far North province) to 250 per 100,000 live births in Bamenda (Northwest province). The DHS survey found that in Yaoundé/Douala, mothers received antenatal care for nearly all births (99 percent), and the majority of mothers (86 percent) were vaccinated against tetanus. In rural areas, however, only 71 percent of the births involved antenatal care and tetanus toxoid was given in only 61 percent of pregnancies (World Bank, 1995).

3.3.2 Child Health

Children under five years of age are at a significant health risk in Cameroon. The infant mortality rate is estimated at 65 per 1,000 live births and the under five mortality rate is 126 per 1,000 live births. The 1991 DHS study found that in the two weeks preceding the survey, nearly 1 in 5 children had had an episode of diarrhea, 1 in 10 children under five had suffered from coughing and rapid breathing, and 1 in 4 children under five had had a fever. Only 41 percent of children with fevers and 50 percent of children with diarrhea were taken to a health facility for treatment.

The DHS study found the main causes of death among children under five to be (in descending order of importance) diarrhea, malaria, measles, respiratory infections, and undernutrition; 60 percent of malaria deaths occur in children in this age group.

Although vaccine-preventable diseases did not figure prominently in the causes of mortality and morbidity for Cameroon as a whole, these diseases are apparent at the provincial level. MOPH data on measles (Eastern, Littoral, Northern, and South provinces) and neonatal tetanus (Central, Eastern, Far North, and North provinces) confirm UNICEF findings that these diseases are the most significant causes of death for infants less than one year old, accounting for 34 percent of all infant deaths in 1986. UNICEF also estimates that less than 40 percent of Cameroonian children were fully vaccinated by their first birthday against childhood diseases (tuberculosis, diphtheria, whooping cough, tetanus, polio, and measles). Figure D-8 presents the overall vaccination coverage at both national and provincial levels.

3.3.3 Nutrition

Results from the 1991 DHS indicated that there were significant nutritional problems: 24 percent of children under five suffer from moderately to severely chronic undernutrition (height-for-age measure); 3 percent suffer from moderate to sever acute undernutrition (weight-for-height measure), and 14 percent are underweight (weight-for-age measure). Comparison of these results with the 1978 National Nutritional Survey indicated that there was a serious problem in the provinces of Adamaoua, North, Far North, and East, where chronic undernutrition increased from about 15 percent to 25 percent and acute undernutrition from 1 percent to 4 percent.

The DHS found a clear age-specific pattern in the prevalence of undernutrition in Cameroon, from less than 2 percent incidence of stunting, undernutrition, and wasting in infants aged 1 to 6 months to over 33 percent stunting, 20 percent underweight, and 10 percent wasting between the ages of 18 and 24 months. The DHS concluded that inappropriate infant and child feeding practices were strongly associated with the high levels of undernutrition found in Cameroon.

The nutritional status of women also raised concern. The 1978 National Nutrition Survey showed that pregnant women suffered from deficiencies of iron, calories and lipids and gained only one-third the normal weight gain during pregnancy. As a result of poor maternal nutritional status, 13 percent of babies in Cameroon were born with low birth weights in 1985 (DHS, 1992; World Bank, 1995). The high levels of malaria are a major contributor to this problem and illustrate the interconnectedness across health problems and observed outcomes.

3.3.4 Women's Health Issues

Health variables specific to women are extremely important and have consistently been a major focus of demographic and health surveys sponsored by USAID and the World Bank. The 1991 DHS (published in 1992) included 3,871 women ages 15-49. Table 7 presents several of the key demographic variables unique to women. Comparisons are shown between Cameroon, SSA, less developed countries, and more developed countries. In general, Cameroonian values demonstrate a mixed pattern relative to SSA and other less developed countries as a group. Until there is significant improvement in major demographic variables for women, it is unlikely that sustained health improvements can be achieved (World Bank, 1995).

3.4 CAMEROON HEALTH SYSTEM

3.4.1 Public Health Sector Organization and Management (Based upon the World Bank 1995 Staff Appraisal Report)

The ministry of Public Health (MOPH) is Cameroon's principal governmental agency addressing health issues, although the National Social Security Fund (CNPS) also provides services through its network of clinics. Other agencies involved in health research, education, and communication include the Ministries of: Higher Education and Scientific Research (medical training), National Education (school-based health programs), Social Welfare and Women's Affairs (health, family planning, and nutrition education to women's groups), Agriculture (health education to women's agricultural groups), and Economy and Finance (consideration of population variables in the national development planning process).

The current organizational structure of the MOPH was established by ministerial decree No. 89/011 in January 1989. This decree established six central directorates. The Directorate of Hospital Medicine is responsible for planning, administering and supervising all public hospitals; it also oversees private hospitals. The Division of Training and Cooperation manages the paramedical training institutions. The Directorate of Preventive and Rural Medicine is responsible for epidemiological surveillance, control of endemic diseases, and execution of the Expanded Program of Immunization (EPI). The Directorate of Pharmacy is in charge of planning the supply of drugs to all health facilities, assuring their quality, and inspecting all public and private pharmacies. The Directorate of Studies, Planning and Health Statistics plans and executes capital investment projects and performs data collection and analyses which include planning, monitoring, and evaluating health facilities. The Directorate of General Affairs is in charge of general administration, personnel, finance, and

health facility management. The Directorate of Family and Mental Health is responsible for the promotion of mother, child, and juvenile health which includes family planning, nutrition, and information, education, and communication (IEC).

Ministerial decree No. 89/011 also organized the provincial health system to reflect the administrative division of the country. Health delegations were established in each of the ten provinces. Headed by a provincial delegate who reports directly to the Minister of Public Health, the provincial health delegation comprises six services (corresponding to the central MOPH directorates) and supervises all health activities in the province including hospitals, pharmaceutical supply, planning and statistics, training, and administration. Provinces are subdivided into departments under the authority of the departmental public health service, which has responsibility for hospitals and health centers as well as for preventive and rural health services.

The Declaration of Health Sector Policy organizes health services at three levels comprising: (a) local health centers, usually staffed by certified nurses and providing preventive and basic curative care to the surrounding population; (b) district and departmental hospitals (of 100 to 150 beds), usually staffed by at least one physician and providing first referral services for the health centers; and (c) provincial and central level hospitals (of more than 200 beds) providing specialized medical services.

As a result of a rapid expansion of health facilities in the late 1970s and early 1980s, Cameroon today possesses an important network of health structures. MOPH lists 1,031 government-operated health facilities which include 1 teaching hospital, 2 referral hospitals, 3 central hospitals, 8 provincial hospitals, 38 departmental hospitals, 132 district hospitals, and 847 health centers. Despite the large number of facilities, coverage remains a problem in both rural and urban areas.

Facility maintenance and equipment repairs are a concern. There is not overall policy governing equipping and maintenance of health centers. The annual budget allocates less than 1 percent of the estimated amounts for repairs. In addition, within the Ministry of Public Health, coordination and planning of maintenance activities is divided between the Directorate of Hospital Medicine (responsible for biomedical equipment and its maintenance) and the Directorate of General Affairs (responsible for maintenance of health facilities and transport).

Owona, et al. (1993) reviewed and critiqued the PHC policy that was established in 1989. While progress has been made in a number of areas, the opportunity for across-the-board improvement is still present. The prolonged economic downturn experience by Cameroon

has seriously and significantly affected the PHC program such that it appears to be functioning at a substantially lower level than projected in 1989. Hence, with the exception of the Yaoundé area, the overall health infrastructure present along the project corridor is anticipated to be minimal.

3.4.2 Private Health Sector Organization

Non-profit religious missions and for-profit clinics constitute the bulk of private providers of health care. There is also a growing number of nongovernmental organizations involved in health activities. Numerous traditional practitioners provide services to the population, and are recognized, organized and syndicated. However, this group is not licensed and their operations are not subject to well-defined standards or quality control; hence, their activities remain largely undocumented. For-profit facilities represent about 5 percent of the 539 private health facilities identified by MOPH; they are located in the major cities of Yaoundé, Douala, Garoua, Maroua, Bafoussam, and Bamenda. MOPH estimates that in 1992 there were 322 physicians (including 78 in the confessional sector) and 39 pharmacists in the private sector.

Religious health facilities, organized by the principal denominations, make up the majority of the private health system in Cameroon. The Catholic health services (SCS) comprise 179 health facilities (including 8 hospitals) and 1,315 personnel. SCS data estimate about 1.5 million consultations performed in 1991-1992. About half of these consultations took place within the Diocese of Yaoundé (including the surrounding rural villages) and half in the other Dioceses of Douala, Bamenda, and Garoua. In addition, SCS operates two training schools (in Yaoundé and Bamenda) which train nurses and nurses' aides.

Protestant health services (FEMEC) comprise 122 health facilities (including 24 hospitals) and 2,633 personnel (including approximately 80 expatriate staff). FEMEC estimates the number of consultations at about 2 million for 1991. The Ad Lucem Medical Foundation operates 7 hospitals and 11 health centers, totaling about 2,000 beds, in four provinces (West, Central, Littoral and South). In addition, Ad Lucem is involved in the importation of essential drugs for the non-profit private sector.

3.5 DEMOGRAPHICS AND HEALTH OF ADULTS

While the demographics of children in the developing world have been well described, the burden of adult ill-health has received far less scrutiny. Adults can be defined as those aged 15 through 59 years (Feachem, 1992). Based upon this terminology, children are those younger than 15 years and the elderly as those aged sixty years and older. The adult group

typically represents those members of a society who are economically productive, biologically reproductive, and responsible for the support of children and elderly dependents.

While infant mortality rates are quite high in SSA, and Cameroon in particular, almost 90 percent of children generally survive to reach the adult demographic category. Within the adult age group in SSA, approximately 38 percent of 15 year olds do not survive to age sixty (Feachem, 1992). Similar statistics can be calculated for Cameroon based upon crude death rates and life expectancy statistics. Relative to the attention paid to the CCD, adult health has not been a major focus of either international agencies or governments. The adult sector is a substantial source of morbidity (illness) and mortality (death) and generally consumes over 50 percent of health sector resources even in developing countries (Feachem, 1992).

Demographic trends in Cameroon and SSA are having the effect of increasing the absolute and relative importance of adults and their health problems. For the proposed project, adult health issues are important since the labor force to build, operate, and maintain the pipeline and other project facilities will draw upon the local adult population. Approximately 52 percent of the Cameroonian population is in the adult category ages 15-64, representing a figure that is consistent with the overall SSA average (Table 8).

From a disease distribution perspective, it has been recognized that the majority of deaths for children (age 0-14) are due to the CCD superimposed upon a background of low birth weight, malnutrition, and poor sanitation and environmental conditions. This observation has led to directed efforts to 1) emphasize primary prevention interventions (e.g., immunizations), 2) reduce exposure to environmental and behavioral risk factors, and 3) use cost-effective approaches to case management (Feachem, 1992). In addition, as described in previous sections, there have been substantial characterization of the magnitude and nature of maternal illness (morbidity) and death.

Recent data in developing countries indicate that the spectrum of adult mortality may be different than the 0-14 age group. Most adult mortality is typically due to three broad categories:

- Communicable and reproductive diseases, particularly tuberculosis (TB) and AIDS
- Noncommunicable disorders (e.g., cancer, digestive, respiratory, circulatory)
- Injuries (e.g., transport, intentional).

These data imply that child and adult mortality vary independently such that single indicators of mortality (e.g., infant mortality rates) may not be sufficient to monitor impacts to both adult

and child mortality. In addition, according to Murray, et al. (Feachem, 1992), the pattern of mortality by cause is not a simple function of the overall level of mortality or life expectancy and may not be a fully appropriate estimator or predictor.

Adult mortality is typically estimated by measurements based on vital registration systems, censuses, or surveys. As of 1992, no SSA country had a vital registration system. Since vital registration systems, censuses, and surveys are infrequent and expensive, gaps in the empirical data base on mortality are filled in by international agencies (e.g., World Bank, UNDP) by using model-based estimates. Despite this limitation, there are extensive demographic and health services data bases for Cameroon.

For the proposed project, overall mortality and morbidity rates provide a window on the relative disease burden; however, the childhood communicable diseases have a distorting impact relative to adults. The adult burden of disease may have significant differences from the 0-14 age group due to the role of sexually-transmitted diseases (STDs) (i.e., AIDS and subsequent vulnerability to other infections), injuries and other noncommunicable lifestyle-related problems (alcohol, tobacco, etc.). For example, the projected disease burden (year 2020) due to tobacco is enormous and is anticipated to be one of the most significant problems. As previously discussed, there are different approaches to these problems (i.e., public health and clinical interventions, instruments of policy). Each of these strategies has a role in approaching the problem of adult health both for the proposed project and for the country in general. In order to better focus these potential strategies and their opportunities for health improvement, a detailed analysis of the Cameroonian disease burden will be presented in the next section.

4.0 DISEASE-SPECIFIC DATA

There are several sources of high quality disease-specific data for Cameroon: 1) Government MOPH publications, 2) incidence and prevalence survey data published in the scientific and medical literature and 3) 1995 expatriate Peace Corps volunteers (PCV) morbidity and mortality survey results (Peace Corps, 1997). These data are particularly relevant because the PCV exposures and subsequent illness/injury profile are expected to be similar to expatriates who will work on the project. The Peace Corps has a comprehensive preventive medicine and education program for its volunteers. The literature category includes WHO studies (e.g., onchocerciasis, guinea worm, schistosomiasis, trypanosomiasis, hepatitis, malaria, STDs/AIDs, tuberculosis World Bank-funded efforts, USAID-sponsored surveys and reports). In addition, there are voluminous high-quality collaborative studies published by Cameroonian University scientists and French research

institutes, e.g., ORSTOM, O.C.E.A.C., Pasteur. All of these sources were researched so that an in-depth disease-specific profile for the project corridor and the country as a whole could be developed. The current survey provides powerful insight into the geographic location and disease spectrum in Cameroon.

Not surprisingly, there are some limitations to the type and comparability of available medical data:

- Data are not always consistently obtained by the same survey instruments; however, the government's mortality and morbidity data were obtained using standardized collection forms.

- Data are collected as either incidence or prevalence rate. Both of these types of rates involve or imply some time relationship. The prevalence rate describes a group at a certain point in time (i.e., it is a "snapshot" of our existing condition). The incidence rate describes the development of a disease in a group over a period of time, which is included in the denominator:

$$\text{Prevalence rate} = \frac{\text{Number of persons with a disease}}{\text{Total number within a group}}$$

$$\text{Incidence rate} = \frac{\text{Number of persons developing a disease}}{\text{Total number at risk}}$$

- Clinical diagnoses without laboratory information, particularly in a rural setting, are frequently used and reported in statistical summaries. This presents a problem of case confirmation and is universally experienced with SSA data. Misdiagnoses and miscategorization undoubtedly occur throughout the data set. The government survey data are both relatively consistent across time and similar in rank order of disease problems across different provinces. The reporting system is inherently passive, i.e., patients must be present for medical attention at locations that collect and process data. This type of system, which is extremely common in SSA, will underreport the "true" burden of disease in the community or village. In addition, since there can be a lack of diagnostic laboratory infrastructure within the health system, diagnoses are sometimes clinical rather than laboratory confirmed. Nevertheless, there is a substantial body of peer-reviewed published data which confirms the clinical diagnostic data set. Therefore,

there is more than sufficient level of "hard" data that can be utilized for strategy planning and monitoring purposes for the project.

- Childhood data may not be entirely predictive of the indigenous adult disease situation; however, it is more predictive of "immunologically naive" expatriates. This problem was discussed previously; however, the childhood data, particularly for infectious diseases, do provide insight on the geographic location and magnitude of many diseases. For most of the major diseases there are a number of published studies that focus exclusively on adults. The two data sources provide a level of detail that is more than sufficient for project planning and evaluation.

4.1 SUB-SAHARAN AFRICA DISEASE DATA

Until recently, there was optimism that the ability to achieve control over infectious diseases was at hand (WHO, 1996a). Small-pox was eradicated; polio, guinea-worm, leprosy, leishmaniasis and neonatal tetanus were targeted for eradication or elimination. However, due to the emergence of new diseases (e.g., AIDS), pathogens resistant to antibiotics, and insects resistant to insecticides, the substantial progress recorded to date may decline or reverse. In addition to the burden of infectious diseases, SSA has significantly elevated incidence and prevalence mortality rates due to traffic accidents, injuries, violence, war, and tobacco-related illnesses. Table 9 presents a comparison of morbidity in SSA, EMEs, and worldwide levels for selected infectious diseases and other noncommunicable causes of death. These data are obtained from the 1996 WHO Global Health Statistics (WHO, 1996b). Both incidence and prevalence rates are presented. Data represent 1990 statistics and are compiled from a variety of WHO and World Bank sources. SSA rates are consistently higher in all categories versus either worldwide or EME rates. A comparison of SSA to other lower-income regions would also demonstrate a pattern of elevated communicable and noncommunicable mortality and morbidity rates.

4.2 SUB-SAHARAN INFECTIOUS DISEASES

Infectious diseases can be classified according to their mode of transmission from their source (human, animal, or environmental) to a new host. Transmission can happen via direct person-to-person contact, through insects and other vectors, by way of contaminated food or water, or in other complex ways (WHO, 1996a). Table 10 presents selected diseases and conditions by four main modes of transmission. A fifth category, "Other emerging issues" is also shown to encompass the problems of antibiotic resistance and health care facility infections. Each of these four modes of transmission will be presented with Cameroon-specific data. In addition, the general problem of antibiotic resistance will

also be briefly discussed. The role of poisonous animals (snakes and invertebrates) and plants (dermatitis and systemic effects) is potentially significant and will be presented as part of a health matrix gap analysis. This analysis is being undertaken to assist in project health and safety planning.

4.3 CAMEROON MORBIDITY AND MORTALITY DATA

There are two main sources of general morbidity and mortality data for Cameroon: 1) MOPH data and 2) the 1991 Demographic Health Survey. The MOPH data has recently been summarized by Kamdoum in two recent publications (Kamdoum, 1996a and b). These papers present countrywide morbidity and mortality data for 1977 and 1992. In addition, similar data from the MOPH are now available for 1993. Table 11 presents a comparison of diseases/reported diagnoses over the years 1977-1993. As this table illustrates, overall morbidity causes have remained quite constant and are dominated by infectious diseases, particularly malaria and intestinal parasites. Tables 12 and 13 present age-specific causes of morbidity. Table 14 presents the leading causes of mortality across all ages, while table 15 shows similar data for 1993 for children less than 5 years old (MOPH, 1996). A comparison of Tables 14 and 15 readily demonstrates that malaria is a dominant source of both childhood and adult mortality. These data are consistent with the morbidity figures (Tables 11-13) and clearly demonstrate the heavy burden of malaria across Cameroon. A detailed analysis of malaria and the other major infectious diseases will be presented in subsequent sections.

Similar disease/age-specific data are available at the provincial level. For example, Table 16 presents 1991-1995 crude morbidity data for the Adamaoua Province. As this table illustrates, while there are rank order differences versus countywide data, the overall dominance of the infectious diseases, particularly malaria, is obvious. The burden of accidents (vehicular and non-vehicular) injuries (intentional and non-intentional) is also significant for both adults and children. Accurate data for these categories are difficult to obtain; however, accidents and injuries represent a substantial morbidity and mortality burden across Sub-Saharan Africa. Therefore, it is likely that Cameroon is similarly affected.

As previously mentioned, the Peace Corps reported health events per hundred volunteers (events/100 PC). In 1995, the most commonly reported events per hundred were: 1) acute diarrhea (64), 2) upper respiratory illness (28), 3) dermatitis (23), 4) dental problems (23), 5) febrile illness (21), 6) mental health needs (18), and 7) unintentional injuries (15). Two-thirds of all hospitalizations for PCVs were caused by infections, e.g. gastrointestinal (44 percent), respiratory (16 percent). Interestingly, malaria-related hospitalizations were only 4 percent, illustrating the benefits of a comprehensive prophylaxis and control (impregnated

clothing, bednets). These data indicate that expatriates will both encounter and experience the existing in-country diseases; however, the impact can be clearly mitigated by a comprehensive medical/education program.

Overall, the project corridor passes through areas that have high endemic levels of infectious diseases. A detailed analysis of these diseases, including geographic disease maps based on published data, will be presented in the next subsections.

4.4 PERSON-TO-PERSON INFECTIOUS DISEASES

Person-to-person transmission of infectious diseases covers an enormous range of different disease categories. Table 10 lists over twelve major disease types. This list would be even longer if the myriad number of STDs (e.g., syphilis, gonorrhea, chlamydia, and herpes) were separately enumerated. Due to the critical importance of the STDs (including AIDS and hepatitis), these disease groups will be discussed in a separate section.

In terms of the proposed project, the most important person-to-person diseases, excluding AIDS/STDs/hepatitis, are acute respiratory infections (ARI), meningitis, and tuberculosis. Each of these will be discussed.

4.4.1 Acute Respiratory Infections (ARI)

ARI are one of the leading causes of morbidity and mortality throughout Cameroon and SSA (Jamison, 1993). ARI is a an amalgam term that includes many conditions and a variety of clinical manifestations caused by a myriad of etiological agents. ARI are subdivided into acute upper and middle infections (AURI) and acute lower respiratory infections (ALRI) which refer to conditions affecting the respiratory tract below the epiglottis. AURI include the common cold, otitis media, pharyngitis, tonsillitis, croup, tracheobronchitis, and acute epiglottitis. These are usually mild and self-limiting and infrequently lead to death. On the other hand, ALRI are more serious and include pneumonia and bronchiolitis. These two diseases are common complications in children of measles and pertussis (whooping cough). In SSA, pneumonia in young children is mainly due to bacterial causes such as strep pneumoniae and Hemophilus influenzae. Both of these bacteria are treatable with antibiotics; however, issues of antibiotic-resistant strains due to overuse of drugs is becoming a significant issue (see Section 4.8). The 1992-1993 Cameroon data report both upper and lower respiratory infections. Both morbidity and mortality levels are high (Tables 11-15) and these family of diseases are invariably in the top ten problems for a given year. While the true magnitude of ALRI in the adult population (ages 15-60) is unknown, the spread of either upper (AURI) or lower (ALRI) respiratory infections is an important

consideration for the design and operation of labor camps associated with proposed project construction activities. Furthermore, it is anticipated that there is a marked seasonality to the respiratory disease rates that could impact a labor force living in a workcamp environment.

4.4.2 Meningitis

Cerebrospinal meningitis is potentially a significant disease for Cameroon, particularly in the dry season in the savanna provinces (North and Extreme-North). The southern wooded savanna zones are also susceptible to meningitis; however, epidemics are less frequently reported (Riou, 1996). Parts of Cameroon are in the designated "meningitis belt" of SSA and in 1993-94 an outbreak of the invasive and highly pathogenic serogroup A subgroup III occurred (Riou, 1996). Epidemics within the African meningitis belt have typically occurred every 8 to 12 years; however, the intervals between large outbreaks have become shorter and more irregular since the early 1980s. There are multiple factors that affect the occurrence and spread of meningococcal disease: 1) decreasing antibody levels in the population, 2) overcrowding, 3) climatic changes (i.e., dry season or prolonged drought), 4) frequent cases of ALRI (lower respiratory) and 5) periods of dry and cool weather.

The most common organism in the epidemics of cerebrospinal meningitis in Africa are Neisseria meningitides serogroup A; however Group C has also been reported. As of March 27, 1996, information from Cameroon had been received on 5 cases with one death (WHO, 1996). Meningitis is potentially preventable through vaccination of both children and adults and the use of antibiotics to protect close contacts of those already infected. The early detection of outbreaks is essential so that appropriate containment measures can be instituted. In general, if the local incidence level exceeds 15 cases per 100,000 population during two consecutive weeks, then epidemic conditions are likely and the need for mass vaccination is imperative (WHO, March 22, 1996).

4.4.3 Tuberculosis (TB)

Over the last 10 to 15 years, TB rates per 100,000 have increased by over 50 percent in SSA (WHO WER, March 1996). The spread of TB has been accentuated by the increase in travel, migration, a general decline in overall health probably related to prolonged economic recession, and the growing AIDS epidemic. TB is primarily a disease of adults aged 15 to 44 and has formed a lethal partnership with AIDS. TB is the leading cause of death in AIDS-positive individuals (one-third of all deaths) in the developing world. In addition, drug-resistant TB is rapidly increasing and severely complicates an already difficult treatment situation.

Tuberculosis in Cameroon has received increasing attention from health authorities (Kuaban, 1995a; Lemardeley, 1995). Tuberculosis rates in Cameroon have slowly increased during the 1980s and 90s such that the annual risk of infection is calculated to be 1.5 to 2 percent. The estimated incidence rate is 100 cases per 100,000 (Kuaban, 1995b). These statistics are further complicated by the high positive case rate associated with each patient that comes to formal medical attention. For example, the "normal" international case finding rate is 5.6 percent. This means that among direct contacts with the original case, it would be expected that another 5.6 percent of direct family/relatives would also be TB positive. In Cameroon, Kuaban (1995b) reports a 14.5 percent positive case finding. In previous studies (LeMoal, 1991) the ability to contact and find these other probable cases was estimated to be only 40 percent. Therefore, the "true" estimated burden of bacillus positive (BK+ in French) cases is 11,000 per year (LeMoal, 1991). Tables 17A - B present both national and provincial data from 1987-1989.

These data demonstrate that the smear positive (BK+) percents of actual identified cases are quite high. Furthermore, as LeMoal et al. (1991) reports, these data are significant underestimates. The 1995 data are presented in Tables 18A - B. These data indicate several trends: 1) there continues to be an under-reporting of cases versus the true estimates, and 2) the age groups 25-34 and 35-44 dominate the case load. The latter observation is further reinforced by Kuaban's (1995c) report of 273 consecutive adult patients admitted to the Jamot Hospital Pulmonary Unit (University Yaoundé) over an eight month period. Overall, 64.1 percent of these cases presented with advanced and extensive disease characterized by infiltrates with or without cavities and occupying a whole lung field. Over 77 percent of the cases had multiple large (greater than 2 cm) cavities by x-ray. Kuaban also noted that intradermal skin testing was not a helpful diagnostic modality versus direct bacteriologic evaluation of pulmonary secretions. Ominously, drug resistance was also observed to be a significant problem (Bercion and Kuaban, 1995) In a study of 105 isolates, a serious pattern of drug resistance was noted (Table 19).

This problem of multi-drug resistance seriously complicates treatment and threatens to make some cases incurable. In addition, multi-drug resistance compromises the WHO program of "directly observed treatment, short-course" (DOTS). This program can theoretically cure 95 percent of all cases for $11(US); however, target cure rates will not be met if drug resistance continues to climb.

While Cameroon has begun a National Program Against Tuberculosis, know by its French acronym of PNLT (Programme National de lutte contre la Tuberculose), the magnitude and complexity of the problem is severe. The number of cases will undoubtedly increase in association with the mounting AIDS epidemic. TB is the leading killer of HIV-positive

individuals and accounts for over 30 percent of AIDS deaths worldwide (WHO, 1996). Overall, tuberculosis represents a serious and growing health problem across Cameroon that generally targets adults in their most productive years. Aggressive programs of 1) case-finding, 2) subject contact that include appropriate diagnostic equipment and treatment are necessary to prevent a further expansion of an already serious problem.

4.5 FOOD, WATER, AND SOIL BORNE INFECTIOUS DISEASES

Contaminated food, water, and soil are capable of transmitting bacteria, viruses, and parasites. Some of the most important medical conditions and diseases associated with these media are schistosomiasis, diarrhea, cholera, typhoid, intestinal worms, hepatitis (A and E), and tetanus. Poor sanitation is a major contributing cause of these infectious problems. The true incidence and prevalence of these diseases (particularly diarrhea and hepatitis) are difficult to accurately assess in a developing country (WHO, 1996a). The water and food-borne diseases are the most widespread health problems in the developing world and are an important source of low or poor economic productivity (WHO, 1996a). Cameroon is affected, by varying degrees, from all of the major water/soil/food infectious diseases. The two most important categories of diseases to the project are water-borne diseases (e.g., typhoid, dysentery, cholera, schistosomiasis) and food-borne illnesses (e.g., salmonellosis, hepatitis A). On a positive note, dracunculiasis (guinea worm disease) is close to being eradicated on a worldwide basis (WHO, 1996a) and the case-load in Cameroon is now quite low. Separate subsections for the major diseases in the water/food/soil categories will be presented in the next sections.

4.5.1 Intestinal Parasites

Intestinal parasites have consistently been listed as one of the top three causes of morbidity in Cameroon (MOPH data 1984-1995). A national survey of *Ascaris lumbricoides* and *Trichuris trichuria* was performed on more than 22,000 children from October 1985 to November 1987 (Ratard, 1991). Prevalence rates were highly correlated with climate type (Figure D-3): a) tropical zone - less than 5 percent, b) Guinea-type climate - 60 to 85 percent for *A. lumbricoides* and 85 to 95 percent for *T. trichuria*, and c) Cameroon-type climate - 50 to 70 percent for *A. lumbricoides* and 70 to 90 percent for *T. trichuria*. The age group distribution followed a pattern that indicated acquisition early in life, rapid increase in early childhood and development of a stable adult prevalence. Table 20 presents a summary table for each province, while Figure D-9 illustrates a more detailed mapping of the study results. Within specific climatic zones there do not appear to be significant differences in prevalence rates between rural villages, small towns, cities or as a function of altitude (Ratard, 1991). However, environmental conditions, such as heat and low humidity, are

significant since Ascaris eggs remain dormant under dry conditions while Trichuris eggs are adversely affected by desiccation. In addition, direct exposure to sunlight is also toxic to Ascaris and Trichuris eggs.

Overall, prevalences are very low in the dry, hot and sunny environments where annual rainfall is less than 1,500 mm and sparse vegetation and sandy soil conditions exist. Conversely, prevalence rates are extremely high in the equatorial zone conditions of the Central and South provinces.

As previously mentioned, there is a clear age-dependence associated with infection. Adult rates (age 20-44) are significantly lower than school children: a) Douloumi-Sudan - type climate: 0 percent/0 percent Ascaris/trichuris, b) Obili (Yaoundé): 17.9 percent/49.3 percent, c) Kindig-Guinea/Savanna: 28.6 percent/55.7 percent, d)Mfou-forest area: 27 percent/49.2 percent, and e) Kumba: Cameroonian-type - Southwest Province: 37 percent/45 percent. While these percent infected levels are substantially below the corresponding childhood rates, they still represent a significant health burden on the adult population.

4.5.2 Cholera

The incidence of cholera has risen dramatically in West Africa. Despite a WHO sponsored project involving 16 West African countries, 13 of the 16 countries reported disease in 1996, compared to only six in 1993 (WHO, Sept 26, 1996). The annual number of cases in this region has increased by six-fold since 1993, i.e. 7,000 cases in 1993 to over 40,000 through September 1996. New significant cholera outbreaks have been reported in 1997. Similarly, the case fatality rate has dramatically increased by nine-fold such that the West Africa region accounts for two-thirds of all cases on the continent and more than 70 percent of all cholera deaths (WHO, Sept 26, 1996).

There are multiple factors which have been invoked to explain the rise of cholera in West Africa: 1) prevalence of humid area with many pools and reservoirs of polluted water, 2) overcrowded living conditions and poor hygiene, and 3) mass movements of populations along roads and rivers associated with pilgrimages, festivals and political instability.

Cameroon specific data for the first 10 months of 1996 is available and presented in Table 21. The data from the Littoral province represents data reported from January 1 - October 31; however, data from the other three provinces is associated with discrete focal epidemics that had limited time spans, e.g. South (February-April), Extreme-North and North (June-September) (MOPH, 1997).

The epidemic in the Extreme-North appeared to be associated with a combination of drought and heavy late rains. At present, the situation is stable; however, the possibility of episodic outbreaks remains quite high.

4.5.3 Schistosomiasis (Bilharziasis)

Schistosomiasis is a chronic disease that has been recognized in Cameroon for decades. Prior to 1985, there were isolated surveys that indicated high levels of endemicity for *S. hematobium* in the northern provinces. Discrete foci were also noted in the Southwestern and Eastern Provinces (Agbor-Tabi, 1989).

In 1985, a schistosomiasis research project further identified endemicity of other schistosome species (*S. intercalatum* and *mansoni*) scattered throughout the country. A detailed National Bilharziasis Survey was conducted under the Cameroon Ministry of Higher Education [Institute for Medical Research and Study of Medicinal Plants (IMPM)]. This project was carried with collaboration by USAID and Tulane University. The results have been published in numerous well-known scientific journals (Ratard 1990, 1992; Greer 1990, 1992; Bausch and Cline 1995).

Beginning in 1985, the IMPM-Tulane University team performed a systematic nationwide survey for human cases and snail intermediate hosts. Over 19,000 urine and 22,000 fecal samples from children and young adults (ages 10-19) were examined, representing every subdivision in Cameroon. Over 700 sites were sampled. The net result of this effort is a series of schistosomiasis disease and vector distribution maps that are probably the most accurate and detailed in existence for a specific country (Figures D-10 through D-14).

Overall, results from these maps indicate that schistosomiasis is primarily concentrated in the northern half of the country. Over 80 percent of all cases occur in three provinces: Extreme-North, North and Adamaoua. The principal sites of transmission in these regions are small seasonal temporary bodies of water; however, there are areas, such as the Mbéré Valley which appear to be permanent foci of transmission (Raccurt, 1987). There are, however, areas of endemicity in the southern half of the country particularly *S. intercalatum* and occasionally *S. mansoni*. Since schistosomiasis is a focal disease, it is important to realize that prevalences observed in isolated foci may not be representative of "true" regional prevalences (Ratard, 1992). The National Survey confirmed this observation since the actual survey based calculated infectious case load was almost three times lower than WHO estimates based on limited sampling (Ratard, 1992).

As previously mentioned, in the northern provinces, transmission of both urinary and intestinal schistosomiasis is highly seasonal and usually occurs in small temporary bodies of water (Greer, 1992). This observation is highly consistent with the extensive, multi-year study performed by Audibert et al. (1990) that examined the impact of a massive rice irrigation project on schistosomiasis infection rates.

This study took place in the Extreme-North Province (Mayo-Danai) and covered the time period from 1979-1985. A stratified sample of 4,000 inhabitants, living in 28 areas was initially evaluated for both schistosomiasis and malaria. Due to population migrations, an additional 1,500 persons were added to the initial sample. Significantly, the prevalence of schistosomiasis and malaria remained constant over the six year study period. In addition, no changes in the transmission sites were observed. Both improved sanitation activities (drain cleaning and well construction) and decreased rainfall were felt to be significant ameliorative factors (Audibert, 1990).

Overall, this study is highly consistent with the observation that large well managed and maintained projects do not necessarily adversely impact schistosomiasis transmission and infection rates.

4.5.4 Food-borne Illnesses

The foodborne illnesses are potentially a major problem for the project because of the daily requirements to provide catering services for large mobile labor camps during the construction phase. Based on existing countrywide morbidity data, diarrheal diseases, which would include enterotoxigenic E. Coli and Campylobacter, are quite common. In addition, exposure to Hepatitis A is over 90 percent (see Section 5.0). Therefore, it would be expected that food-borne illness could episodically become a major problem during construction. This problem is amenable, however, to standard sanitation interventions that are discussed in Section 7.8 and 8.8 of the Environmental Assessment.

4.6 INSECT VECTOR-BORNE INFECTIOUS DISEASES

The insect vector-borne diseases are some of the most difficult epidemiological, pharmacological, and immunological challenges in the project region (Feachem, 1991). While there have been tremendous control improvements with some of the diseases (e.g., onchocerciasis, leishmaniasis, and trypanosomiasis), malaria has continued to be a stubbornly vexing cause of morbidity and mortality. The vectorial capacity of *A. gambiae* and *An. funestus* is undiminished, and the resistance of these vectors to insecticides and of the parasites to drugs has increased (World Bank, 1991; Butler, 1997). This section will

discuss the major insect vector-borne diseases in detail. A system of GIS maps based on published or in-progress studies of disease and vector locations are available from Dames and Moore (1997). Basic geographic disease distribution maps are included in this appendix. As a group, these diseases have been and continue to be the subject of major WHO and World Bank funded efforts; hence, the only constant is change. Due to the quantity and quality of the existing data base, a detailed disease distribution picture for the insect vector-borne diseases within Cameroon can be presented.

4.6.1 Malaria

The overall malaria situation in SSA in general, and Cameroon in particular, has reached a critical stage. This crisis has been triggered by the rapid rise in the parasites resistance to chloroquine, the main means of chemoprophylaxis and treatment on the continent (Butler, 1997). A seven-fold increase in malaria deaths over five years in parts of West Africa has been attributed to the emergence of chloroquine resistance. By a wide margin, malaria is the top cause of disease mortality in Cameroon. (Table 14). Since 1985, the rise and spread of chloroquine resistance in Cameroon has been dramatic. In order to better understand the complex interaction between malaria transmission rates, drug resistance and disease incidence, a brief discussion of the transmission dynamics will be presented.

Malaria transmission is higher in SSA than any other location in the world because of the abundance of the highly efficient African mosquito vectors of malaria, *A. gambiae* and *An. funestus* (Bradley, 1991). The longevity of the anopheline mosquito is critical to the perpetuation of malaria transmission. Development of the infective sporozoite parasites in the vector takes at least one week and is influenced by ambient temperature. Therefore the mosquito must survive longer than one week after feeding on a human host if transmission is to be continued.

In order to understand malaria transmission, the concept of basic case reproduction rate (BCRR) must be understood. BCRR is the mean number of new cases of malaria to which one case will directly give rise after passing once through the vector mosquitos under conditions of zero immunity in the human population (Bradley, 1991). For example, a BCRR of 5 means that one case will give rise to five cases in the next generation and 25 in the succeeding generation of cases (Bradley, 1991). Conversely, if the BCRR falls below 1, the disease transmission will gradually diminish and cease. Therefore, as a general rule, malaria transmission is directly proportional to the density of the vector, the square of the average number of blood meals on a person per day and the 10^{th} power of the probability of the mosquito surviving for one day (Mouchet, 1993).

In an endemic area, the supply of uninfected individuals who are susceptible is limited and "herd immunity" becomes important in reducing transmission and severity of disease. In this situation, there are two important scenarios that can occur: 1) the criteria for directly observing the BCRR will not be met and must be calculated based on mosquito biology (i.e., density of mosquitos, their man-biting habit, and their longevity), and 2) a sudden influx of non-immune or non-protected individuals is introduced into an area and an explosive epidemic occurs.

For effective malaria transmission, two conditions must occur: 1) the mosquito species needs to be long-lived and 2) have a high man-biting habit. Unfortunately, both *An. gambiae* and *An. funestus* meet these criteria and are associated with BCRRs in excess of 1,000. Thus, there is a tremendous reservoir of capacity for malaria transmission far in excess of that required to maintain levels of endemicity (see Table 22 for endemicity definitions).

Endemicity of malaria is traditionally defined by either using spleen or parasite rates in children ages 2-9. In areas which are hyper or holoendemic people are constantly infected. Eventually, a state of "premunition" is achieved such that repeated infections cause little or no serious clinical effects. This form of immunity does not prevent infection but does control, at some level, clinical symptomatology (White, 1996b).

These biological facts have several significant consequences:

- Transmission is extremely hard to control since BCRRs must be reduced by a thousand-fold

- Everyone in areas of high endemicity is usually affected at an early age and if they survive early childhood, develop premunition (immunity which protects against severe disease)

- Despite yearly variations in the determinants of transmission, BCRRs do not fall to 1, and malaria remains highly endemic and stable

- Non-immune adults who enter an area of hyperendemicity can eventually acquire protective immunity; however, the likelihood of an explosive epidemic outbreak is increased if large number of non-immune individuals are present.

Table 23 presents the common ecologic categories of malaria transmission in Africa. The pipeline area potentially crosses through categories 1-3; therefore, malaria should be expected to be a constant threat, especially during the peak transmission periods.

4.6.1.1 Malaria Mapping in Cameroon

The first published epidemiologic map of malaria in Cameroon was by Languillon (Languillon, 1956, 1957). Malaria was hyperendemic in almost all areas (Figure D-15). The most common types of malaria were: *P. falciparum*, *P. malariae*, and *P. ovale.* Over 22 species of Anopheles were identified: *gambiae*, *funestus*, *moucheti*, *nili*, and, *hancocki*, among others. Mouchet (1961) developed detailed maps of the Anopheles distribution (Figures D-16 and D-17). Malaria eradication campaigns (1953-1964) were organized throughout Cameroon using a variety of organochlorine pesticides. After a period of improvement, transmission rates accelerated and malaria prevalence continued at near hyperendemic levels due to lack of sustainability, financial considerations and political instability (Moyou, 1992).

In 1969, Abane and Delfini (1969) developed a new epidemiologic map for malaria in Cameroon based on data from the 1962-69 time period. In this map, Cameroon was divided into eight ecologic zones; however, overall transmission levels were still high and appeared to have increased since the 1950's eradication campaigns. Since the 1969 compilation, malaria endemicity has begun to vary quite substantially as a function of urbanization and deforestation (Moyou, 1992). Malaria is still perennial south of the Adamaoua Province; however, in the southern regions, transmission levels are somewhat higher in rural and deforested locations versus the main urban areas of Yaoundé and Douala (Louis, 1995).

In a 1990 article, Ripert (1990), published the results of 20 new malaria surveys in Cameroon. This effort was based on the assumption that prevalence rates had changed since Abane and Delfini's 1969 studies. In Ripert's paper, the results of 12 standard epidemiologic surveys, six in rural areas and six in southern rainforest locations, plus eight similar studies in various urban areas were reported. Three malaria indices in children ages 2-9 were utilized: 1) parasitemic, 2) serologic and 3) spleenic. The parasitemic index is based upon the number of parasites per microliter of blood. Typically, *P. falciparum* parasites counts over 100,000/ul are associated with substantially increased morbidity and mortality. Counts over 500,000/ul generally have mortalities over 50 percent. These counts cannot be considered as absolute indicators since relatively high counts can be tolerated by children living in areas of intense transmission as compared to non-immune adults. For example, counts over 2000,000/ul are fairly typical in semi-immune children who are clinically symptomatic. A similar level in a non-immune adult would produce severe disease. The sensitivity and specificity of this indicator is limited but can be improved by staging parasite development, i.e. the greater the number of mature parasites, the worse the prognosis (White, 1996b). Only some stages of malaria parasites in the blood, the *gametocytes*, are infective to mosquitoes. This observation means that under conditions of intense

transmission, *gametocytes* are confined to extremely young children and malaria is primarily transmitted by this subgroup (Bradley, 1991). Table 24 illustrates this observation, based on data from Uganda.

The spleen rate is a clinical measurement of spleen size that is easy to perform in field conditions. Historically, the spleen rate correlates with the parasite rate (Table 22). Table 25 presents parasitemic (*gametocyte*) index and parasite form for the 20 study locations. As this table illustrates, *P. falciparum* is the dominant malaria form and is occasionally seen in association with *P. ovale* and/or *malariae*. *Gametocyte* indices were relatively low, probably due to the age distribution of the study groups (ages 2-9).

Table 26 presents the overall parasitemic, serologic and spleenic indices for all of the study sites. Based on the results in this table, Ripert et al. categorized Cameroon as mesoendemic with areas of hyperendemicity in certain southern forest areas. In cities, the results were variable and ranged from hypo-endemic to hyper-endemic. Cartographically, these results are presented in Figures D-18 to D-20 and can be contrasted with the 1957 maps.

The overall results are consistent with the perennial transmission seen in the Southern Region and the seasonal pattern present in the Northern Region. These patterns are consistent with the categories presented in Table 23. In areas occupied formerly by tropical forest (Category 1, Table 23), malaria transmission is continuous and intense. Further north, transmission in the Savanna (Category 2, Table 23) is seasonal, although individuals can receive hundreds of inoculations per year (Bradley, 1991). In the Sahelian zone (Category 3, Table 23) malaria intensity is highly variable and is extremely dependent upon climatic conditions, i.e. rainfall and temperature. Category 4, high altitude, pattern is seen quite regularly in parts of Cameroon; however, these areas are generally not within the project corridor. As Ripert's results indicate, urban area malaria is quite variable (e.g., over 50 percent in Edea). This variability is not only between cities, but also within a given urban location.

Manga et al. (1993) studied the distribution of *A. gambiae* in Yaoundé and Edea. The study areas are characterized by hilly reliefs and swampy valleys. Human-biting rates demonstrated a marked gradient between the valley ("0" meters) and the hilltops (350 meters). The overall results explain why malaria transmission is extremely heterogenous within districts and is primarily centered around valleys and at the base of hills. In urban areas the *A. gambiae* bites near its breeding areas, which, in both study locations, had high density of houses, e.g. less than 2 meter separation. Given the high number of available hosts, the mosquitoes did not disperse in the vertical direction and a marked fall in

transmission was observed as a function of distance from the valleys to the hilltops. The public health implications of these findings are obvious.

Finally, renewed efforts at mapping are currently underway using GIS techniques for all of Sub-Saharan Africa (Le Sueur, 1996) This new mapping effort is known as the "Mapping Malaria Risk in Africa/Atlas du Risque de la Malaria en Afrique" (MARA/ARMA) and is a worldwide collaborative effort (Le Sueur, 1996). Published results are not available as of early 1997.

4.6.1.2 Chloroquine Resistance

The resistance of *P. falciparum* to chloroquine, the major antimalarial used in SSA, was first reported in two expatriate children in Cameroon in 1985 (Sansonetti, 1985). Chloroquine resistance spread rapidly and was found in Kribi, Yaoundé, Goroua, and Douala by 1987 (Moyou, 1992). In 1985, OCEAC began a national *in vivo* surveillance system for antimalarial drug resistance (Louis, 1995).

The OCEAC methodology is very simple (Jambou, 1988):

1. 200 school children are given chloroquine at a dose of 25 mg/kg body weight over three days, i.e. 15 mg - Day 0, then 5 mg - Day 1 and 5 mg - Day 2.
2. A thick smear is taken for each child at Day 0.
3. Those children who have a thick smear positive have repeat smears at Day 3 and Day 7 in order to document therapeutic efficacy.

In-vivo drug resistance is typically categorized using criteria developed by WHO (White, 1996b):

- R_1 (low grade): relapse of the infection between 7 and 28 days of completing treatment following initial resolution of symptoms and parasite clearance

- R_2 (high grade): reduction of parasitemia by greater than 75 percent at 48 hours, but failure to clear parasites within 7 days

- R_3: parasitemia does not fall by greater than 75 percent within 48 hours.

These criteria are broad and useful for surveillance purposes but do have several limitations if more precise analyses are required (White, 1996b):

- Few patients are followed for 28 days. The OCEAC methodology is a 7 day study and may underestimate resistance. Short protocols may not be able to distinguish between reinfection and relapse.

- Therapeutic failure may be due to dosing problems, poor compliance, absorption problems and other host pharmacokinetics factors.

Despite these and other more complex considerations, both the surveillance protocol and resistance criteria are appropriate tools. The overwhelming majority of published studies in Cameroon use these approaches and are the basis of the data that has been developed and published.

Table 27 presents chloroquine resistance data for South Cameroon in 1989 and 1993-94. While these data are quite variable, there is a pattern of increasing resistance levels. Similar data from 1986-1988 were reported by Brasseur (1992) for locations in both the Northern and Southern Regions. *In vivo* 7-day assays from 389 individuals from the southwest showed R_2 - R_3 levels of resistance in 18-52 percent of cases as a function of location (Brasseur, 1992). Data from the Northern Region, e.g. Ngaoundéré (6 percent resistance), Garoua (7 percent), and Maroua (7 percent) demonstrated substantially lower levels of resistance. Figure D-21 presents a countrywide chloroquine resistance map based on published studies between 1985 and 1995.

The difference between the Northern (dry) and Southern (rainy) regions is quite striking. Data from the Southern Region is consistent with rapid spread from an initial focus and eventual establishment of a stable plateau level. In contrast, the Northern Region data are not consistent with a rapid geographic spread. There are multiple potential explanations for this observation: 1) lower rate and seasonal nature of mosquito transmission of the parasite in the Sahelian geography and 2) substantially lower use, almost two-fold different, of chloroquine in the North versus the South (Brasseur, 1992). The implications of the observed North-South differences are significant for the proposed project since it will cross zones of widely differing malaria prevalence and chloroquine resistance. Mitigation strategies are presented in Sections 7.8 and 8.8 of the EA and are further developed in the Environmental Management Plan (EMP).

4.6.2 Onchocerciasis

Onchocerciasis (river blindness) is due to infection with *O. volvulus*. Man is the natural host and the vectors are different species of the Simulium complex (blackflies), e.g., *S. damnosum*, *S. sirbanum*, *S. squamosum*, etc. *Simulium* flies breed optimally in well-

oxygenated water. The pregnant *Simulium* oviposits into rapidly flowing rivers and streams. Transmission is maximized near these locations. This observation accounts for the moniker "river blindness."

Clinically, the major manifestations of onchocerciasis are dermatitis, eye lesions and nodule formation. Significant morbidity is produced only after extensive and prolonged exposure over many years. It is not uncommon to find individuals with biopsy positive microfilariae in their skin who otherwise have no overt signs or symptoms (McMahen and Simonsen, 1996).

The control of onchocerciasis (river blindness) in recent years has dramatically changed due to the WHO Onchocerciasis Control Program (OCP). OCP has eliminated the disease as a public health problem from 11 countries in West Africa through a combination of extensive insecticide spraying of vector breeding sites and the widespread distribution of a safe, effective drug, Ivermectin. However, despite the progress of the WHO-OCP project, onchocerciasis is still hyperendemic in many areas of Cameroon.

The level of endemicity of onchocerciasis in a population has been classified by the OCP on the basis of the age-standardized microfilarial prevalences: a) sporadic (<10 percent), b) hypoendemic (12-29 percent), c) mesoendemic (30-59 percent) and d) hyperendemic (60 percent or greater). There has been further augmentation of this criterion based on the addition of findings other than microfilarial load: 1) presence of at least one nodule or any other clinical sign and 2) presence of microfilariae in the anterior chamber of the eye. The addition of these criterion increased prevalence rates by 10 percent in one study in Sierra Leone (McMahon and Simonsen, 1996). In the forest of southern Cameroon, the prevalence of nodules and skin lesions are strongly predictive of high levels of endemicity.

The epidemiology of onchocerciasis is significantly influenced by the density, biting, infectivity rates and flight range of the vectors. Flies of the *S. damnosum* complex have specific breeding requirements: 1) adequate velocity of water, 2) appropriate food supplies, and 3) suitable attachment sites, e.g. rocks, sticks, vegetation. Exposed rocks that create white water rapids are primary larval habitats. In general, female blackflies restrict their flight range to within a few kilometers of breeding sites; however, based on wind direction and speed, the flies can migrate several hundred kilometers from one river basin to another (McMahon and Simonsen, 1996). Biting is usually most intense within the immediate vicinity of breeding sites. Unlike the *An. gambiae* mosquitoes, peak biting activity is during daylight hours (as apposed to midnight to 0400 hours for anopheline mosquitoes).

The main West African members of the *S. damnosum* complex can be generally divided into savanna species, e.g. *S. damnosum* s.s. / *S. sirbanum* and forest species, e.g. *S. yahense* and *S. squamosum*. *S. mengense* has been described in southwestern forest zone; however its vector potential has not been clearly defined (Traoré-Lamizana and Lemasson, 1987).

4.6.2.1 Vector and Disease Mapping

Figures D-22 and D-23 are geographic distribution maps produced by ORSTOM for the *Simulium damnosum* complex in Cameroon during the wet and dry season. These maps are primarily focused on the northern regions of Cameroon (Traoré-Lamizana, 1987). An onchocerciasis disease distribution map (Figure D-24) was produced as part of the 1993 Cameroon River Blindness (Ivermection Distribution) Program sponsored by USAID (Boyle, 1993). The 1993 disease map corresponds quite well to the 1987 ORSTOM *S. damnosum* distribution. As part of the WHO-OCP new disease distribution maps have been created. The Rapid Epidemiological Mapping of Onchocerciasis (REMO) is a major component of the OCP and covers both the project area and other contiguous locations. Based on REMO data, Cameroon was divided into six division:

- Division I - Extreme-North, dry sahelian climate
- Division II - Northern Guinea Savanna Zone from approximately 8° to 10°N, with a southern boundary being the escarpment of Ngaoundéré and the northern watershed of the Sanaga basin
- Division III - From 4° to 7° 30'N. This is the watershed of the Sanaga river basin. A large empty zone that is virtually uninhabited north of the Sanaga River is included.
- Division IV - Tropical rainforest area, covering south of 3°N and the whole area east of 12° 15'E. The northern boundary is the watershed between the Sanaga and Nyong Rivers.
- Division V - Littoral or coastal plain approximately 20 km wide. This area is generally unsuitable for onchocerciasis vectors.
- Division VI - Generally English speaking West Cameroon. A large portion of the land is above 2,000 meters.

Figure D-25 is a map of these divisions and zones.

Based on the 1994-96 data supplied by the MOPH, a new disease map using REMO data has been constructed (Figure D-26). These data are keyed to prevalence of nodules in male patients who were examined as part of the REMO survey. Other 1987-1997, non-REMO

studies are combined and graphically presented in Figure D-27 and indicate significant onchocerciasis transmission in southern Cameroon.

Overall, vector and disease distributions are consistent. There are substantial areas of hyperendemicity, particularly in the Northern and Central Provinces and perhaps in the Southern Province as well. The proposed project corridor crosses through many areas that are hyperendemic. The use of safe, short acting insecticides, e.g. temiphos (Abate®), is a major consideration and will be discussed in both the EA and EMP.

4.6.3 Filariasis

4.6.3.1 Lymphatic Filariasis

One prevalence survey in 1980 was performed in the Logone Valley, Yagoua (Extreme-North) (Ripert, 1982). This study, which is out of the project area, examined the prevalence of bancroftian filariasis (*W. bancrofti*). Prevalence was determined by using both microfilarian rates and detection of specific antibodies. Over 600 individuals were studied in 12 villages. Mircrofilarian rates were 22.1 per 100 in males and 9.8 per 100 in females. These results were felt to be consistent with older reported studies. The national survey noted that female *A. gambiae*, also an important malaria vector, were the mosquitos most frequently observed in surveyed households.

4.6.3.2 *Loa Loa*

Loa Loa is a filarial parasite of man with a distinct geographical distribution in the tropical rain forest of Western and Central Africa. Clinically, prolonged exposure is associated with localized angioedema (Calabar swelling) and subconjunctival migration of adult worms across the eye ("African eye worm") (Nutman, 1988). Human *L. loa* is transmitted by day-biting female tabanid flies of the genus *Chrysops*. *Chrysop* flies are abundant in the forest canopy and are attracted by movement, dark colors and wood smoke. Transmission takes place primarily during the rainy season (McMahon and Simonsen, 1996).

Loiasis is hyperendemic in the Southern Region. It has been estimated that in Cameroon exposed individuals may receive one infective bite every five days (Mommers, 1994). Despite this observation, studies in Southern Cameroon consistently demonstrate a 30 to 35 percent prevalence of microfilarial carriers (Garcia, 1995; Fain, 1981; Mommers, 1994). A map of the distribution of *L. loa* in Cameroon is shown in Figure D-28.

Garcia et al. (1995) published the first longitudinal epidemiologic survey of loiasis Mbalmayo at both the population and individual level. This study was located in the region of Mbalmayo, 70 km southeast of Yaoundé (Figure D-28). Data was obtained on 738 subjects on both sides of a 10 km long trail across the forest. At the population level, both the prevalence and the log transformed parasite density were stable over time, ranging between 26.8 and 29.0. These results were consistent with those of previous cross-sectional studies. The implication of this observation is that the epidemiologic situation can be assessed by a one-time survey, without loss of significant information (Garcia, 1995).

4.6.4 Trypanosomiasis

The human African trypanosomiases (HAT or sleeping sickness) are caused by parasites of the genus *Trypanosoma*. The organisms responsible for HAT are members of the species *T. brucei*, a group of organisms that can be transmitted to man by the bite of the tsetse flies, *Glossina*. HAT is endemic only in areas where *Glossina* species are found. The "*Glossina* belt" is approximately from 14°N from Senegal in the West to 10°N in Southern Somalia in the East and 20°S corresponding to the Northern fringes of the Kalahari and Namibian Desert.

HAT in the Central African states has been well described in many review articles (Lemadeley, 1995; Penchenier, 1996). Figure D-29 presents the 1990 Central African Region map of active or possible active HAT foci (WHO, 1990). The estimated population at risk for HAT in Central Africa, including Cameroon is shown in Table 28 while Table 29 presents new cases of HAT in Central Africa. The transmission of *T. b. gambiense* as seen in Cameroon, is associated with particular sites, usually near riverine vegetation, river crossings, water collection points, washing sites, sacred forests and villages adjacent to rivers or lakes (Molyneux, 1996).

The history of HAT in Cameroon is long and extremely well documented (Lemardeley, 1995; Penchenier, 1996; Noncho Amida, 1990; Louis, 1995; Ebó Oeyenga, 1995; Ghogoma, 1989). Throughout the 20th Century HAT has been endemic in Cameroon. The first cases were discovered early in the 20th Century. Infection rates were from 30 to 90 percent and epidemics were common, particularly in the area between the Nyong River and the Sanaga River.

By 1930, Cameroon was described by the famous French physician, Dr. Eugene Jamot as having "...an epidemic fire...burning in the South of Cameroon" (Ghogoma, 1989). See Figures D-30 and D-31. After extensive public health campaigns, HAT is only reported in a few areas in Cameroon (Figure D-32). The 1977-1986 case load is shown in Tables 30A -

B. There continues to be an active HAT foci in the Fontem area; in addition, Bafia, Campo and Douala occasionally report cases. Since 1990, government support for HAT programs has disappeared and surveillance activities are only passive rather than active case finding (personal communication Dr. B. Cline, 1997). While at present, the prevalence of HAT in Cameroon is quite low, epidemic spread is still possible since the most contagious stage of the disease occurs before overt clinical signs and symptoms are present. Fortunately with the exception of the Chad portion of the project, the pipeline corridor is not in close contact with any of the Cameroonian foci with the possible exception of the Kribi area.

4.6.5 Yellow Fever

Cameroon has had sporadic but significant outbreaks of Yellow Fever that have been documented over the 1990-1994 time period. In December 1990, a major epidemic occurred in the Mayo-Sava and Mayo-Tsanaga departments. Two towns Mokolo (M-Tsanaga) and Mora (M-Sava) were impacted. One hundred eighty-two cases were reported with 125 deaths. Scientists from the Centre Pasteur de Garoua reported that "true" estimates of cases were between 5 and 20,000 with 500 to 1,000 deaths (Vicens, 1993).

In November 1994, a restricted outbreak of 10 cases and 5 deaths was reported in the town of Ngaoundéré, in Adamaoua Province. Entomological surveys confirmed the presence of *Ae. aegypti* and the virus was isolated from these mosquitos. This outbreak was limited due to its occurrence during the dry season which tended to inhibit *Ae. africanus* and *aegypti* vector densities and subsequent jungle and urban transmission (WHO WER, Oct 18, 1996). No cases were reported in 1995. A highly effective and safe vaccine exists for yellow fever and can be used to prevent infection and control epidemics.

4.7 ANIMAL BORNE INFECTIOUS DISEASES (INCLUDING NEW AND EMERGING DISEASES)

Infectious diseases that are transmitted from animals to humans are called zoonoses. Of these, rabies and brucellosis are well known examples. Ebola-Marburg hemorrhagic fever probably has an animal host; however, this has not yet been definitely established. There have been no known outbreaks of Ebola in Cameroon; however there have been three episodes in nearby Gabon in 1994 and 1996 (Dispatch, 1997). Figure D-33 is a map of the locations of the Gabon outbreaks. Reportedly, there is an extremely low antibody prevalence against Marburg virus in Northern and Southern Cameroon; however, a mid-1980s survey found a 10 percent antibody prevalence for an "Ebola-like" virus (personal communications, 1997). Lassa Fever is transmitted by direct or indirect contact with dust or food contaminated with urine from infected rodents. Person-to-person transmission can

also occur. Lassa Fever is possibly enzootic in the Extreme-North. Low antibody prevalence was detected in human sera from residents in Mora (Extreme-North, Mayo-Sava). Sporadic outbreaks have been reported in West Africa other than Sierra Leone (e.g., Liberia, Nigeria, Guinea).

4.8 EMERGING DISEASES AND ANTIBIOTIC RESISTANCE IN INFECTIOUS DISEASES

Antimicrobial resistance by disease-causing organisms is an issue of increasing public health concern. A growing number of infections have become increasingly untreatable or more difficult to control (e.g., TB, malaria (see Figure D-21, cases of malaria with chloroquine failure), cholera, dysentery, and pneumonia). According to WHO, a major cause of this problem is the uncontrolled and inappropriate use of antibiotic drugs (WHO, 1996a). WHO currently has an active program, WHONET, of global surveillance of bacterial resistance to antimicrobial agents. The practice of mass drug administration will be carefully reviewed and considered on a disease-by-disease basis.

5.0 SEXUALLY TRANSMITTED DISEASES (INCLUDING AIDS AND HEPATITIS B-D)

5.1 HEPATITIS

Viral hepatitis is a general category for a diverse but related group of infectious agents that are extremely common in Sub-Saharan Africa in general and Cameroon in particular. Hepatitis viruses B, C, and D can all be transmitted via sexual contact. Percutaneous and premucosal exposure to infective body fluids e.g. blood, saliva, semen, and vaginal fluids, are primary transmission routes. Hepatitis A (HAV) is not a sexually transmitted disease but is included in this section for completeness.

5.1.1 Hepatitis Type A (HAV)

Type A (HAV) is highly contagious, usually transmitted by the fecal-oral route and from contaminated food, milk, and water. There is no carrier state for Hepatitis A Virus (HAV), perpetuation of the virus in nature appears to depend on nonepidemic, inapparent subclinical infection. In Cameroon, 91.4 percent of subjects in one large-scale study were anti-HAV positive. None of the study subjects had anti-IGM antibodies to HAV which confirms the early occurrence of HAV infection in Cameroon (Ndumbe, 1989, 1994). In Cameroon, the high and early occurrence of HAV is attributed to poor hygiene standards (Ndumbe, 1994).

5.1.2 Hepatitis Type B (HBV)

In SSA, intimate contact among young infants/children is associated with a high frequency of hepatitis B surface antigen (Hb_sAg). Perinatal transmission occurs in infants born to Hb_sAg carrier mothers or mothers with acute HBV during the 3rd trimester of pregnancy or during the early postpartum period. Sexual transmission is also quite prominent. In Ndumbe's study (1994) of 369 pregnant women in a rural hospital in Manyemen, Cameroon, 5.4 percent were Hb_sAg positive.

For Hb_sAg, the highest prevalence was seen in the 10-19 year age group, where 10.5 percent were positive. The incidence of prior HBV infection was extremely high with 85 percent of the women demonstrating evidence of previous exposure to the virus based on the prevalence of anti-HB_c (Ndumbe, 1994). Similar rates (up to 10 percent) have been found in urban Yaoundé demonstrating that the high prevalence rates are not an isolated rural phenomenon (Ndumbe, 1989, 1991, 1994). Comparable Hb_sAg in the US are 0.1 - 0.5 percent. In Mayo Sava (Extreme-North) Hb_sAg rates were 25.3 percent (Merlin and Josse, 1985) and in the West Province 8.5 percent (Aebischer, 1990).

5.1.3 Hepatitis Type C (HCV)

Formerly known as non-A, non-B hepatitis, HCV is the cause in more than 90 percent of cases of transfusion-associated non-A, non-B hepatitis. The prevalence rate of HCV infection in the adult SSA population is extraordinarily high when compared to the Established Market Economics (EMEs). In the EMEs, HCV ranges from 0.5 to 2 percent in blood donor groups (Mencarini, 1991).

Mencarini et al. (1991) evaluated the prevalence of HCV infection in a group of 315 normal subjects living in various regions of Cameroon: a) Extreme-North, Amoré department, b) North - town of Garoua, c) West - Mifi department and d) Littoral - Moungo department. Prevalence rates were strongly correlated with age but not sex. There was a higher prevalence in the northern provinces; however, there were no significant difference in prevalence between samples from rural or urban environments (Mencarini, 1991). Figure D-34 presents the results of this study. The overall prevalence rate was 9.8 percent. This extremely high rate triggered further investigations in many other locations and study populations.

Ndumbe and Skalsky (1993) found a 5.5 percent prevalence in pregnant women in Yaoundé and a 6.8 percent rate in a similar group in the rural hospital in Manyemen (Ndumbe, 1994). The variability of results has been attributed to the different assays used by investigators

(Nkengasong, 1995; Tibbs, 1991). Nkengasong et al. argued that previous studies carried out in some tropical countries used first generation enzyme immunoassays (EIAs) and were flawed because of poor sensitivity and specificity of the assays.

Since the development of second and third generation HCV EIAs, sensitivity has greatly improved. Confirmation testing by radio-immunoblot assays (RIBA) has reduced the number of false positives. Overall, most studies in the last 2 to 3 years use a combination of second or third generation enzyme linked immunosorbent assay (ELISA) plus RIBA confirmation. Nkengasong, et al. performed a prevalence study on 251 individuals originating from Ebolowa, an urban area in Southern Cameroon near the pipeline corridor. Table 31 shows the prevalence of anti-HCV antibody in the different study groups. As illustrated in this table, the overall prevalence of HCV was extremely high and demonstrated a marked correlation with age. A statistically significant difference between sexes (33 percent males and 25 percent females) was not present.

There are several mutually nonexclusive explanations for the high prevalence rates:

- Ritual scarification and tattooing
- Use of nondisposable or poorly sterilized skin-piercing medical equipment
- Possible role of transmission through an insect vector. HCV is a flavinirus. Other infections in this family are known to be arthropod borne.
- Blood donation/transfusion
- Sexual transmission.

Based on this study, the authors dubbed HCV as a possible "sleeping giant in Southern Cameroon." (Nkengasong, 1995).

In order to further explore the HCV problem, additional studies have been performed in several villages in Southern Cameroon (Kowo, 1995; Louis, 1994b and 1994c). These studies are particularly interesting because they studied relatively isolated rural populations of Baka Pygmies and Bantus (e.g. Boulous and Fangs). The overall results of Kowo et al. (1995) are shown in Figure D-35 and those of Louis et al. in Table 32.

According to Kowo et al., the overall prevalence rate of 13 percent found in a forest population of Southern Cameroon is probably one of the highest known worldwide, using the new generation assays (Kowo, 1995). There was a significant difference between Pygmies and Bantus. Since Pygmies are monogamous and relatively isolated, it is less likely that HCV was acquired from the outside versus low efficiency continuous transmission. This study also found that 7.2 percent of the subjects were Hb_sAg carriers, a rate that was

previously discussed, is within the levels observed throughout Cameroon. Interestingly, there were no confirmed cases of HIV or Human T-lymphotropic virus (HTLV) infection.

The Louis et al. studies (1994b and 1994c) included: 1) 807 residents (ages 5 and greater) of 5 villages in the Djoum area, 2) 771 (ages 15 and greater) residents of Balu du Dja (Mékas) and, 3) 608 individuals (age 15 and greater) who lived along the Yokadouma-Mouloundou route. The overall prevalence rate in Djoum was 12.5 percent for all ages, but there was a marked difference in the age 15 to over 70 Bantous (21.1 percent) and the similar aged Pygmes (2.86 percent). High rates in ages 15 - ≥70 were also seen in the Mékus Bantou group (40.36 percent) (Table 33). The Yokudouma (age 15 - ≥70) Bantous had substantially lower prevalence rates (7.5 percent) (Table 34). The explanation for these differences is not known.

The pygmies in the Mékas study had a HTLV-1 confirmed (western blot) positive rate of 1.5 percent (Louis, 1994b). Additional pygmy studies have been published involving the Baka Pygmies of the Eastern Province (Ndumbe, 1993) and the Bakola Pygmies of the Ocean Department (Campo-Bipindi area) (Delaporte, 1994).

In the Eastern Province study of 141 subjects (ages 18-45), the prevalence of Hb_sAg was high (14.2 percent). Exposure to the hepatitis B virus on the basis of anti-HB_c was 93.5 percent. The prevalence of HCV antibodies was 7.9 percent. Anti-HDV antibodies were found in 45 percent of the study subjects. Approximately 13.4 percent had antibodies to syphilis. HIV-1 was 0.7 percent or one case out of 140 samples, while HTLV-1 was 10.9 percent (15 out of 138).

In the Bakola pygmies, HCV prevalence was 8 percent (Delaporte, 1994). Syphilis was endemic with a 55 percent positivity rate; however, the biological test could not differentiate between yaws and venereal syphilis. The HIV/HTLV status of the Bakola pygmies will be discussed in detail in the next section, since the pipeline corridor will pass through the Lolodorf-Bipindi-Kiribi area.

Overall, the HCV epidemiology in Cameroon and SSA has been recently reviewed by Deparis et al. (1996). These authors, (which include F.J. Louis and M. Merlin) make several interesting observations:

- The endemicity of HCV can be categorized on a regional basis

  - hyperendemic - Central African states
  - meso-endemic - Sahelien Zone, Northern

- hypo-endemic - Southeastern States

- The impact of HCV on chronic liver diseases appears to be independent of HBV. Unlike HBV there does not appear to be an impact between HCV and liver cancer.

- The HCV epidemic appears to have evolved independently from the epidemic curve produced by HIV. The age distribution patterns are quite strikingly different.

- The HCV seroprevalence increases with age in SSA, i.e. low before age 15 and maximum after age 40. HBV reaches high levels in SSA around age 15.

- Sexual transmission of HCV appears weak but not negligible.

- The possibility of a vector borne transmission of HCV in Central Africa exists but will be difficult to firmly prove.

An overall map of the HCV studies in Cameroon is presented in Figure D-36.

5.1.4 Hepatitis D

The hepatitis delta virus (HDV) was first observed in Italian drug addicts in 1977. HDV was eventually shown to be a defective virus particle that could only grow in the presence of the hepatitis B virus surface antigen. Ndumbe (1991) performed a study on the prevalence of HDV and its risk factors in the Yaoundé area. Sera from 110 Hb_sAg subjects were tested for HDV infection (antibody and antigen): a) 43 pregnant women; b) 23 prostitutes; c) 20 patients with febrile jaundice; d) 16 multi-transfused sickle cell children; and e) 8 medical students. Overall results are shown in Table 35. This study demonstrated that HDV infections exists in Hb_sAg positive patients in Yaoundé. The two dominant risk factors are blood transfusion and sexual exposure.

5.1.5 Hepatitis E

Hepatitis E is an enterically transmitted (fecal) virus that is an important cause of large epidemics of acute hepatitis in India, Asia, the Middle East, and Northern Africa. HEV has not been reported as a major source of disease in Cameroon.

5.2 INTRODUCTION - HIV/AIDS

The Human Immunodeficiency Virus (HIV)/AIDS epidemic is not a monolithic phenomenon across the globe. The epidemic is composed of many separate and individual epidemics that are spread unevenly across regions such as SSA. Thus, characteristics such as geography, the type and nature of the population affected, the frequencies of risk behaviors and practices and the temporal introduction and amplification of the virus all have a profound affect on the magnitude and spread of the epidemic (Cohen and Trussell, 1996). Furthermore, there are biologic factors that can have profound impacts on the spread of the epidemic by increasing or decreasing the susceptibility to the virus, altering positively or negatively the infectiousness of those with HIV, and changing the progression of infection to death and disease (Cohen and Trussell, 1996). These biological factors include: the presence of classical STDs, e.g., genital ulcers, syphilis, etc., male circumcision, the simultaneous infection with other immunologically interactive diseases, e.g., malaria and the other tropical diseases, and the viral characteristics of HIV-1, HIV-2, and their multiple genetic strains (Cohen and Trussell, 1996 and Fauci, 1996). HIV-2 is a closely related human immunodeficiency virus which is primarily found in West Africa. Both sexual and mother-to-child transmission of HIV-2 are less efficient than for HIV-1. Not surprisingly, HIV-2 prevalence levels have remained relatively stable.

In order to better follow and understand both the data that will be presented and the subsequent discussion, there are several technical terms that must be clearly understood. HIV or human immunodeficiency virus refers to infection. For example, an individual can be exposed to the HIV virus and subsequently become infected. However, this infection does not necessarily produce clinical signs and symptoms and is detectable only by laboratory testing. Therefore, HIV prevalence and incidence rates refer to the number of persons currently infected or likely to become infected in a given time period. AIDS, or the acquired immune deficiency syndrome, refers to active symptomatic disease. Since there can be an extremely long period of time between infection and development of active disease, the number of HIV positive individuals is significantly different from the number of verified AIDS cases.

5.2.1 HIV/AIDS in Sub-Saharan Africa

As a region, in a relatively short period of time (since 1981) there has been a massive epidemic of virtually unprecedented proportions that has affected SSA. It is estimated that there are over 11 million HIV-infected African adults and 3 million AIDS-related deaths as of 1995 (WHO, 1995).

By the year 2000 estimates are that 20 million individuals will be HIV infected and at least 8 million will have died of AIDS. As many as 1 million African children are estimated to have been infected as a result of mother to child transmission (Cohen and Trussell, 1996). Estimates of the doubling time of the epidemic in SSA range from 1-3 years in high (20-30 percent) prevalence regions to 5 years or more in areas that have lower (10 percent or less) prevalence rates (Potts, 1991). The variability in prevalence rates is multifactorial: 1) presence of other active STDs, 2) differences in sexual behavior, e.g., number of partners, use of condoms, 3) contact between low-risk and high-risk groups, i.e., the pattern of mixing between groups with various degrees of sexual activity, 4) probability of transmission from an infected individual to his/her partner, and 5) timing of sexual contact during the highly variable incubation period of AIDS (Robinson, 1995).

Recent evidence indicates that life expectancy rates are declining in some of the most severely affected countries (US Bureau of the Census, 1994). In a prospective cohort study in rural Masaka District, Uganda, the HIV-1 epidemic has had a measurable and dramatic impact on adult mortality even though the overall prevalence (8 percent) and incidence (1 percent) rates were relatively low (Mulder, 1994). The projected cumulative effect of the HIV/AIDS epidemics is enormous. As this study demonstrates, the prevalence and incidence rates do not have to be extremely high for major impacts. As countries, such as Cameroon, move from low prevalence (1 to 5 percent) status to higher levels (8 to 15 percent prevalence), the expected effects will be potentially staggering.

Initially, HIV prevalence was not uniformly distributed across all SSA countries. This was illustrated by 1990 data (Figure D-37). As shown in Figure D-37, the epidemic disproportionately affected East and Southern Africa where up to one in three adults were infected in certain urban populations. The density of cases in West Africa was, as of 1990, substantially lower except in Abidjan, Cote d'Ivoire where high levels of infection, i.e., greater than 10 percent, were found. As a general finding, rates were lower in rural settings compared to urban locations. The highest rates were usually found in men and women between 20 and 40 years old and in people with STDs and TB. There was a marked occupational bias with high rates in long-distance truckers, military personnel, and women employed in the commercial sex industries. These groups are known as "high-risk" populations. "Low-risk" populations include pregnant women and the general population. There was a marked difference in the age distribution of peak HIV prevalence between men (older) and women (younger) because sexual partnerships tend to be formed between older men and young women. There were differences in male-to-female and female-to-male transmission rates with the former being more efficient than the latter. Therefore, as the epidemic spread into the rural population, the absolute number of infections became higher among women than men (Cohen and Trussell, 1996). It is illustrative to compare the 1990

African seroprevalence data with more recent prevalence mapping studies from 1995 and January 1997. Figures D-38 through D-41 are 1995 data. It is obvious that the HIV prevalence has significantly increased across all of SSA and particularly in the Central African States (including Cameroon). This latter observation is illustrated in Figure D-42.

January 1997 prevalence mapping demonstrates the inexorable increase and spread, particularly in the low-risk urban populations, of HIV-1 (Figures D-43 and D-44). HIV-2 has remained relatively stable (Figures D-45 and D-46).

As these maps clearly illustrate, Cameroon has moved from a low prevalence (<5 percent) country to a much higher prevalence situation that is similar to its neighboring countries (Figure D-47). A detailed analysis of this transformation in Cameroon will be presented in latter sections after basic information on the transmission and amplification of HIV is introduced.

5.2.2 Transmission and Amplification

The analysis of the basic reproductive rate of infection is similar to the calculation of the malaria BCRR (Section 4.6.1). The basic reproductive rate of infection, Ro, within low risk groups is probably less than unity (1.0). Ro defines the average number of secondary cases generated by one primary case, with Ro>1 needed for epidemic propagation to occur (Cohen and Trussell, 1996). Therefore, if low-risk groups, e.g., rural population, come in contact with high-risk groups, e.g., commercial sex workers and their male clients, the opportunity to generate an epidemic is substantial. For example, the altered contact and mixing of different subgroups that can occur between truckers, their contacts and then their spouses and/or girlfriends can amplify the basic case reproduction rate. For example, Carswell et al. in a 1989 study of East African truck drivers argue that although commercial sex workers have high prevalence levels of HIV, it is the contact with travelers from other parts of Africa, initially confined to major trading routes and highways, that acts as the portal of entry for HIV into a given region (Carswell, 1989; Hunt, 1989). Analogously, small changes in the pattern of mixing between sexual activity classes can also slow, or even prevent an epidemic that would otherwise be widely disseminated (Potts, 1991). Similarly, treatment of active STDs would also have a beneficial impact of approximately 40 percent reduction in HIV incidence (Grosskurth, 1995a, 1995b).

The basic biological and behavioral factors that determine the transmission dynamics of HIV and the other STDs have been well described in a number of publications (Anderson and May, 1988; Auvert, 1990; Over and Piot, 1993; Potts, 1991; Royce, 1997). The observations and models discussed in these papers are all fundamentally based on the relationship

between Ro- the reproductive rate or the number of new infections transmitted by one infected person in the susceptible population and three determinants referred to in the literature by two different but synonymous symbols of the rate of spread: 1) β or Q, which represents the mean probability of sexual transmission per partnership; 2) D, the mean number of years an infected person remains infectious and 3) c or a, the average rate of new sexual partner selection per year or the number of contacts per time period between an infected person and a susceptible person (Cohen and Trussell, 1996). The relationship is linear, i.e., Ro=βcD or Ro=QaD. In a 1993 article, Over and Piot present some of the basic values for each determinant of Ro based on several assumptions regarding the study groups and the simulation under consideration (Jamison, 1993). The most important measure of sexual behavior is c, the rate of sexual partner change within a population. The variable "c" is not the average or mean number (μ) of new sexual partners per person but instead is μ+variance/μ, where variance refers to number of new sexual partners per year. The variable "c" is then a reflection of the heterogeneity in sexual behavior, as measured by the variance of sexual partner change (Over and Piot, 1993). This quantity is larger than the average number of new partners and adds substantially to the reproductive rate and hence, the likely future growth rate of the epidemic. Therefore, both mean and variance matter and the few individuals with many partners ensure that infections spread rapidly (Cohen and Trussell, 1996). This observation illustrates why female commercial sex workers, their clients, truck drivers, migrant workers, and the military form a potent high risk core group capable of amplifying transmission rates in a population that has relatively low prevalence.

Based on initial work by Auvert et al. (1991), Robinson (1994, 1995) developed a simulation model for the transmission dynamics of HIV infection and STDs. This model called SimulAIDS, represents a significant enhancement of the ability to model both projected transmission rates and effects from various intervention strategies. The Robinson et al. (1994,1995) project had general unique and important features: 1) it was based on a specific rural African cohort of 10,000 in southwest Uganda where the British Medical Research Council had collected extensive data form 1989-90; 2) it simulated transmission dynamics of HIV and two other STDs (ulcerative and non-ulcerative); 3) it analyzed and modeled the proportion of HIV infections attributed to selected STDs; and 4) it assessed the effects of a range of intervention strategies.

The basic shape of the HIV epidemic is a sigmoid curve with a maximum equilibrium level based on infection and death rates. The infection rates are a complex product of behavioral and unique societal characteristics (Caldwell, 1993). Figure D-48 is a simulated HIV prevalence curve in adults from Robinson's analysis (1994). A similar projection for Cameroon, based on the DEMPROJ (demographic projection) model was published by Garcia-Calleja (1992a, 1992b). These projections, shown in Figures D-49 and D-50 are

similar in shape to Robinson's curves, but use different starting dates and input parameters. Both projections show a peak prevalence approximately 10 years after the start of the epidemic.

The Cameroonian projections indicated that the 1991 - 1992 time frame would be the peak period. All available data indicates that this is not the case. Cameroon had generally been considered a low prevalence country (less than 5 percent prevalence) but data from 1992-1996 clearly shows that this is no longer the case. These discrepancies are multifactorial and may be due to improvement in data collection, HIV diagnosis, and in the record keeping system. Nevertheless, it appears that Cameroon was in a pre-epidemic phase from 1985-1991 and may well be entering an epidemic period between 1996-2000. Thus, HIV prevalence curves would be right-shifted along the x-axis; however, the fundamental sigmoid-shaped curve would remain. The ability to impact these prevalence curves will be presented and discussed after the 1985-1996 Cameroon-specific data is presented in the next section.

5.2.3 CAMEROON HIV/AIDS DATA: 1985-1996

Cameroon reported its first AIDS case in 1985. Since then, the number of reported cases has continued to rise (Table 36). The characteristics of the epidemic in Cameroon are similar to those seen in SSA (Garcia-Calleja, 1992a and b), where the main mode of transmission is heterosexual. The primary targets of the epidemic have been urban young and sexually active ages 15-40 (Figures D-51 and D-52). In 1987, there was neither strategy nor national program to combat the spread of HIV infections (Baer and Heng, 1994). In 1988, the Government of Cameroon (GOC), initiated a National AIDS Committee to develop a HIV/AIDS prevention and central strategy. In 1988, sentinel surveillance began in six locations: 1) Yaoundé, 2) Bertoua, 3) Garoua, 4) Bamenda, 5) Limbé, and 6) Douala. These sentinel sites initially analyzed data from low-risk pregnant females. Data from 1989-92 are shown in Figure D-53 while the most recent data, 1992-95, are seen in Figure D-54 (HIV), Figure D-55 (Syphilis prevalence rates), and Tables 37A - B. As illustrated in these tables and figures, HIV prevalence rates in low-risk pregnant females have significantly increased, from an overall 3.0 percent rate in 1992 to 4.8 percent in 1995 (MOPH, 1997).

During the 1988-1996 time period, two five-year Medium-Term Plans (MTP) were established: a) MTP-1, 1988-1992 and b) MTP-2, 1994-1998. A comprehensive review of the overall program occurred in 1993. Throughout the entire period of both MTPs, there has been extensive multi-donor support e.g. USAID, World Bank, ORSTOM, German Technical Cooperation Agency (GTZ), etc. As a result of both GOC and multi-lateral agency efforts, there have been a tremendous number (over 300) of HIV prevalence studies performed

throughout Cameroon. Figure D-56 is a map of the HIV study locations that have been reported in the published literature. Based on this map, the number of study sites appears to be quite extensive in the Southern and Western Regions of Cameroon. This observation is true but somewhat deceptive as there have been numerous studies in the Central, Adamaoua and North Provinces. However, many of these studies are rural population surveys that were not focused on a specific city location since the population density is extremely low in most areas of these provinces (Table 4). Therefore, these studies do not appear (Figure D-56) as a discrete point location. As this map illustrates, there is a wide geographical distribution of the study locations; furthermore, there are a variety of sub-populations within each study. Data from some of the most important surveys will be presented in the next subsections.

5.2.3.1 Subpopulation: Low-Risk

Based on data collected by the US Bureau of the Census, International Programs Center Population Division (hereinafter referred to as IPC) the various sampled populations can be divided into two groups: a) low-risk - pregnant women, blood donors and other general population surveys; b) high-risk - commercial sex workers or prostitutes (CSW), STD clinic patients, military personnel and truckers. This categorization is arbitrary but useful and is based on the general likelihood of a defined group engaging in unprotected sex with multiple partners. Low-risk does not imply no risk since pregnant women are obviously sexually active (IPC, 1995).

Data from studies on pregnant women are presented in chronological order in Table 38 (IPC, 1997). Some of the salient features of these data are graphically shown in Figures D-57 and D-58. These data indicate that rates have significantly increased over the five years from 1990 to 1995 i.e., 0.5 percent in 1987 to 4.5 percent in 1995 (MOPH, 1997). In the major sentinel surveillance sites, some prevalence rates have increased by 3-10 fold, indicating that Cameroon is moving out of the pre-epidemic phase and into an epidemic period.

Similar data are seen in blood donors (Table 39 and Figure D-59). General population studies (Table 40) for 1985-1994 also indicate that Cameroon is moving from a very low prevalence condition to medium (5-10 percent) prevalence status (Garcia-Calleja, et al., 1993; IPC, 1995 and 1997). Data from a recent 1996 study in Batouri (Remy et al., 1996) confirms this observation where rates have increased from no detectable cases in 1991 to 1.7 percent in men and 4.1 percent in women.

5.2.3.2 Subpopulation: High-Risk

Seropositive rates in CSW have skyrocketed over the ten year period from 1985 to 1995 (Table 41 and Figure D-60). In 1992, CSW had overall rates of 35 percent seropositivity in Cameroon (IPC, 1995). There rates have undoubtedly continued to rise. A recently published study in Mbaimboum (North Province) confirms this alarming trend (Chambon 1994a, 1995a and b). In the Chambon et al. study, 54.8 percent of the CSW were seropositive. In addition, the rates in single women (24.5 percent), men (6.8 percent) and truckers (24.5 percent) were at the highest levels seen in Cameroon. Mbaimboum is a 10,000 inhabitant town at the junction of Cameroon, Chad and the CAR. This town appeared to rapidly develop as a commercial and transportation crossroad. As such, Mbaimboum is unfortunately well situated to act as a dissemination reservoir to the surrounding rural areas (Chambon, 1995a).

Two other 1993 studies in truck drivers also demonstrate high seropositivity (Table 42). A 1996 study in Douala and Ekok of truck drivers found 15.2 percent seropositive rates (Sam-Abbenyi, 1996). According to data from the MOPH, overall trucker rates were 17 percent at the end of 1995 (MOPH, 1997). Truck drivers represent the third highest seropositive group in Cameroon after CSW (at least 35 percent) and inmates in Douala prison (20 percent) (Sam-Abbenyi, 1996). Two other high risk groups are patients seen in STD clinics (Table 43 and Figure D-61) and military/police (Table 44). The rates seen in these two groups are both higher than general adult surveys but are below the extremely high levels seen in CSW and truckers. Data from the MOPH (1997) puts military/police seropositive rates at 6.5 percent. The STD patient rates are critical because the simultaneous presence of other STDs appear to act as a major cofactor in accelerating the spread of HIV.

5.2.3.3 Subpopulation: Pygmies

There have been several HIV seroprevalence studies of the Baka and Bakola Pygmies (Table 45). In a previous section that discussed Hepatitis C Virus (Section 5.1.3) many of the unique characteristics of the Pygmy groups were presented. HIV rates in Pygmy populations have consistently been below 1.6 percent. While other diseases, such as Hepatitis B and C, are quite prevalent, to date, the Baka and Bakola Pygmies have not been significantly impacted by HIV.

5.2.3.4 Subpopulation: Variants

Worldwide, there are at least nine identified subtypes of HIV-1, i.e., A-H and O (Brodine, 1995). These subtypes are variably dispersed and intermixed geographically. While

subtypes A, C, and D are the most common in Africa, the epidemiology of HIV subtypes in Cameroon is more complex. Most of the known HIV-1 Group M (major) subtypes have been identified in Cameroon. Cases of infection by highly divergent Group O strains (O for outlier) have been found almost exclusively in patients of Cameroonian origin (Mauclère et al., 1997). The importance of this genetic heterogeneity is unknown; however, different subtypes may have impacts on the epidemiology of transmission and amplification (Brodine, 1995). Burke and McCutchan (1996) have challenged the conventional view of the HIV epidemic that is based on a single emergence of a simian (monkey) immunodeficiency virus (SIV) into humans some years ago with a gradual mutation and global spread. These authors feel that the global HIV epidemic can be best understood by a chaotic model:

- Divergence - the current HIV pandemic is composed of at least five major virologically and geographically distinct sustained subepidemics

- Dispersion - international HIV-1 dispersions are commonplace, but only some become sustained regional epidemics

- Adaptation - HIV-1 independently continues to adapt to local host populations. HIV has a high replication error frequency (i.e. 1 million-fold greater than human DNA genome) and high replication rate.

The implications of these assumptions are that new variants are continually generated, any one of which, under the right host setting, could become the next major epidemic. The implications for vaccine development are profound; however, the clinical, diagnostic, and intervention implications are equally serious (Mauclère, 1997).

5.2.4 Intervention Strategies

In SSA, the transmission of HIV is clearly enhanced by the presence of multiple sexual and non-sexual factors: 1) sexual contact in the presence of other STDs; 2) lack of use of condoms; 3) sexual contact during menses; 4) use of desiccating substances in the vagina; 5) low rates of male circumcision; 6) non-sterile injections and scarifications; 7) transfusions; 8) mother-child infections; and 9) pre-existing immunologic compromise due to other parasitic disease, e.g. malaria.

Each of these cofactors either singly or in combination influence the rate of HIV transmission. Similarly each potential cofactor presents an opportunity for an active intervention strategy directed towards decreasing transmission and amplification. The literature on HIV/AIDS intervention strategies is voluminous (Oakley, 1995; Pepin, 1989;

Allen, 1992; Green, 1995; Cohen and Trussell, 1996). As previously mentioned, Robinson et al. (1994, 1995) performed a series of simulations based on different "packages" of interventions: 1) treatment of STDs, 2) condom use, 3) behavior modification, 4) STD and condom, 5) STD and behavior, 6) condom and behavior, and 6) all interventions. Projections were modeled assuming 25 and 50 percent effectiveness of the various packages of interventions. Figures D-62 through D-65 show the output of these simulations based upon the various packages of interventions. Dramatic reductions up to 82 percent in long-term HIV prevalence were projected for the high cofactor multiple intervention scenarios at the 50 percent level. Confirmation of the impact on HIV transmission via STD treatment interventions has been recently published (Grosskurth, 1995a, 1995b). This large clinical study clearly indicates that the treatment of STDs can significantly decrease (up to 40 percent) the transmission of HIV. Therefore, it is likely that other intervention strategies e.g. condoms, behavioral (information, education, communication) coupled with STD treatment could achieve similarly dramatic results. A review of the knowledge, attitudes and practices (KAP) literature is ongoing and will be incorporated into and presented within the overall STD mitigation and management plans.

6.0 CONCLUSIONS AND SUMMARY

The variety and complexity of the infectious disease burden in Cameroon is enormous. Substantial efforts have been made to develop the geographic distribution of diseases in Cameroon. Disease rates clearly have geographic distribution as a function of local ecological conditions. The project area is located in a variety of provinces that have high levels of many vector and non-vector infectious diseases. Much of the available data have been presented, although additional information and mapping is contained in Dames and Moore (1997). Sections 7.0 and 8.0 of the EA present and discuss the different strategies available to control these diseases. The World Bank (Listorti, 1996) has adopted a series of guidelines that emphasize the role of subsector analysis (housing, water and sanitation, transportation, and telecommunications) in managing and controlling disease burdens associated with infrastructure projects like the proposed pipeline and oil field development. Sections 7.0 and 8.0 of the EA describe in detail the approaches and benefits of the subsector remediation approach for large projects like the this Project. Strategy interventions and policy tools within the control of the project are further explored; however, policy tools are primarily a function of government rather than the private sector. The critical issues of STDs and AIDS amplification has been presented and discussed. STD/AIDS spread represents the most difficult public health issue associated with the project. Further development of intervention and policy strategies are presented in Section 8.0 of the EA and in the Environmental Management Plan.

Overall, the analysis of baseline disease and demographic data demonstrates that Cameroon is still in a pretransitional state subject to the problems associated with high fertility and high mortality disease problems. However, sufficient detailed baseline geographic disease data are available so that appropriate intervention strategies can be developed. These strategies and proposed interventions are subjects of Sections 7.0 and 8.0 of the EA and the accompanying Environmental Management Plan.

ACRONYMS

AG	Antigen
AIDS	Acquired Immune Deficiency Syndrome
ALRI	Acute Lower Respiratory Infections
ARI	Acute Respiratory Infections
AURI	Acute Upper and Middle Respiratory Infections
BCRR	Basic Care Reproduction Rate
BHA	Better Health in Africa
CDHS	Cameroon Demographic Health Survey
CAR	Central African Republic
CCD	Communicable Childhood Diseases
CI	Confidence Interval
CNPS	National Social Security Fund
CSW	Commercial Sex Workers or prostitutes
DEMPROJ	Demographic projection model
DHS	Demographic and Health Survey
DOTS	Directly observed treatment, short-course
EA	Environmental Assessment
EIAs	Enzyme Immunoassays
ELISA	Enzyme Linked Immunosorbent Assay
EME	Established Market Economy
EMP	Environmental Management Plan
EPI	Expanded Program of Immunization
FEMEC	Protestant health services
GIS	Geographical Information System
GOC	Government of Cameroon
GTZ	German Technical Cooperation Agency
HAT	Human African Trypanosomiases
HAV	Hepatitis A Virus
HB_c	Hepatitis B Core
HBV	Hepatitis B Virus
Hb_sAg	Hepatitis B Surface Antigen
HCV	Hepatitis C Virus
HDV	Hepatitis Delta Virus
HEV	Hepatitis E Virus
HIV	Human Immunodeficiency Virus
HIV-1	Human Immunodeficiency Virus–1

HIV-2	Human Immunodeficiency Virus–2
HTLV	Human T-lymphotropic Virus
HTLV-1	Human T-lymphotropic Virus-1
IEC	Information, Education, and Communication
IGM	Immunoglobulin M
IMPM	Institute for Medical Research and Survey of Medicinal Plants
IPC	US Bureau of the Census, International Programs Center Population Division
KAP	Knowledge, Attitudes, and Practices
MARA/ARMA	Mapping Malaria Risk in Africa/Atlas du Risque de la Malaria en Afrique
MTP	Medium-Term Plans
MTP-1	Medium-Term Plans 1, 1988-1992
MTP-2	Medium-Term Plans 2, 1994-1998
MOPH	Cameroonian Ministry of Public Health
NGO	Nongovernmental Organizations
OCEAC	Organisation de Coordination pour la lutte contre les Endémies en Afrique Centrale
OCP	Onchocerciasis Control Program
ORSTOM	Office de la Recherche Scientifique et Technique Outre-Mer
PCV	Peace Corps Volunteers
PHC	Primary health care
PNLT	Programme National de lutte contre la Tuberculose (National program against tuberculosis)
REMO	Rapid Epidemiological Mapping of Onchocerciasis
RIBA	Radio-Immunoblot Assays
SCS	The Catholic health services
SIV	Simian (monkey) Immunodeficiency Virus
SSA	Sub-Saharan Africa
STD	Sexually-Transmitted Disease
TB	Tuberculosis
UN	United Nations
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WER	Weekly Epidemiological Record
WHO	World Health Organization
WHONET	World Heath Organization Net

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BY DISEASE CATEGORY

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TABLE 1
DEMOGRAPHIC TERMS AND DEFINITIONS

Population	Based on most recent population censuses or surveys. World Bank numbers are mid-1992 estimates. More current Cameroon specific data are from the 1991 DHS and the 1995 World Bank Staff Appraisal Report.
Population Growth Rates	Calculated from the mid-year population by the exponential method for World Bank estimates. Rates are expressed in percentages.
Crude Birth/Death Rate	Indicates the number of live births and deaths occurring per thousand in a given year.
Total Fertility Rate	Represents the number of children that would be born per woman, if she were to live to the end of her child-bearing years and bear children at each age in accordance with currently prevailing age-specific fertility rates.
Life Expectancy at Birth	Number of years a newborn would live if subjected throughout life to the current age-specific mortality rates.
GNP Per Capita	Figures in US dollars based on the World Bank's Atlas method.
Adult Literacy Rate	Proportion of the population 15-years-old and over who can read and write a short, simple statement on their everyday life.
Infant Mortality Rate	Number of infants who die before reaching one year of age, per thousand live births in a given year.
Under-five Mortality Rate	Probability of dying between birth and age five, expressed per 1,000 live births.
Adult Mortality Rate, Ages 15–59	Probability of an adult age 15 dying before reaching age 60, expressed per thousand.
Immunization Coverage	Percentage of children in a given year who were fully immunized against each disease or group of disease by age one. The requirements for full immunization depend on the type of disease.

Sources: World Bank, Better Health in Africa, 1995.

TABLE 2
REPUBLIC OF CAMEROON
BASIC DATA

	25 - 30 years ago	15 - 20 years ago	Most recent estimate (1991)
Area and Population			
Total area (thousands of square kilometers)	475	475	475
Total population (thousands)	5,825	7,439	12,000
Urban population as percent of total population	16.40%	26.90%	42%
Per capita GNP (US$)	....	....	$850
Population Growth			
Average annual population growth rate	1.90%	2.90%	3%
Projected population for year 2000 (millions)	....	....	15.5
Projected population for year 2025 (millions)	....	.....	32.5
Total fertility rate	5.2	6.3	5.8
Crude death rate (per 1000)	....	14	12
Age structure of population			
0 - 14 years	....	....	44.70%
15 - 64 years	....	....	51.60%
over 65 years	....	....	3.70%
Life expectancy (years)	42	47	55
Health			
Infant mortality rate, 0 - 1 year (per thousand live births)	143	109	65
Under five mortality rate (per thousand live births)	....	198	126
Maternal mortality (per 100,000 live births)	....	....	430
Babies with low birth weight	....	....	13%
Population per physician	26,720	13,700	11,998
Population per nurse	5,831	3,800	2,000
Family Planning			
Percent of women wanting no more children	....	....	12.40%
Percent of women wanting two years between births	....	....	34.70%
Percent of women using any method of contraception	....	....	16.10%
Percent of women using any modern method	....	2.00%	5.00%
Education			
Total illiteracy rate (% of population)	81%	59%	46%
Female illiteracy rate	....	....	50%
Percentage of age group enrolled in school			
Primary	94%	97%	101%
Secondary	5%	13%	26%
Tertiary	....	2%	4%

Sources: Cameroon Demographic and Health Survey, 1991.
Ministry of Public Health, 1993.
World Bank, Staff Appraisal Report, 1995.

TABLE 3
REPUBLIC OF CAMEROON
POPULATION DATA

DEMOGRAPHIC INDICATORS	1976*	1987*	1991**
Crude birth rate (per thousand)	45	41.2	42
Crude death rate (per thousand)	20.4	13.7	12
Infant mortality rate (per thousand)	156.5	82.9	65
Percentage less than 15 years of age	43.4	46.4	44.7
Percentage between 15 and 64 years of age	52.9	50.2	51.6
Percentage over 65 years of age	3.7	3.4	3.7

Notes: * From 1976 and 1987 censuses in Cameroon.
** From 1993 World Development Report and CDHS, 1992.

Source: World Bank, Staff Appraisal Report, 1995.

TABLE 4
POPULATION DISTRIBUTION - 1991

PROVINCE	SURFACE AREA (sq.km.)	POPULATION	DENSITY (inhab./sq.km.)
Adamaoua	63,701	554,000	8.80
Center	65,420	1,851,000	27.00
East	109,002	578,000	5.30
Far-North	34,263	2,110,000	61.40
Littoral	20,229	1,521,000	75.20
North	66,090	931,000	13.80
Northwest	17,409	1,391,000	80.40
West	13,883	1,500,000	107.30
South	50,752	424,000	9.10
Southwest	24,709	927,000	34.70
Total	**465,458**	**11,787,000**	**(mean) 24.80**

Source: World Bank, Staff Appraisal Report, 1995.

TABLE 5
KEY HEALTH INDICATORS FOR CAMEROON, SSA, AND OTHER COUNTRIES

Indicator	Country Group				
	High-income	Middle-income	Low-income	SSA	Cameroon
Life expectancy at birth (years)	77	68	62	51	53
Infant mortality (per 1,000 live births)	8	38	71	104	65
Maternal mortality (per 100,000 live births)	17	107	308	686	430

Source: World Bank, Better Health Africa, 1995.
World Bank, Staff Appraisal Report, 1995.

TABLE 6
CORE DEMOGRAPHIC STATISTICS, 1990-1995

Parameter	Sub-Saharan Africa	EME	Cameroon	
Data Source[1]	BHA	BHA	BHA	World Bank
Population	501,932,000	1,226,756,000	12,245,000	12,000,000
Fertility Rate (number of infants per woman)	6.5	1.9	5.8	5.8
Infant Mortality (per 1,000 live births)	104	14	122	65
Crude Birth Rate (per 1,000 pop)	45	14	42	42
Crude Death Rate (per 1,000 pop) Males Females Both	15	10	12	12
Life Expectancy (years) Males Females Both	49 52 51	71 78 77	55 N/A 58	N/A N/A 53
Maternal Mortality Rate (per 100,000 live births)	686	17	450	430
Population Growth (%)	3.0	0.5	2.5	3
GNP per capita ($US)	340	20,000	850	850
Literacy Rate (%) Males Females	56 38	96 95	54 43	 Total 54
1990 Under 5 Mortality Rate (per 1,000 live births)	175	15	125	126
Adult Mortality (Age 15-59) (per 1,000) Males Females	381 322	188 86	316 256	N/A N/A
Stunting Malnutrition, 1980–1990 (%)	34.0	4.0	43	N/A
Wasting Malnutrition (%)	10	3.0	2.0	N/A

Notes:
1) Source Listing:
BHA=Better Health Africa (1995)
World Bank = World Bank Staff Appraisal Report (1995)
2) N/A=Not Available

Source: World Bank, Staff Appraisal Report, 1995.

TABLE 7
DEMOGRAPHIC VARIABLES FOR WOMEN

Parameter	Year of Data	More Developed Countries	Less Developed Countries	SSA	Cameroon
No. of women of child-bearing age, 15–49 (thousands)	1990	305,605	1,008,656	108,318	2,480
Maternal mortality (per 100,000 live births)	1988	17	450	700	450
Prenatal health care coverage rate (percent)	1985–90	99	65	60	56
Births attended by trained health personnel (percent)	1985–90	99	42	34	25
Pregnant women immunized for tetanus (percent)	1989–91	0	43	30	35
Prevalence of anemia in pregnant women (percentage below norm)	1970–80s	4	50	40	10
Primary school enrollment (female/100 males)	1990	95	81	76	85
Secondary school enrollment (female/100 males)	1990	100	73	67	65

Source: World Bank, Better Health in Africa, 1995.

TABLE 8
POPULATION BY BROAD AGE GROUPS, WORLD AND MAJOR REGIONS
1970–2015

Region and year	Percent of population aged (years)			Population aged 15-59 years (millions)		
	0–14	15–59	60+	Men	Women	Total
World						
1970	37.5	54.2	8.3	1004	1000	2004
1985	33.7	57.5	8.8	1414	1371	2784
2000	31.2	59.2	9.6	1866	1805	3672
2015	27.5	61.3	11.2	2350	2280	4630
Developing Countries						
1970	41.8	52.2	6.0	704	679	1383
1985	37.5	56.0	6.5	1050	1005	2054
2000	34.1	58.6	7.4	1476	1415	2891
2015	29.3	61.7	9.1	1953	1887	3840
Established Market Economies						
1970	26.0	59.0	15.0	196	205	401
1985	20.7	62.0	17.3	236	235	471
2000	18.6	62.4	19.0	255	250	505
2015	17.4	59.4	23.2	251	245	496
Sub-Saharan Africa						
1970	44.8	50.5	4.7	73	75	148
1985	46.0	49.4	4.6	111	114	226
2000	45.1	50.4	4.5	180	183	363
2015	41.0	54.2	4.8	292	295	587
Cameroon						
1995	44.7	46.5	6.3	21.5%	25.1%	N/A

Sources: World Bank, Staff Appraisal Report, 1995.
Bulato, 1990a (World Population Projections).
CDHS, 1992.

TABLE 9
1990 GLOBAL HEALTH STATISTICS
FROM 1996 WHO
Disease Rates (per 100,000 cases)

	SUB-SAHARAN AFRICA		WORLD		EME	
Death Rates: Male Female Both	1,714 1,504 1,607		1,006 910 958		937 850 893	
	Incidence	Prevalence	Incidence	Prevalence	Incidence	Prevalence
TB/HIV (neg)	222	432	119	240	19	4.7
Primary Syphilis	588	30	189	9.3	49	2.0
Cervical Chylamydia	472	23.9	239	10.9	239	7.9
Urethia	1,023	47.3	584	24.8	456	14.4
Cervical GC	780	40	268	13	108	3.6
Urethial GC	1,276	59	487	21	206	6.5
Cases HIV	209.9	1,071	33.1	156.8	17.3	163.3
Episodes Diarrhea	127,995	2,354	77,344	1,365	20,963	366
Whooping Cough	1,693	141	576	48	70	5.9
Polio	7.6	3.2	4.1	3.8	-	-
Episodes Measles	2,551	100	842	33	457.6	18
Episodes Tetanus	37	1.4	15.6	0.6	0.1	-
N. Meningitis	1.9	0.2	1.3	0.1	0.6	0.1
Hepatitis B & C	48	8.0	36	6.0	22.2	3.7
Episodes Malaria	36,485	500	4,058	53	-	-
Episodes Trypanos	11.8	52.3	1.1	5.1	-	-
Infections Schisto	-	35,474	-	3,954	-	-
Leishman	14.9	65.4	7.9	24.3	0.1	0.4
Lymphatic Filariasis	89.0	2,051	20.2	519	-	-
Blindness Oncho	8.5	69.6	0.8	6.8	-	-
Itching Oncho	256	1,131	24.9	110	-	-
Cases Leprosy	11.9	62.1	9.9	46.2	0	1.3
Blindness Trachoma	12.9	93	3.6	28.1	-	-
Episodes Lower Respiratory Infections	10,796	296	6,881	185	1,160	22
Chronic Lower Respiratory Infections	29	707	16	570	-	-
Episodes Otitis	17,930	1,379	12,058	928	5,067	390
Wasting Malnutrition		1,426		979	-	-
Grade O Goitre		13,689		8,801	-	3,187
Episodes Traffic Accidents	371		273		285	

Source: WHO - Global Burden of Diseases & Injury Series, Vol. II, 1996(b).

TABLE 10
SELECTED INFECTIOUS DISEASES AND EMERGING ISSUES POTENTIALLY CRITICAL FOR CAMEROON

1. Person to person	Acute lower respiratory infection (ALRI) Diphtheria Influenza Leprosy Measles Meningococcal meningitis Tuberculosis Whooping cough (pertussis) Poliomyelitis, acute Trachoma HIV/AIDS Sexually transmitted diseases Hepatitis B, C, D
2. Food, water, and soil-borne	Cholera Diarrhea, including enterotoxigenic E.coli, and campylobacter Dracunculiasis (guinea-worm infection) Schistosomiasis Shigellosis Trematode infections Typhoid and paratyphoid Hepatitis A and E Salmonellosis (other than typhoid and paratyphoid) Ascariasis Hookworm diseases Tetanus, neonatal Tetanus, other Trichuriasis Entamoeba histolytica, Giardia lamblia, Cryptosporidium
3. Insect-borne	Dengue fever Dengue hemorrhagic fever, chikungunya fever, West Nile and Sindbis fevers Filariasis (lymphatic) Malaria Yellow fever Rift Valley fever Leishmaniasis, cutaneous and mucocutaneous Leishmaniasis, visceral (kala-azar) Onchocerciasis (river blindness) Plague Sleeping sickness (African trypanosomiasis) Crimean - Congo Hemorrhagic fever African TickTyphus (Bouton nerve fever) house-borne and tick-borne Relapsing fever flea-borne and house-borne typhus Loiusis
4. Animal-borne	Rabies (dog-mediated) Brucellosis, Q fever, Leptospirosis, Echinococcosis, Anthrax ***Other new and emerging diseases/infections, including:*** Arbovirus infections Bovine spongiform encephalopathy Ebola-Marburg virus disease Hantaan virus disease Listeriosis
5. Other emerging issues	Antibiotic resistance and hospital infections Lassa fever Hemorrhagic fevers with Renal syndrome

Source: WHO, 1996(a).

TABLE 11
CAUSES OF MORBIDITY, 1977, 1992, 1993

Causes	Percent (of total)		
	1977	1992	1993
Malaria	20%	23%	23%
Intestinal Parasites	12%	7%	6%
Skin Diseases	8%	7%	7%
Upper Respiratory	7%	5%	4%
Diarrheal Infections	3%	4%	4%
Lower Respiratory/Pneumonia	3%	4%	4%
STDs	4%	5%	6%
Anemias	2%	2%	N/A
Mouth Diseases	2%	2%	2%

Source: Kamdoum, 1996.

TABLE 12
AGE-SPECIFIC CAUSES OF MORBIDITY - 1993
(0 - 4 YEARS)

Cause	Age Interval	
	0-1 years	1-4 years
Malaria	23.4%	27.0%
Lower Respiratory Infection /Pneumonia	8.3%	7.0%
Upper Respiratory Infection	–	6.0%
Acute Respiratory Infection	8.9%	–
Skin Diseases	6.5%	7.0%
Serious Diarrheal Diseases	5.5%	–
Intestinal Parasites	–	9.0%

Source: MOPH, 1993.

TABLE 13
AGE-SPECIFIC CAUSES OF MORBIDITY - 1993
(5 - 44 YEARS)

Cause	Age Interval	
	Children 5-14 years	Adults 15-44 years
Malaria	28.0%	20.0%
Lower Respiratory Infection	4.0%	–
Upper Respiratory Infection	6.0%	–
Skin Diseases	9.0%	11.0%
Intestinal Parasites	10.0%	6.0%
STDs		7.0%

Source: MOPH, 1993.

TABLE 14
REPUBLIC OF CAMEROON
CAMEROON: CAUSES OF MORTALITY 1992

Causes	Percent
Malaria	34.84%
Anemias	12.95%
Respiratory Diseases	8.63%
Neonatal Tetanus	8.43%
Malnutrition	8.12%
Meningitis	7.71%
Pneumonias	6.78%
Diarrheal Diseases	5.96%
Hypertension	3.49%
Intestinal Obstructions	3.08%

Source: Ministry of Public Health, 1996.

TABLE 15
MORTALITY: 1993
CHILDREN LESS THAN 5 YEARS OLD

Causes	Percent
Diarrheal Diseases	17.6%
Malaria	14.6%
Acute Respiratory Infections	12.9%
Measles	12.0%
Malnutrition	9.1%
Low Birth Weight	7.1%
Tetanus	3.7%
Obstetrical Complications	3.4%
Accidents	1.8%
Anemias	1.6%

Source: Ministry of Public Health, 1996.

TABLE 16
CRUDE DATA ON MOST COMMON DISEASES IN THE ADAMAOUA PROVINCE: 1991-1995
TOTAL POPULATION: 590,670

Maladies	1991	1992	1993	1994	1995
Malaria	14,324	19,152	14,058	16,740	19,670
Cholera	0	0	0	0	0
Typhoid Fever	19	41	176	610	408
Meningitis	16	47	150	124	62
Onchocerciasis	19	126	203	172	180
HIV	142	153	218	337	300
AIDS	89	90	156	212	206
Diarrheal Diseases	254	1,053	154	371	425
Pulmonary Diseases	1,290	1,807	2,776	2,838	1,722
Measles	172	360	156	84	338
Tuberculosis*	24	40	69	38	82
Amoebiasis	48	605	429	108	624
Other Dysenteries	198	200	216	350	390

Source: Ministry of Public Health, 1996.

* Significantly underestimated

TABLE 17-A
TUBERCULOSIS CASES DATA

Year	Number of patients	Bacillus+ (BK+)	% BK+/Total
1987	3,878	2,892	74.5%
1989	5,521	4,288	77.6%

Source: OCEAC, No. 96, September 1991.

TABLE 17-B
TUBERCULOSIS CASES DATA - PROVINCES

Provinces	1987		1988		1989	
	Total	BK+	Total	BK+	Total	BK+
Admaoua	133	105	142	119	130	81
East	173	114	164	98	313	282
Littoral	912	875	966	933	1000	970
North-West	107	83	142	123	235	177
South	315	269	309	264	230	214
Total	3878	2892	4982	3671	5521	4288

Source: OCEAC, No. 96, September 1991.

TABLE 18-A
1995 PULMONARY TUBERCULOSIS

Pulmonary			Extra Pulmonary	Total
Smear Positive				
New Cases	Relapses	Smear (-)		
2896	236	142	18	3292

Source: MOPH, 1996.

TABLE 18-B
NEW CASES OF PULMONARY TB, SMEAR POSITIVE BY AGE AND SEX

0-14		15-24		25-34		35-44		45-54		55-64		65+		Total	
M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
20	9	208	185	569	313	323	223	287	153	204	106	164	93	1814	1082

Source: MOPH, 1996.

TABLE 19
TUBERCULOSIS DRUG RESISTANCE

	Antibiotic*					
	INH	S	R	E	T	R T INH
% of resistance	17	15.2	6.7	4.8	1.9	5.7

INH: Isoniazid
S: streptomycin
R: Rifampin
E: Ethambutol
T: Thioacetazone

Source: Bercion & Kuaban, 1995.

TABLE 20
INTESTINAL PARASITE PREVALENCE BY PROVINCE

Province	Percent	
	Ascaris	*Trichuris*
Extreme-North	2.6%	3.1%
North	1.7%	6.7%
Adamaoua	11.5%	21.6%
Central	67.9%	91.2%
East	70.6%	82.3%
South	78.1%	97.3%
Littoral	54.8%	87.5%
West	61.1%	72.6%
Northwest	59.2%	33.5%
Southwest	58.7%	80.3%
Total Survey	45.3%	58.4%

Source: Ratard, 1991.

TABLE 21
CHOLERA IN CAMEROON
Jan. 1 - Oct. 31, 1996

Province	Health District	Notification Since January 1996		Case Fatality Rate (%)
		Number of Cases	Mortality	
Littoral	Wouri	885	27	3.0%
	Melon	77	7	9.1%
	Pouma	34	4	12.0%
	Ngambe	6	1	17.0%
Total Littoral		1002	39	4.0%
South	Ocean	323	23	7.1%
Total South		323	23	7.1%
Extreme-North	Mada	108	10	9.3%
	Makary	40	11	27.5%
	Kousseri	386	37	9.2%
	Kolofata	123	14	11.4%
	Mora	615	44	7.1%
	Tokombere	52	8	15.4%
	Bogo	11	7	63.6%
	Maroua Urban	318	22	6.9%
	Maroua Rural	155	16	10.3%
	Guidiguis	4	0	0.0%
	Mokolo	117	27	23.0%
	Meri	75	10	13.3%
	Maga	306	33	11.0%
	Yagoua	62	7	8.5%
	Koza	19	5	26.3%
	Bourha	5	2	40.0%
	Mindif	11	2	18.2%
Total Extreme-North		2407	255	10.6%
North	Bibemi	1045	19	1.8%
	Pitoa	468	49	10.4%
	Figuil	146	21	14.3%
	Garoua Rural	167	32	19.2%
	Garoua Urban	13	4	31.0%
	Guider	74	6	8.1%
	Rey Bouba	49	4	8.2%
	Poli	7	1	14.3%
	Mayo Oulo	48	25	52.1%
	Lagdo	4	1	25.0%
Total North		2033	164	8.1%
TOTAL		**5765**	**481**	**8.3%**

Source: MOPH, 1996.

TABLE 22
TRADITIONAL TERMINOLOGY FOR LEVELS OF MALARIA ENDEMICITY

TERM	SPLEEN RATE IN CHILDREN (PERCENT)
Hypoendemic	Less than 10
Mesoendemic	11-50
Hyperendemic	51-75, more than 25 in adults
Holoendemic	More than 75, low in adults

Source: Bradley, World Bank, Disease and Mortality in Sub-Saharan Africa, 1991.

TABLE 23
ECOLOGICAL CATEGORIES OF AFRICAN MALARIA

CHARACTERISTIC	1	2	3	4
Ecological type	Forest and Former forest	Savanna	Sahel	High altitude/desert
Transmission pattern	Stable but intense and perennial	Stable but intense and seasonal	Short season	Unstable
Mean annual number of infective bites per person	In the 100s	Approximately 100	Approximately 10	Low
Duration of the transmission season	12 months a year	6-8 months	2-3 months	Nil except in epidemics
Parasite and spleen rates	Scarcely vary	Seasonal variation	Seasonal variation	Great variation between years
Acquired immunity (premonition)	Very high even by 5 years of age	Very high by 10 years of age	Limited	Negligible
Morbidity	30-50% over the year	30-50%; increased during rainy season	Greater than 70% during rainy season	–

Source: Bradley, World Bank, 1991.
Mouchet, 1993.

TABLE 24
PATTERN OF PARASITEMIA IN HOLOENDEMIC MALARIA, LANGO, UGANDA

Age	Parasites (percent)	Gametocytes (percent)	Percentage with more than 100 gametocytes per cubic millimeter
2 weeks - 3 months	66	41	13
4 - 5 months	83	44	3
6 - 8 months	90	51	2
9 - 11 months	99	44	3
12 - 17 months	98	44	2
18 - 23 months	98	36	2
24 months - 4 years	97	35	0
5 - 9 years	94	28	1
10 - 14 years	88	15	0
15 years and older	31	5	0

Source: Bradley,1991.

TABLE 25
PARASITE INDEX AND MALARIA TYPE FOR TWENTY STUDY SITES: CAMEROON

		P. falciparum gametocyte index (percent)	P. falciparum (percent)	P. ovale (percent)	P. malariae (percent)
Forest					
I	Djoum	2.6%	98.2%	1.2%	0.6%
II	Minkama	–	95.6%	0.0%	4.4%
III	Manyemen	1.8%	62.0%	35.0%	3.0%
IV	Bamendjin	–	99.0%	1.0%	0.0%
V	Nanga Eboko	1.4%	100.0%	0.0%	0.0%
VI	Tiko	0.0%	100.0%	0.0%	0.0%
Savanna					
VII	Mbang Boum	0.7%	98.7%	1.3%	0.0%
VIII	Koza	1.7%	100.0%	0.0%	0.0%
IX	Mayo Guerleo	2.4%	96.4%	0.0%	3.6%
X	Djohong	7.9%	93.6%	0.0%	6.4%
XI	Maga	0.5%	98.3%	0.0%	1.7%
XII	Yagoua	0.6%	100.0%	0.0%	0.0%
City Locations					
XIII	Edéa	4.3%	97.6%	1.2%	1.2%
XIV	Kumba	5.5%	97.7%	2.3%	0.0%
XV	Batouri	1.2%	89.0%	3.0%	8.0%
XVI	Limbé	0.5%	100.0%	0.0%	0.0%
XVII	Ngaoundéré	2.9%	94.4%	0.0%	5.6%
XVIII	Douala	0.5%	100.0%	0.0%	0.0%
XIX	Yaoundé	0.3%	100.0%	0.0%	0.0%
XX	Maroua	0.0%	100.0%	0.0%	0.0%

Source: Ripert, 1990.

TABLE 26
MALARIA INDICES: CAMEROON

		Parasitemia (percent)	Serologic (percent positive)	Splenomegaly (percent)
Forest				
I	Djoum	56%	72%	35%
II	Minkama	42%	–	–
III	Manyemen	38%	67%	27%
IV	Bamendjin	37%	–	–
V	Nanga Eboko	29%	60%	24%
VI	Tiko	12%	52%	23%
Savanna				
VII	Mbang Boum	46%	91%	11%
VIII	Koza	41%	–	–
IX	Mayo Guerleo	32%	94%	11%
X	Djohong	32%	82%	14%
XI	Maga	14%	67%	26%
XII	Yagoua	10%	56%	35%
City Locations				
XIII	Edéa	54%	71%	21%
XIV	Kumba	35%	44%	18%
XV	Batouri	25%	–	–
XVI	Limbé	20%	65%	30%
XVII	Ngaoundéré	20%	80%	6%
XVIII	Douala	11%	34%	44%
XIX	Yaoundé	9%	39%	8%
XX	Maroua	8%	53%	18%

Source: Ripert, 1990.

TABLE 27
CHLOROQUINE RESISTANCE
SOUTHERN CAMEROON

Location	Resistance 1989 (percent)	Resistance 1993-1994 (percent)
Batouri	–	2.5%
Edéa	17.0%	25.6%
Limbé	39.0%	8.6%
Mbandjock	8.0%	–
Mbébé - Kikot	6.0%	–
Mékas	–	13.8%
Nkoabang	30.0%	–
Nyété	17.0%	–
Pouma	30.0%	–
Sangmélima	–	14.3%
Yaoundé	28.0%	10.0%

Source: Louis, 1995.

TABLE 28
ESTIMATED POPULATION AT RISK FOR TRYPANOSOMIASIS

Country	Population at risk for HAT
Angola	3,000,000
Cameroon	1,000,000
Congo	500,000
Gabon	400,000
Equitorial Guinea	300,000
Uganda	2,000,000
Central African Republic	100,000
Sudan	5,000,000
Chad	50,000
Zaire	10,000,000
TOTAL	**22,350,000**

Source: Lemardeley, 1995. (Table 1)

TABLE 29
NEW CASES OF HAT: CENTRAL AFRICA
1980-1994 OCEAC COUNTRIES

Year	Cameroon	Congo	Gabon	Guinea	CAR	Chad	Zaire
1980	635	351	427	--	111	--	5,167
1981	257	626	345	--	73	--	4,847
1982	414	539	209	56	74	--	5,103
1983	1,038	252	70	72	459	19	5,703
1984	1,100	436	89	70	426	13	6,282
Subtotal	3,444	2,204	1,140	198	1,143	32	27,102
1985	633	561	63	70	473	45	7,150
1986	1,102	391	59	291	140	185	8,769
1987	585	302	31	366	67	219	10,665
1988	441	567	32	98	170	337	9,684
1989	109	642	29	63	154	357	9,588
Subtotal	2,870	2,463	214	888	1,004	1,143	45,856
1990	86	580	80	36	308	187	7,515
1991	69	703	45	45	197	21	5,824
1992	21	727	--	30	520	38	7,250
1993	3	754	--	85	126	201	11,380
1994	24	650	--	27	153	50	14,076
Subtotal	203	3,414	125	223	1,304	497	46,045
Total	**6,517**	**8,081**	**1,479**	**1,309**	**3,451**	**1,672**	**119,003**

Source: Lemardeley, 1995. (Table 2)

TABLE 30-A
EVOLUTION OF HAT
IN CAMEROON: 1977-1986

Foci/Treatment Centers	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	Total
Mbam	304	167	122	220	393	590	2,246	445	764	155	5,406
Fontem	61	369	485	-	-	383	744	467	-	298	2,807
Santchou	-	-	-	-	-	32	41	54	39	141	307
Campo	11	42	3	0.5	3	4	4	2	3	18	95
Wouri	40	16	11	15	8	15	2	7	7	4	125
Jamot Hospital, Yaoundé	12	13	14	15	8	14	20	19	18	21	154
Manyemen Hospital	-	-	-	2	2	-	3	2	4	2	15
Total	428	607	635	257	414	1,038	3,060	996	835	639	8,909
Deaths Declared: 130					**Death Rate: 130/8909 = 1.45%**						

Source: Noncho Amida, 1990.

TABLE 30-B
SURVEILLANCE FOR HAT IN CAMEROON: 1985 - 1986

Focus	Census Population	Population Examined	Participation Rate	Confirmed Cases	New Contamination Rate	Year
Mbam	145,994	89,356	61.20%	472	0.53%	1985
Santchou	35,889	20,157	56.20%	37	0.18%	
Campo	3,540	2,856	80.60%	3	0.10%	
Wouri	24,258	12,220	50.37%	5	0.04%	
Total	**209,681**	**124,589**	**59.40%**	**517**	**0.41%**	**1985**
Mbam	152,244	83,095	54.58%	71	0.09%	1986
Santchou	35,889	20,570	55.31%	140	0.68%	
Campo	3,540	2,856	30.60%	4	0.14%	
Wouri	-	-	-	0	-	
Fontem	52,587	23,668	45.00%	298	0.01%	
Total	**344,260**	**130,189**	**53.29%**	**513**	**0.39%**	1986

Source: Noncho Amida, 1990.

TABLE 31
ANTI-HCV ANTIBODY: EBOLOWA STUDY

Group	%	95%CI
Blood Donors	22	7.4 - 36.6
Medical Cases	29	18.8 - 39.2
Pregnant Females	5	0 - 14.3
Surgical Cases	37	27.1 - 46.9
STD Patients	12	0 - 24.9
Overall	27.5	21.9 - 31.1
Age		
14-30	9	3.8 - 14.2
31-45	41	28 - 54
46-60	50	35 - 65
>60	56	38.6 - 73.4
Overall	27.5	21.9 - 33.1

Source: K. Kengasong et al., 1995.

TABLE 32
DISTRIBUTION OF HCV SEROPOSITIVE IN DJOUM

Age Group (Years)	Bantu	Positive	Percentage	Pygmies	Positive	Percentage
15-19	56	1	1.78%	23	0	0.00%
20-29	84	0	0.00%	29	1	3.45%
30-39	62	1	1.61%	18	0	0.00%
40-49	76	27	40.90%	14	1	7.14%
50-59	78	26	33.30%	11	0	0.00%
60-69	71	30	40.30%	2	0	0.00%
± 70	38	13	34.20%	8	1	12.50%
TOTAL	**465**	**98**	**21.10%**	**105**	**3**	**2.86%**

Source: Louis et al., 1994.

TABLE 33
DISTRIBUTION OF HCV
MÉKAS

Age Group (Years)	Bantu	Positive	Percentage
15-19	7	0	0.00%
20-29	36	3	8.33%
30-39	27	5	18.52%
40-49	16	9	56.25%
50-59	29	17	58.62%
60-69	30	21	70.00%
± 70	21	12	57.14%
TOTAL	**166**	**67**	**40.36%**

Source: Louis, et al., 1994.

TABLE 34
DISTRIBUTION OF HCV
YOKADOUMA

Age Group (Years)	Bantu	Positive	Percentage
15-19	15	0	0.00%
20-29	57	2	3.50%
30-39	42	1	2.38%
40-49	28	2	7.14%
50-59	34	6	17.65%
60-69	18	3	16.67%
± 70	6	1	16.67%
TOTAL	**200**	**15**	**7.50%**

Source: Louis, et al., 1994.

TABLE 35
HDV PREVALENCE

Group	Marker	
	Anti-HDV % ± 95% Confidence Interval (CI)	HDV Antigen (ag)
Pregnant women	2.3 ± 4.5	0
Prostitutes	26.1 ± 6.5	6.3 ± 11.9
Febrile jaundice	55 ± 21.8	5 ± 9.6
Sickle cell patients	62.5 ± 23.7	0
Medical Students	25 ± 30	0
Total	27.3 ± 8.3	2.2 ± 4.6

Source: Ndumbe, 1991.

TABLE 36
NUMBER OF AIDS CASES IN CAMEROON: 1985-1995

Year	Number of Cases	Cumulative Total
1985-86	21	21
1987	20	41
1988	33	74
1989	60	134
1990	183	317
1991	604	921
1992	1,308	2,229
1993	1,385	3,614
1994	1,761	5,375
1995	2,766	8,141

Source: MOPH, June 1996.

TABLE 37-A
SEROPREVALENCE OF SYPHILIS[1]

April 1995				
Site	**number**	**TPHA+[2]**	**percent[3]**	**95% CI**
Yaoundé	300	70	23.3	18.5 - 28
Bertoua	298	9	3.0	1.1 - 4.9
Garoua	298	18	6.0	3.3 - 8.7
Bamenda	251	NA	NA	NA
Limbé	102	5	4.9	0.9 - 8.9
November 1995				
Bamenda	309	11	3.6	1.6 - 5.6

1 Seroprevalence of syphilis among pregnant women in five HIV sentinel surveillance sites in Cameroon, 1995.
2 The Rapid Protein Reagent (RPR) and *Triponema pallidum* Haemagglutination (TPHA) Tests, were carried out for evidence of recent exposure to T. pallidum. The TPHA test was not conducted in Bamenda during this session, due to lack of reagents.
3 In April 1995, the seroprevalence of syphilis ranged form 3.0% in Bertoua to 23.3% on Yaoundé.

NA = Not available

Source: MOPH, 1996.

TABLE 37-B
SEROPREVALENCE OF HIV-1[1]

April 1995				
Site	**number**	**HIV+**	**percent[2]**	**95% CI**
Yaoundé	300	8	2.7	0.9 - 4.5
Bertoua	298	18	6.0	3.3 - 8.7
Garoua	298	10	3.4	1.4 - 5.4
Bamenda	251	17	6.8	3.8 - 9.8
Limbe	102	8	7.8	2.8 - 12.8
November 1995				
Bamenda	309	33	10.7	7.3 - 14.1

1 Seroprevalence of HIV-1 among pregnant women in five sentinel surveillance sites in Cameroon, 1995.
2 Seroprevalence of HIV-1 in the month of April 1995 ranged from 2.7% in Yaoundé to 7.8% in Limbé.

Source: MOPH, 1996.

TABLE 38
CAMEROON HIV/AIDS DATA
PREGNANT WOMEN

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Moungo district	1986	Pregnant women	F	ALL	650.00	HIV	0.15	ELISA, WB	The Moungo district located in the northern part of Littoral Province of Cameroon. Ndounge Hospital. Age range 15-42.
Central and Northern regions	1987	Pregnant women	F	ALL	67.00	HIV1	0.00	ELISA, RIPA/WB	
Central and Northern regions	1987	Pregnant women	F	ALL	67.00	HIV2	0.00	ELISA, RIPA/WB	
Four areas	1987-90	Pregnant women	F	ALL	2417.00	HIV1	0.91	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTI LAV.
Four areas	1987-90	Pregnant women	F	ALL	2417.00	HIV2	0.00	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTI LAV.
Four areas	1987-90	Pregnant women	F	ALL	2417.00	HIV1&2	0.00	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTI LAV.
Yaounde	1988	Pregnant women	F	ALL	600.00	HIV	1.50	UNK	
Yaounde	1989	Pregnant women	F	ALL	1101.00	HIV1	0.90	IFA, WB	
Yaounde	1989	Pregnant women	F	ALL	1101.00	HIV2	0.00	IFA, WB	
Yaounde	1989	Pregnant women	F	ALL	1014.00	HIV1	0.20	ELISA, WB	Central Antenatal clinic. Apr. - Jul. 89.
Yaounde	1989	Pregnant women	F	ALL	1014.00	HIV2	0.00	ELISA, WB	Central Antenatal clinic. Apr. - Jul. 89.
Yaounde	1989	Pregnant women	F	ALL	900.00	HIV1	1.11	ELISA, WB	Since Feb. 89.
Yaounde	1989	Pregnant women	F	ALL	900.00	HIV2	0.00	ELISA	Only between 5 and 10% of samples screened. Since Feb. 89.
Yaounde	1989	Pregnant women	F	ALL	300.00	HIV	0.70	ELISA *2, WB	Sentinel surveillance. First time attending antenatal care clinic, PMI central.

TABLE 38
CAMEROON HIV/AIDS DATA
PREGNANT WOMEN
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Bamenda	1989	Pregnant women	F	ALL	200.00	HIV1	0.50	ELISA, WB	The capital of Northwest Province. Age range 15-42 yrs. Sept. - Nov. 89.
Bamenda	1989	Pregnant women	F	ALL	200.00	HIV2	0.00	ELISA, WB	The capital of Northwest Province. Age range 15-42 yrs. Sept. - Nov. 89.
Kumba	1989	Pregnant women	F	ALL	199.00	HIV1	0.50	ELISA, WB	Largest town of the Southwest Province. Age range 15-40 yrs. Sept. - Nov. 89.
Kumba	1989	Pregnant women	F	ALL	199.00	HIV2	0.00	ELISA, WB	Largest town of the Southwest Province. Age range 15-40 yrs. Sept. - Nov. 89.
Limbe	1989	Pregnant women	F	ALL	210.00	HIV1	1.00	ELISA, WB	Former capital of the Southwest Province. Age range 13-40 yrs. Sept. - Nov. 89.
Limbe	1989	Pregnant women	F	ALL	210.00	HIV2	0.00	ELISA, WB	Former capital of the Southwest Province. Age range 13-40 yrs. Sept. - Nov. 89.
Ngaoundere	1989	Pregnant women	F	ALL	100.00	HIV	0.00	IFA, WB	
Enongal & Ebolowa	1989-90	Pregnant women	F	ALL	170.00	HIV2	0.00	ELISA*2, LIA	Women attending antenatal clinics in South provincial hospitals of Enongal & Ebolowa.
Yaounde	1990	Pregnant women	F	ALL	1188.00	HIV1	1.30	IFA, WB	
Yaounde	1990	Pregnant women	F	ALL	1188.00	HIV2	0.00	IFA, WB	
Yaounde	1990	Pregnant women	F	ALL	300.00	HIV	1.30	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic, PMI central.
Bamenda	1990	Pregnant women	F	ALL	732.00	HIV1	1.10	IFA, WB	
Bamenda	1990	Pregnant women	F	ALL	300.00	HIV	0.70	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Douala	1990	Pregnant women	F	ALL	797.00	HIV1	1.10	IFA, WB	
Douala	1990	Pregnant women	F	ALL	300.00	HIV	1.10	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Limbe	1990	Pregnant women	F	ALL	651.00	HIV1	1.10	IFA, WB	
Limbe	1990	Pregnant women	F	ALL	300.00	HIV	1.10	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.

TABLE 38
CAMEROON HIV/AIDS DATA
PREGNANT WOMEN
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Yaounde	1991	Pregnant women	F	ALL	1205.00	HIV	1.60	ELISA*2, WB	Sentinel site: PMI central. Also see S0261.
Yaounde	1991	Pregnant women	F	ALL	N/A	HIV1	2.10	ELISA, WB	Only the prevalence rate was given. Total sample size was 2892 for total period of Feb. 89 - June 91. Jan. - June 91.
Bamenda	1991	Pregnant women	F	ALL	300.00	HIV	2.30	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Garoua	1991	Pregnant women	F	ALL	300.00	HIV	1.50	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic. Feb. 91.
Garoua	1991	Pregnant women	F	ALL	300.00	HIV	2.50	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic. May 91.
Kumba	1991	Pregnant women	F	ALL	97.00	HIV1	6.19	ELISA, RAPID, LIA	Rapid test: CLONATEC.
Kumba	1991	Pregnant women	F	ALL	97.00	HIV1&2	2.06	ELISA, RAPID, LIA	Rapid test: CLONATEC.
Limbe	1991	Pregnant women	F	ALL	300.00	HIV	4.70	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Manyemen (rural)	1991-92	Pregnant women	F	ALL	382.00	HIV1	2.88	ELISA, WB	Rural area located in Southwest Province. Presbyterian General Hospital. Attending antenatal clinic. June 91 - June.
Manyemen (rural)	1991-92	Pregnant women	F	ALL	382.00	HIV2	0.00	ELISA, WB	Rural area located in Southwest Province. Presbyterian General Hospital. Attending antenatal clinic. June 91 - June.
Yaounde	1992	Pregnant women	F	ALL	300.00	HIV1	2.00	ELISA, WB	Sentinel site: PMI antenatal clinic. Apr. 92.
Yaounde	1992	Pregnant women	F	ALL	300.00	HIV1	1.70	ELISA, WB	Sentinel site: CASS antenatal clinic. Apr. 92.
Yaounde	1992	Pregnant women	F	ALL	200.00	HIV1	1.00	ELISA, WB	Sentinel site: EFOULAN antenatal clinic. Apr. 92.
Bafoussam	1992	Pregnant women	F	ALL	82.00	HIV	1.22	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Bamenda	1992	Pregnant women	F	ALL	300.00	HIV	3.50	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.

TABLE 38
CAMEROON HIV/AIDS DATA
PREGNANT WOMEN
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Bamenda	1992	Pregnant women	F	ALL	190.00	HIV	4.21	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Bertoua	1992	Pregnant women	F	ALL	150.00	HIV	7.90	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Douala	1992	Pregnant women	F	ALL	300.00	HIV	2.40	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Efoulan	1992	Pregnant women	F	ALL	300.00	HIV	1.00	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Garoula	1992	Pregnant women	F	ALL	300.00	HIV	2.50	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Garoua	1992	Pregnant women	F	ALL	300.00	HIV	2.00	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Kumba	1992	Pregnant women	F	ALL	92.00	HIV1	1.09	ELISA, RAPID, LIA	Rapid test: CLONATEC.
Kumba	1992	Pregnant women	F	ALL	92.00	HIV2	0.00	ELISA, RAPID, LIA	Rapid test: CLONATEC.
Limbe	1992	Pregnant women	F	ALL	300.00	HIV	2.00	ELISA*2, WB	Sentinel surveillance. First time attending antenatal care clinic.
Limbe	1992	Pregnant women	F	ALL	104.00	HIV	2.88	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Ngaoundere	1992	Pregnant women	F	ALL	150.00	HIV	1.33	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Manyemen (rural)	1992	Pregnant women	F	ALL	300.00	HIV	2.90	ELISA*2, WB	Sentinel surveillance. Rural site: Presbyterian hospital Manyemen. First time attending antenatal care clinic.
Manyemen (rural)	1992(?)	Pregnant women	F	ALL	376.00	HIV	3.46	ELISA	Manyemen General Hospital.
Yaounde	1993	Pregnant women	F	ALL	301.00	HIV	1.30	ELISA*2/ RAPID	Sentinel site: PMI antenatal clinic. Age range 11-40 yrs. July 93.
Bamenda	1993	Pregnant women	F	ALL	165.00	HIV	7.80	ELISA*2/ RAPID	Sentinel site. Age range 14-42 yrs. July 93.
Douala	1993	Pregnant women	F	ALL	275.00	HIV	4.70	ELISA*2/ RAPID	Sentinel site: PMI antenatal clinic. Age range 11-45 yrs. July 93.

TABLE 38
CAMEROON HIV/AIDS DATA
PREGNANT WOMEN
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Garoula	1993	Pregnant women	F	ALL	301.00	HIV	3.00	ELISA*2/ RAPID	Sentinel site. Age range 14-38 yrs. July 93.
Limbe	1993	Pregnant women	F	ALL	142.00	HIV	4.10	ELISA*2/ RAPID	Sentinel site. Age range 12-46 yrs. July 93.
Yaounde	1994	Pregnant women	F	ALL	301.00	HIV1	2.66	ELISA*3, RAPID	Rapid test: CLONTEC.
Yaounde	1994	Pregnant women	F	ALL	301.00	HIV2	0.00	ELISA*3, RAPID	Rapid test: CLONATEC.
Yaounde	1994	Pregnant women	F	ALL	300.00	HIV1	3.00	UNK	Sentinel surveillance site. First time attending antenatal clinic. Apr. 94.
Yaounde	1994	Pregnant women	F	ALL	300.00	HIV1	3.00	UNK	Sentinel surveillance site. First time attending antenatal clinic. Nov. 94.
Bamenda	1994	Pregnant women	F	ALL	336.00	HIV1	4.17	UNK	Sentinel surveillance site. First time attending antenatal clinic. Nov. 94.
Bamenda	1994	Pregnant women	F	ALL	171.00	HIV1	14.62	UNK	Sentinel surveillance site. First time attending antenatal clinic. Apr. 94.
Bertoua	1994	Pregnant women	F	ALL	311.00	HIV1	10.93	UNK	Sentinel surveillance site. First time attending antenatal clinic. Apr. 94.
Bertoua	1994	Pregnant women	F	ALL	300.00	HIV1	10.33	UNK	Sentinel surveillance site. First time attending antenatal clinic. Nov. 94.
Bertoua	1994	Pregnant women	F	ALL	200.00	HIV1	9.50	ELISA*3, RAPID	Located in the Eastern Province. Rapid test: CLONATEC.
Bertoua	1994	Pregnant women	F	ALL	200.00	HIV2	0.00	ELISA*3, RAPID	Located in the Eastern Province. Rapid test: CLONATEC.
Douala	1994	Pregnant women	F	ALL	300.00	HIV1	7.00	UNK	Sentinel surveillance site. First time attending antenatal clinic. Apr. 94.
Douala	1994	Pregnant women	F	ALL	299.00	HIV1	4.35	UNK	Sentinel surveillance site. First time attending antenatal clinic. Nov. 94.
Garoula	1994	Pregnant women	F	ALL	300.00	HIV1	2.33	UNK	Sentinel surveillance site. First time attending antenatal clinic. Apr. 94.
Garoula	1994	Pregnant women	F	ALL	300.00	HIV1	4.00	UNK	Sentinel surveillance site. First time attending antenatal clinic. Nov. 94.
Limbe	1994	Pregnant women	F	ALL	103.00	HIV1	2.91	UNK	Sentinel surveillance site. First time attending antenatal clinic. Apr. 94.

TABLE 38
CAMEROON HIV/AIDS DATA
PREGNANT WOMEN
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Not specified	1994	Pregnant women	F	ALL	2622.00	HIV1	4.00	WB	June 94.
Yaounde	1995(?)	Pregnant women	F	ALL	1200.00	HIV	3.92	UNK	
Not specified	1995(?)	Pregnant women	F	ALL	1567.00	HIV1	3.45	WB	
Yaounde	1996(?)	Pregnant women	F	ALL	367.00	HIV	1.91	ELISA*2, WB	Central Hospital.

TABLE 39
CAMEROON HIV/AIDS DATA
BLOOD DONORS

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Yaounde	1987	Blood donors	F	ALL	745.00	HIV1	0.67	ELISA, WB	CHU and Central Hospitals.
Yaounde	1987	Blood donors	M	ALL	4455.00	HIV1	0.31	ELISA, WB	CHU and Central Hospitals.
Douala	1987	Blood donors	B	ALL	N/A	HIV	0.84	ELISA, WB	Only the prevalence rate was given.
Yaounde	1987(?)	Blood donors	B	ALL	2475.00	HIV	0.53	ELISA, WB	
Yaounde	1987-88	Blood donors	B	ALL	3535.00	HIV1	0.28	ELISA, WB	10 ELISA HIV1+.
Douala	1987-88	Blood donors	B	ALL	5277.00	HIV	0.63	ELISA, WB	Age range 18-60 yrs.
Four areas	1987-90	Blood donors	B	ALL	8384.00	HIV1	1.00	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Four areas	1987-90	Blood donors	B	ALL	8384.00	HIV2	0.01	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Four areas	1987-90	Blood donors	B	ALL	8384.00	HIV 1&2	0.00	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Yaounde	1988	Blood donors	B	ALL	10980.00	HIV1	0.90	ELISA, WB	CHU and Central Hospitals. 9490 males & 1490 females.
Yaounde	1988	Blood donors	B	ALL	N/A	HIV	3.49	ELISA, WB	Only the prevalence rate was given.
Yaounde	1988	Blood donors	F	ALL	1490.00	HIV1	1.54	ELISA, WB	CHU and Central Hospitals.
Yaounde	1988	Blood donors	M	ALL	9490.00	HIV1	0.80	ELISA, WB	CHU and Central Hospitals.
Douala	1988	Blood donors	B	ALL	N/A	HIV	1.07	ELISA/WB	Only the prevalence rate was given.
Yaounde	1988-89	Blood donors	B	ALL	5980.00	HIV1	0.43	ELISA	University Teaching Hospital of Yaounde. 5300 males & 650 females. Jan. 88 - May 89.
Yaounde	1988-89	Blood donors	F	ALL	680.00	HIV1	0.74	ELISA	University Teaching Hospital of Yaounde. Jan. 88 - May 89.

TABLE 39
CAMEROON HIV/AIDS DATA
BLOOD DONORS
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Yaounde	1988-89	Blood donors	M	ALL	5300.00	HIV1	0.40	ELISA	University Teaching Hospital of Yaounde. Jan. 88 - May 89.
Douala	1988-89	Blood donors	B	ALL	5406.00	HIV	0.83	ELISA, WB	Age range 18-60 yrs.
Yaounde	1989	Blood donors	B	ALL	11393.00	HIV1	0.99	ELISA, WB	CHU and Central Hospitals. 9919 males & 1474 females.
Yaounde	1989	Blood donors	B	ALL	N/A	HIV	4.18	ELISA, WB	Only the prevalence rate was given.
Yaounde	1989	Blood donors	F	ALL	1474.00	HIV1	3.46	ELISA, WB	CHU and Central Hospitals.
Yaounde	1989	Blood donors	M	ALL	9919.00	HIV1	0.63	ELISA, WB	CHU and Central Hospitals.
Bamenda	1989	Blood donors	B	ALL	155.00	HIV1	1.90	ELISA, WB	The capital of the Northwest Province. 96% males & 4% females. Age range 18-55 yrs. Sept. - Nov. 89.
Bamenda	1989	Blood donors	B	ALL	155.00	HIV2	0.00	ELISA, WB	The capital of the Northwest Province. 96% males & 4% females. Age range 18-55 yrs. Sept. - Nov. 89.
Douala	1989	Blood donors	B	ALL	N/A	HIV	2.59	ELISA, WB	Only the prevalence rate was given.
Limbe	1989	Blood donors	B	ALL	229.00	HIV1	1.30	ELISA, WB	Former capital of the Southwest Province. 99% males & 1% females. Age range 17-59 yrs. Sept. - Nov. 89.
Limbe	1989	Blood donors	B	ALL	229.00	HIV2	0.00	ELISA, WB	Former capital of the Southwest Province. 99% males & 1% females. Age range 17-59 yrs. Sept. - Nov. 89.
Ngaoundere	1989	Blood donors	B	ALL	66.00	HIV	1.50	IFA,WB	
Enongal & Ebolowa	1989/ 90	Blood donors	B	ALL	100.00	HIV1	3.00	ELISA*2, LIA	South provincial hospitals of Enongal & Ebolowa.
Enongal & Ebolowa	1989/ 90	Blood donors	B	ALL	100.00	HIV2	0.00	ELISA*2, LIA	South provincial hospitals of Enongal & Ebolowa.
Yaounde	1990	Blood donors	B	ALL	N/A	HIV	4.09	ELISA, WB	Only the prevalence rate was given.
Douala	1990	Blood donors	B	ALL	N/A	HIV	4.66	ELISA, WB	Only the prevalence rate was given.

TABLE 39
CAMEROON HIV/AIDS DATA
BLOOD DONORS
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Three cities	1990	Blood donors	B	ALL	5558.00	HIV1,2	4.30	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. 4656 males & 902 females. HIV1 and/or HIV2.
Three cities	1990	Blood donors	F	ALL	902.00	HIV1, 2	2.66	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. HIV1 and/or HIV2.
Three cities	1990	Blood donors	M	ALL	4656.00	HIV1,2	4.62	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. HIV1 and/or HIV2.
Yaounde	1991	Blood donors	B	ALL	1281.00	HIV	1.25	ELISA, WB	General Hospital. Age range 18-60 yrs. Jan. 91 - Dec. 91.
Yaounde	1991	Blood donors	B	ALL	N/A	HIV	2.87	ELISA, WB	Only the prevalence rate was given.
Batouri	1991	Blood donors	B	ALL	N/A	HIV1	0.00	UNK	Only the prevalence rate was given.
Bertoua	1991	Blood donors	B	ALL	N/A	HIV1	4.20	UNK	Only the prevalence rate was given.
Douala	1991	Blood donors	B	ALL	N/A	HIV	4.57	ELISA, WB	Only the prevalence rate was given.
Three cities	1991	Blood donors	B	ALL	5549.00	HIV1,2	3.46	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. 4619 males & 930 females. HIV1 and/or HIV2.
Three cities	1991	Blood donors	F	ALL	930.00	HIV1,2	3.12	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. HIV1 and/or HIV2.
Three cities	1991	Blood donors	M	ALL	4619.00	HIV1,2	3.53	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. HIV1 and/or HIV2.
Yaounde	1991-92	Blood donors	B	ALL	207.00	HIV	0.97	ELISA, WB	Age range 18-30 yrs. Dec. 91 - Mar. 92.
Yaounde	1992	Blood donors	B	ALL	1017.00	HIV	2.85	ELISA, WB	General Hospital. Age range 18-60 yrs. Jan. 92 - Dec. 92.
Yaounde	1992	Blood donors	B	ALL	107.00	HIV	2.80	ELISA	Central Hospital. Sept. - Dec. 92.
Bafoussam	1992	Blood donors	B	ALL	15.00	HIV	0.00	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Bamenda	1992	Blood donors	B	ALL	91.00	HIV	3.30	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Limbe	1992	Blood donors	B	ALL	106.00	HIV	5.66	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.

TABLE 39
CAMEROON HIV/AIDS DATA
BLOOD DONORS
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Nkongsamba	1992	Blood donors	M	ALL	250.00	HIV1	3.60	UNK	Divisional Hosiptal Nkongsamba.
Three cities	1992	Blood donors	B	ALL	6074.00	HIV1,2	4.58	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. 5066 males & 1000 females. HIV1 and/or HIV2.
Three cities	1992	Blood donors	F	ALL	1008.00	HIV1,2	4.56	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. HIV1 and/or HIV2.
Three cities	1992	Blood donors	M	ALL	5066.00	HIV1,2	4.58	ELISA, RAPID, WB	Cities: Douala, Ebolowa, & Yaounde. Blood banks. HIV1 and/or HIV2.
Yaounde	1992	Blood donors - family	B	ALL	6408.00	HIV	8.01	RAPID, ELISA	Central Hospital. Since Jan. 92. Rapid test: HIVCHEK.
Yaounde	1992	Blood donors - volunteer	B	ALL	417.00	HIV	6.71	RAPID, ELISA	Central Hospital. Volunteers were students, workers, Red Cross & soldiers. Since Jan. 92. Rapid test: HIVCHEK.
Yaounde	1993	Blood donors	B	ALL	1020.00	HIV	4.41	ELISA, WB	General Hospital. Age range 18-60 yrs. Jan. 93 - Dec. 93.
Yaounde	1993	Blood donors	B	ALL	905.00	HIV	5.86	ELISA, WB	General Hospital. 730 males & 175 females. Jan. 1 - June 30, 93.
Yaounde	1993	Blood donors	F	ALL	175.00	HIV	4.57	ELISA, WB	General Hospital. Jan. 1 - June 30, 93.
Yaounde	1993	Blood donors	M	ALL	730.00	HIV	6.16	ELISA, WB	General Hospital. Jan. 1 - June 30, 93.
Nkongsamba	1993	Blood donors	M	ALL	138.00	HIV1	5.80	UNK	Divisional Hospital Nkongsamba. Jan. - May 93.
Three cities	1993	Blood donors	B	ALL	7389.00	HIV1,2	7.06	ELISA, RAPID, WB	Cities: Douala, Ebolowa & Yaounde. Blood banks. 5954 males & 1435 females. HIV1 and/or HIV2.
Three cities	1993	Blood donors	F	ALL	1435.00	HIV1,2	5.85	ELISA, RAPID, WB	Cities: Douala, Ebolowa & Yaounde. Blood banks. HIV1 and/or HIV2.
Three cities	1993	Blood donors	M	ALL	5954.00	HIV1,2	7.36	ELISA, RAPID, WB	Cities: Douala, Ebolowa & Yaounde. Blood banks. HIV1 and/or HIV2.
Not specified	1993(?)	Blood units	B	ALL	123.00	HIV	12.20	RAPID, WB	Blood transfusion centers. 3 rapid assays used.

TABLE 39
CAMEROON HIV/AIDS DATA
BLOOD DONORS
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Three cities	1994	Blood donors	B	ALL	8880.00	HIV1,2	10.81	ELISA, RAPID, WB	Cities: Douala, Ebolowa & Yaounde. Blood banks. 7148 males & 1732 females. HIV1 and/or HIV2.
Three cities	1994	Blood donors	F	ALL	1732.00	HIV1, 2	8.08	ELISA, RAPID, WB	Cities: Douala, Ebolowa & Yaounde. Blood banks. HIV1 and/or HIV2.
Three cities	1994	Blood donors	M	ALL	7148.00	HIV1,2	11.47	ELISA, RAPID, WB	Cities: Douala, Ebolowa & Yaounde. Blood banks. HIV1 and/or HIV2.

TABLE 40
CAMEROON HIV/AIDS DATA
GENERAL POPULATION

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Mora	1985	General population	B	ALL	322.00	HIV	0.00	ELISA, WB	Data collected in a cluster sample of the survey area. Age range 5-64 yrs.
Rural area	1985	General population	B	ALL	395.00	HIV1	0.00	ELISA, WB	Age group 5-65 yrs.
Small towns	1985	General population	B	ALL	322.00	HIV1	0.00	ELISA, WB	Age groups 15-44 yrs.
Bafoussam	1986	General population	B	ALL	253.00	HIV1	1.58	ELISA, WB	Located in West area.
Campo	1986	General population	B	ALL	416.00	HIV1	0.48	ELISA, WB	13 ELISA HIV1+.
Mbouda	1986	General population	B	ALL	151.00	HIV1	0.00	ELISA, WB	Located in West area.
Ebone (rural)	1986	General population	B	ALL	218.00	HIV1	0.46	ELISA, WB	Rural area located in Southwest area.
Small towns	1986	General population	B	ALL	688.00	HIV1	0.44	ELISA, WB	Age groups 15-44 yrs.
Not specified	1986-87	General population	B	ALL	738.00	HIV1	2.98	UNK	Population were from the medical consultations.
Bakwat	1987	General population	B	ALL	204.00	HIV1	0.00	IFA, WB	
Bandjoun	1987	General population	B	ALL	300.00	HIV1	0.33	ELISA, WB	Located in West area.
Bakwat (rural)	1987	General population	B	ALL	204.00	HIV1	0.00	ELISA, WB	Rural, area located in Southwest area.
Rural area	1987	General population	B	ALL	484.00	HIV1	0.83	ELISA, WB	Age group 15-65 yrs.
Small towns	1987	General population	B	ALL	1902.00	HIV1	0.58	ELISA, WB	Age group 15-65 yrs.
Not specified	1987	General population	B	ALL	4111.00	HIV1	0.56	UNK	The south of Cameroon.
Not specified	1987	General population	B	ALL	4037.00	HIV2	0.00	UNK	The south of Cameroon.

TABLE 40
CAMEROON HIV/AIDS DATA
GENERAL POPULATION
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Four areas	1987-90	General population	B	ALL	2417.00	HIV1	0.70	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Four areas	1987-90	General population	B	ALL	2417.00	HIV2	0.15	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Four areas	1987-90	General population	B	ALL	2417.00	HIV 1&2	0.00	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Various towns	1988	General population	B	ALL	6632.00	HIV1	0.44	ELISA, WB	183 ELISA HIV1+.
Mora areas	1988	General population	B	ALL	413.00	HIV1	0.24	ELISA, WB	Mora town and rural areas around the town. Located in North area.
Not specified	1988	General population	B	ALL	542.00	HIV1	4.06	UNK	Population were from the medical consultations.
Kumba	1989	General population	B	ALL	391.00	HIV1	0.26	ELISA, RAPID, LIA	Rapid test: CLONATEC.
Kumba	1989	General population	B	ALL	391.00	HIV2	0.00	ELISA, RAPID, LIA	Rapid test: CLONATEC.
Not specified	1989	General population	B	ALL	1268.00	HIV1	10.80	UNK	Population were from the medical consultations.
Not specified	1990	General population	B	ALL	N/A	HIV	1.25	UNK	
South areas	1991(?)	General population	B	ALL	779.00	HIV1	1.41	ELISA, WB	
South areas	1991(?)	General population	B	ALL	779.00	HIV2	0.00	ELISA, WB	
Batouri	1992	General population	B	ALL	600.00	HIV1	2.10	ELISA, LIA, WB	Ages 5+. Also, see L0107.
Rural areas	1992	General population	B	ALL	600.00	HIV1	1.60	ELISA, LIA, WB	Ages 5+. Also, see L0107.
North	1993	General population	B	ALL	412.00	HIV	11.00	UNK	
Limbe	1994	General population	B	ALL	351.00	HIV1	9.69	ELISA*3, RAPID	Located in the Southwestern Province. Rapid test: CLONATEC.
Limbe	1994	General population	B	ALL	351.00	HIV2	0.00	ELISA*3, RAPID	Located in the Southwestern Province. Rapid test: CLONATEC.

TABLE 41
CAMEROON HIV/AIDS DATA
COMMERCIAL SEX WORKERS

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Meiganga	1985	Prostitutes	F	ALL	221.00	HIV	8.00	UNK	
Meiganga (rural)	1985	Prostitutes	F	ALL	314.00	HIV	3.00	ELISA, RIPA/WB	Rural area.
Central & North regions	1986	Prostitutes	F	ALL	53.00	HIV1	7.50	IFA, WB	
Central & North regions	1986	Prostitutes	F	ALL	53.00	HIV2	0.00	IFA, WB	
Three Southern villages	1986	Prostitutes	F	ALL	N/A	HIV1	0.00	IFA, WB	Only the prevalence rate was given.
Three Southern villages	1986	Prostitutes	F	ALL	N/A	HIV2	0.00	IFA, WB	Only the prevalence rate was given.
Douala	1987	Prostitutes	F	ALL	164.00	HIV	7.30	ELISA, WB	Feb. - Apr. 87.
Douala	1987	Prostitutes	F	ALL	101.00	HIV	4.00	ELISA, WB	Oct. - Dec. 87.
Yaounde	1987-88	Prostitutes	F	ALL	523.00	HIV1	6.88	ELISA, WB	36 ELISA HIV1+.
Douala	1987-88	Prostitutes	F	ALL	453.00	HIV1	6.60	IFA, WB	
Douala	1987-88	Prostitutes	F	ALL	453.00	HIV2	0.00	IFA, WB	
Four areas	1987-90	Prostitutes	F	ALL	559.00	HIV1	7.33	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Four areas	1987-90	Prostitutes	F	ALL	559.00	HIV2	0.71	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Four areas	1987-90	Prostitutes	F	ALL	559.00	HIV 1&2	0.00	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Yaounde	1988	Prostitutes	F	ALL	125.00	HIV1	5.60	UNK	
Yaounde	1988	Prostitutes	F	ALL	125.00	HIV2	0.00	UNK	
Douala	1988	Prostitutes	F	ALL	117.00	HIV	4.30	ELISA, WB	Oct. - Dec. 88.
Douala	1988	Prostitutes	F	ALL	89.00	HIV	6.70	ELISA, WB	Feb. - Mar. 88.
Yaounde	1988(?)	Prostitutes	F	ALL	168.00	HIV1	7.14	ELISA, WB	Age range 17-38 yrs.

TABLE 41
CAMEROON HIV/AIDS DATA
COMMERCIAL SEX WORKERS
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Yaounde	1988(?)	Prostitutes	F	ALL	168.00	HIV2	0.00	ELISA, WB	Age range 17-38 yrs.
Douala	1989	Prostitutes	F	ALL	55.00	HIV	10.90	ELISA, WB	June - July 89.
Yaounde	1989-90	Prostitutes	F	ALL	303.00	HIV1	8.58	ELISA, WB	Age 15+. Nov. 89 - Mar. 90.
Yaounde	1989-90	Prostitutes	F	ALL	303.00	HIV2	0.66	ELISA, WB	Age 15+. Nov. 89 - Mar. 90.
Yaounde	1989-90	Prostitutes	F	ALL	303.00	HIV1,2	9.24	ELISA, WB	Datatype breakdown given in K0073. Age 15+. Nov. 89 - Mar. 90. HIV1 + HIV2 + HIV1&2..
Bamenda	1990-91	Prostitutes	F	ALL	N/A	HIV	9.80	IFA, WB	Only the prevalence rate was given.
Edea	1990-91	Prostitutes	F	ALL	N/A	HIV	2.80	IFA, WB	Only the prevalence rate was given.
Yaounde	1992	Prostitutes	F	ALL	485.00	HIV	3.50	IFA, WB	
Yaounde	1992	Prostitutes	F	ALL	262.00	HIV1,2	26.60	RAPID, WB	One case of HIV2 & two HIV 1&2. Age range 15-51 yrs. As of Spet. 92. HIV1 + HIV2 + HIV1&2.
Douala	1992	Prostitutes	F	ALL	236.00	HIV1, 2	45.30	RAPID, WB	One case of HIV2. Age range 16-62 yrs. As of Sept. 92. HIV1 + HIV2 + HIV1&2.
Yaounde	1993	Prostitutes	F	ALL	300.00	HIV	23.00	UNK	
Douala	1993	Prostitutes	F	ALL	332.00	HIV	35.00	UNK	
Yaounde	1994	Prostitutes	F	ALL	297.00	HIV1	21.21	ELISA*3, RAPID	Rapid test: CLONATEC.
Yaounde	1994	Prostitutes	F	ALL	297.00	HIV2	0.00	ELISA*3, RAPID	Rapid test: CLONATEC.
Yaounde	1995	Prostitutes	F	ALL	N/A	HIV	17.70	UNK	Only the prevalence rate was given. Age range 18-45 yrs. Feb. - Dec. 95.
Douala	1995	Prostitutes	F	ALL	N/A	HIV	15.20	UNK	Only the prevalence rate was given. Age range 18-45 yrs. Feb. - Dec. 95.
Not specified	1995	Prostitutes	F	ALL	2035.00	HIV	18.00	UNK	
Not specified	1995(?)	Prostitutes	F	ALL	1560.00	HIV	16.40	UNK	

TABLE 42
CAMEROON HIV/AIDS DATA
TRUCK DRIVERS

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Ngaoundere	1988	Truck drivers	B	ALL	18.00	HIV	0.00	IFA, WB	
Douala	1993	Truck drivers	M	ALL	117.00	HIV	14.53	ELISA	Age range 19-55 yrs. Sept. 13-30, 93.
Southwest & Littoral	1993	Truck drivers	M	ALL	156.00	HIV	17.00	UNK	

TABLE 43
CAMEROON HIV/AIDS DATA
STDs

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Four areas	1987-90	STD pts.	B	ALL	1042.00	HIV1	1.90	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Four areas	1987-90	STD pts.	B	ALL	1042.00	HIV2	0.00	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Four areas	1987-90	STD pts.	B	ALL	1042.00	HIV 1&2	0.00	ELISA, LIA, WB	Areas: Yaounde, Douala, Kumba & Bamenda. LIA test: PEPTILAV.
Yaounde	1988	STD pts.	B	ALL	300.00	HIV	1.00	UNK	
Yaounde	1989	STD clinic pts.	B	ALL	407.00	HIV1	3.44	ELISA, WB	Elig-Essono STD clinic. Aug. - Sept. 89.
Yaounde	1989	STD clinic pts.	B	ALL	407.00	HIV2	0.00	ELISA, WB	Elig-Essono STD clinic. Aug. - Sept. 89.
Yaounde	1989	STD clinic pts.	B	ALL	N/A	HIV1	1.50	UNK	Only the prevalence rate was given. Feb. - Dec. 89. Total sample size was 1461 for the total period of Feb. 89 - June 91.
Yaounde	1989	STD pts.	B	ALL	467.00	HIV1	1.71	ELISA, WB	Since Feb. 89.
Yaounde	1989	STD pts.	B	ALL	467.00	HIV2	0.00	ELISA	Only between 5 & 10% of samples screened. Since Feb. 89.
Bamenda	1989	STD pts.	B	ALL	200.00	HIV1	3.00	ELISA, WB	The capital of the Northwest Province. 35% males & 65% females. Age range 15-60 yrs. Sept. - Nov. 89.
Bamenda	1989	STD pts.	B	ALL	200.00	HIV2	0.00	ELISA, WB	The capital of the Northwest Province. 35% males & 65% females. Age range 15-60 yrs. Sept. - Nov. 89.
Kumba	1989	STD pts.	B	ALL	51.00	HIV1	1.20	ELISA, WB	Largest town of the Southwest Province. 24% males & 76% females. Age range 15-50 yrs. Sept. - Nov. 89.
Kumba	1989	STD pts.	B	ALL	51.00	HIV2	0.00	ELISA, WB	Largest town of the Southwest Province. 24% males & 76% females. Age range 15-50 yrs. Sept. - Nov. 89.
Limbe	1989	STD pts.	B	ALL	31.00	HIV1	0.00	ELISA, WB	Former capital of the Southwest Province. 18% males & 87% females. Age range 16-33 yrs. Spet. - Nov. 89.

TABLE 43
CAMEROON HIV/AIDS DATA
STDs
(CONTINUED)

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Limbe	1989	STD pts.	B	ALL	31.00	HIV2	0.00	ELISA, WB	Former capital of the Southwest Province. 13% males & 87% females. Age range 16-33 yrs. Sept. - Nov. 89.
Ebolowa	1989/ 90	STD clinic pts.	B	ALL	151.00	HIV1	1.32	ELISA*2, LIA	Central STD clinic in the Ebolowa Hospital.
Ebolowa	1989/ 90	STD clinic pts.	B	ALL	151.00	HIV2	0.00	ELISA*2, LIA	Central STD clinic in the Ebolowa Hospital.
Yaounde	1989-90	STD clinic pts.	B	ALL	1161.00	HIV1	2.30	ELISA, LIA, WB	Elig-Essono STD clinic. Feb. 89 - Dec. 90. LIA test: PEPTILAV.
Yaounde	1989-90	STD clinic pts.	B	ALL	1161.00	HIV2	0.00	ELISA, LIA, WB	Elig-Essono STD clinic. Feb. 89 - Dec. 90. LIA test: PEPTILAV.
Yaounde	1989-90	STD clinic pts.	B	ALL	1161.00	HIV 1&2	0.10	ELISA, LIA, WB	Elig-Essono STD clinic. Feb. 89 - Dec. 90. LIA test: PEPTILAV.
Yaounde	1989-90	STD clinic pts.	B	ALL	1161.00	HIV 1&2	2.41	ELISA, LIA, WB	Elig-Essono STD clinic. 848 males & 313 females. Feb. 89 - Dec. 90. LIA test: PEPTILAV. HIV1 + HIV2 + HIV1&2.
Yaounde	1989-90	STD clinic pts.	F	ALL	313.00	HIV 1&2	2.56	ELISA, LIA, WB	Elig-Essono STD clinic. Feb. 89 - Dec. 90. LIA test: PEPTILAV. HIV1 + HIV2 + HIV1&2.
Yaounde	1989-90	STD clinic pts.	M	ALL	848.00	HIV 1&2	2.36	ELISA, LIA, WB	Elig-Essono STD clinic. Feb. 89 - Dec. 90. LIA test: PEPTILAV. HIV1 + HIV2 + HIV1&2.
Yaounde	1989-90	STD pts.	B	ALL	450.00	HIV1	2.89	ELISA, WB	Age 15+. Nov. 89 - Mar. 90.
Yaounde	1989-90	STD pts.	B	ALL	450.00	HIV2	0.00	ELISA, WB	Age 15+. Nov. 89 - Mar. 90.
Yaounde	1990	STD clinic pts.	B	ALL	93.00	HIV1	6.45	ELISA, WB	Clinic in Elig-Essono, Yaounde. 46 males & 41 females. Mar. - May 90 & Aug. - Oct. 90.
Yaounde	1990	STD clinic pts.	B	ALL	93.00	HIV2	0.00	ELISA, WB	Clinic in Elig-Essono, Yaounde. 46 males & 41 females. Mar. - May 90 & Aug. - Oct. 90.
Yaounde	1990	STD clinic pts.	B	ALL	N/A	HIV1	2.30	UNK	Only the prevalence rate was given. Calendar year. Total sample size was 1461 for the total period of Feb. 89 - June 91.
Yaounde	1990	STD clinic pts.	F	ALL	47.00	HIV1	2.13	ELISA, WB	Clinic in Elig-Essono, Yaounde. Mar. - May 90 & Aug. - Oct. 90.
Yaounde	1990	STD clinic pts.	M	ALL	46.00	HIV1	10.87	ELISA, WB	Clinic in Elig-Essono, Yaounde. Mar. - May. 90 - Aug. - Oct. 90.
Yaounde	1991	STD clinic pts.	B	ALL	N/A	HIV1	2.60	UNK	Only the prevalence rate was given. Up to June 91. Total sample size was 1461 for the total period of Feb. 89 - June 91.

TABLE 43
CAMEROON HIV/AIDS DATA
STDs
(CONTINUED)

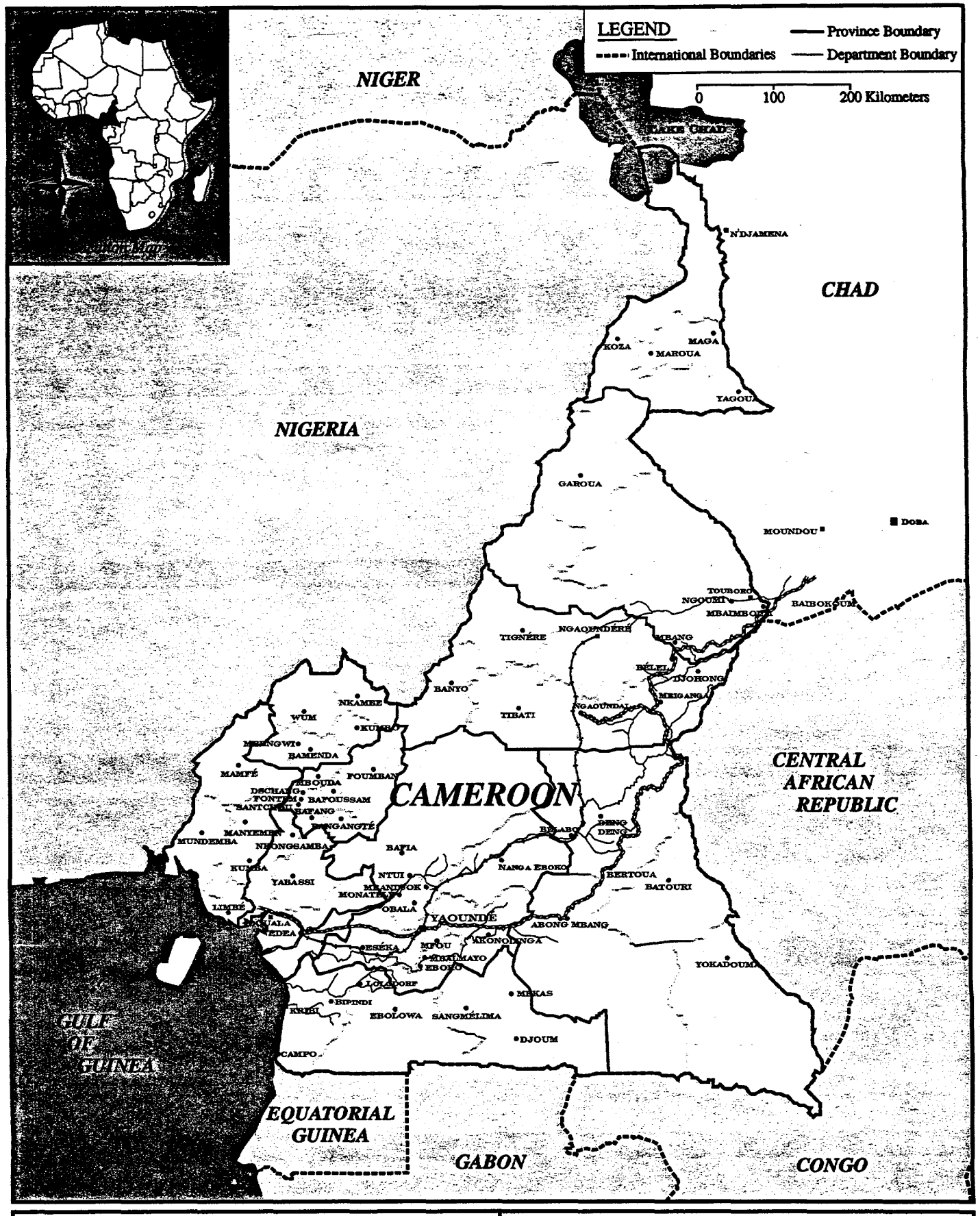
GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Kumba	1992	STD clinic pts.	B	ALL	164.00	HIV1	4.27	ELISA, RAPID, LIA	Rapid test: CLONATEC.
Kumba	1992	STD clinic pts.	B	ALL	164.00	HIV2	0.00	ELISA, RAPID, LIA	Rapid test: CLONATEC.
Bafoussam	1992	STD pts.	B	ALL	96.00	HIV	5.21	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Bamenda	1992	STD pts.	B	ALL	65.00	HIV	6.15	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Ngaoundere	1992	STD pts.	B	ALL	57.00	HIV	8.77	ELISA, RAPID, LIA	Mar. - Apr. 92. Rapid test: CLONATEC.
Yaounde	1993(?)	STD clinic pts.	M	ALL	161.00	HIV	4.97	ELISA, LIA	LIA test: INNO-LIA.
Yaounde	1994	STD clinic pts.	B	ALL	647.00	HIV1	5.41	ELISA*3, RAPID	Rapid test: CLONATEC.
Yaounde	1994	STD clinic pts.	B	ALL	647.00	HIV2	0.00	ELISA*3, RAPID	Rapid test: CLONATEC.
Banka (semirural)	1994	STD clinic pts.	B	ALL	100.00	HIV1	9.00	ELISA*3, RAPID	Semi-rural area located in Western Province. Private hospital. Rapid test: CLONATEC.
Banka (semirural)	1994	STD clinic pts.	B	ALL	100.00	HIV2	0.00	ELISA*3, RAPID	Semi-rural area located in Western Province. Private hospital. Rapid test: CLONATEC.
Yaounde	1995(?)	STD clinic pts.	M	ALL	161.00	HIV1	5.00	ELISA, RAPID, WB	Age range 17-46 yrs.

TABLE 44
CAMEROON HIV/AIDS DATA
MILITARY

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
National	1990	Military	M	ALL	1190.00	HIV2	0.00	IFA, WB	
Six cities	1990	Military	M	ALL	1295.00	HIV1	3.30	ELISA, WB	Cities: Yaounde, Douala, Bafoussam, Koutaba, Ngaoundere, & Maroua.
Six cities	1990	Military	M	ALL	1295.00	HIV2	0.00	ELISA, WB	Cities: Yaounde, Douala, Bafoussam, Koutaba, Ngaoundere, & Maroua.
Not specified	1990	Military & police	B	ALL	N/A	HIV	3.20	UNK	Sentinel surveillance.
Not specified	1992	Military & police	B	ALL	N/A	HIV	6.28	UNK	Sentinel surveillance.
Not specified	1993	Military	M	ALL	1812.00	HIV1	6.18	ELISA, WB	July 93.
Not specified	1993	Military	M	ALL	1812.00	HIV2	0.05	ELISA, WB	July 93.

TABLE 45
CAMEROON HIV/AIDS DATA
ADULT PYGMIES

GEO AREA	DATE OF STUDY	SUB POP	SEX	AGE	SAMP SIZE1	DATA TYPE	PREVALENCE RATE	TEST TYPE	COMMENTS
Djoum (rural)	1990	Adults - bantu	B	ALL	779.00	HIV1	0.00	ELISA, WB	Isolated rural rainforest area.
Djoum (rural)	1990	Adults - bantu	B	ALL	779.00	HIV2	0.00	ELISA, WB	Isolated rural rainforest area.
Mekas (rural)	1993	Adults - bantu	B	ALL	684.00	HIV1	0.88	ELISA, WB	Isolated rural rainforest area located 70 km from Djoum.
Mekas (rural)	1993	Adults - bantu	B	ALL	684.00	HIV2	0.44	ELISA, WB	Isolated rural rainforest area located 70 km from Djoum.
Djoum (rural)	1990	Adults - pygmy	B	ALL	125.00	HIV1	1.60	ELISA, WB	Isolated rural rainforest area.
Djoum (rural)	1990	Adults - pygmy	B	ALL	125.00	HIV2	0.00	ELISA, WB	Isolated rural rainforest area.
Kribi region/rual	1992(?)	Adults - pygmy	B	ALL	141.00	HIV 1&2	0.71	ELISA, LIA	6 villages of Kribi regions: Mballam, Mayos, Kenjo, Djiboj, Cyrie-Cuss, & Kwamb.
Mekas (rural)	1993	Adults - pygmy	B	ALL	92.00	HIV1	0.00	ELISA, WB	Isolated rural rainforest area located 70 km from Djoum.
Mekas (rural)	1993	Adults - pygmy	B	ALL	92.00	HIV2	0.00	ELISA, WB	Isolated rural rainforest area located 70 km from Djoum.



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BASE MAP OF CAMEROON WITH PROVINCES

DAMES & MOORE
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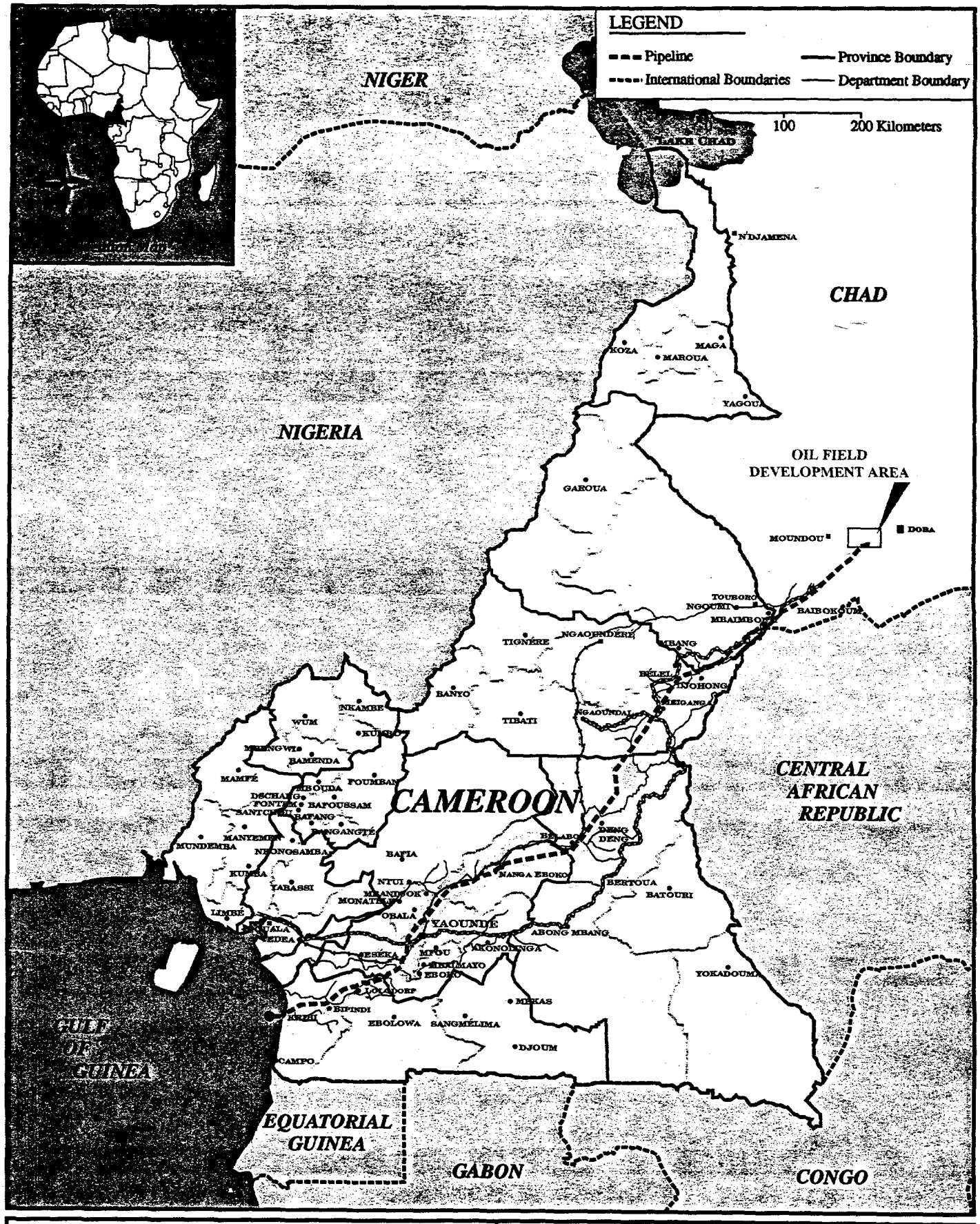
FIGURE D-1



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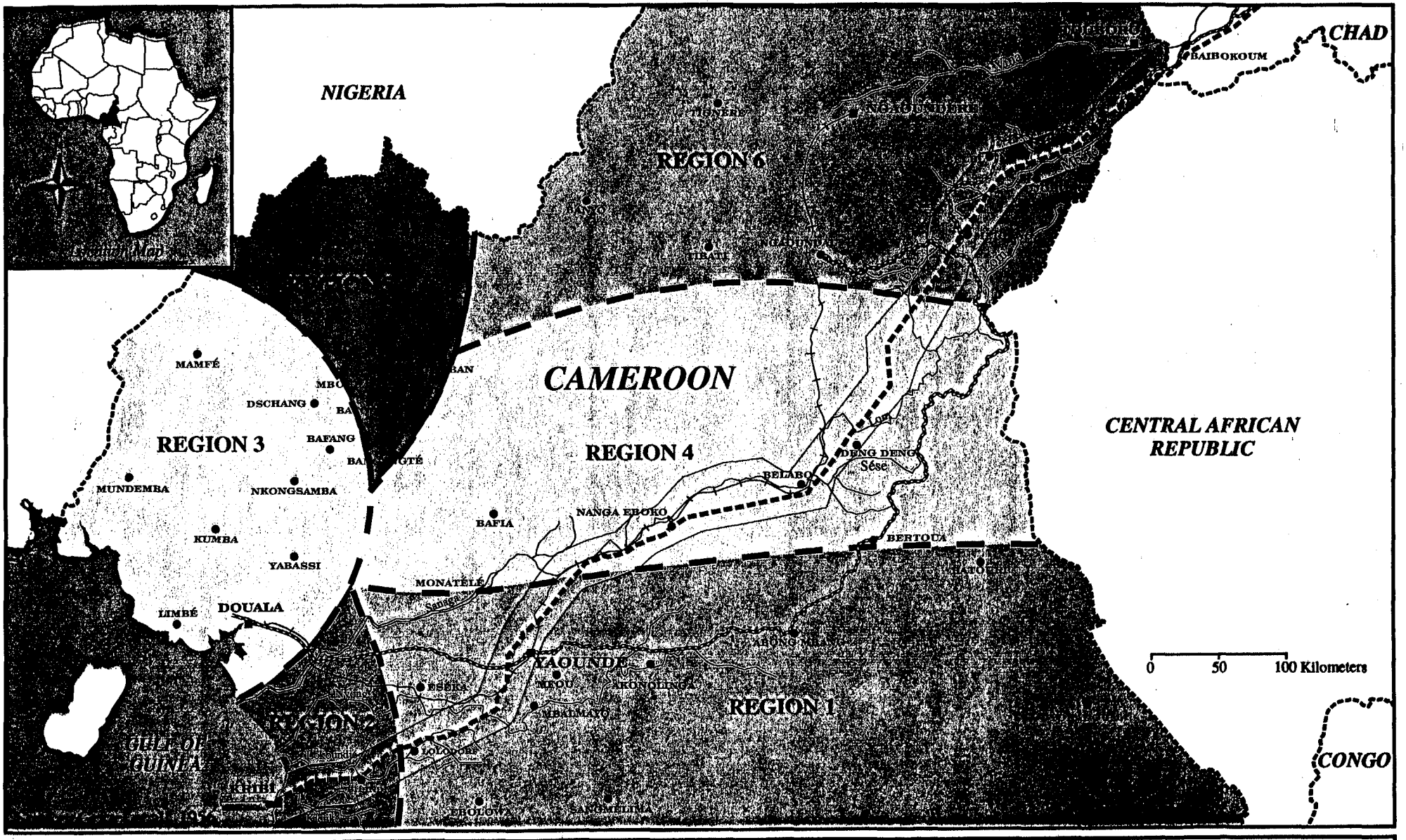
BASE MAP OF CAMEROON WITH PROVINCES AND PIPELINE

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-2



LEGEND

- REGION 1 - Equatorial climate
- REGION 2 - Southern coast equatorial climate
- REGION 3 - Northern coast equatorial climate
- REGION 4 -Transient equatorial & tropical climate
- REGION 5 - Western mountain tropical climate
- REGION 6 - Adamaoua highland tropical climate

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CLIMATIC AND HYDROLOGIC REGIONS IN CAMEROON

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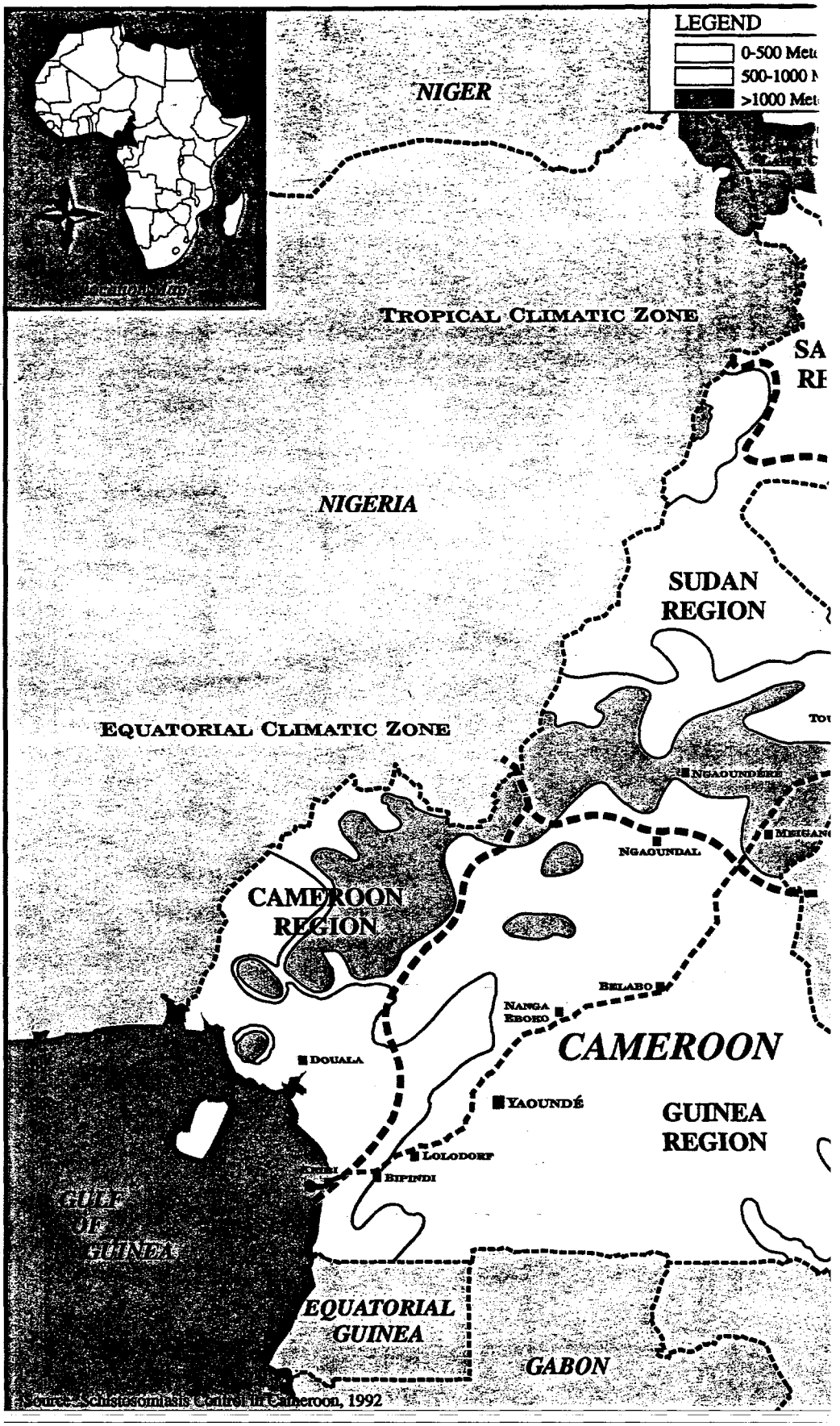
FIGURE D-3



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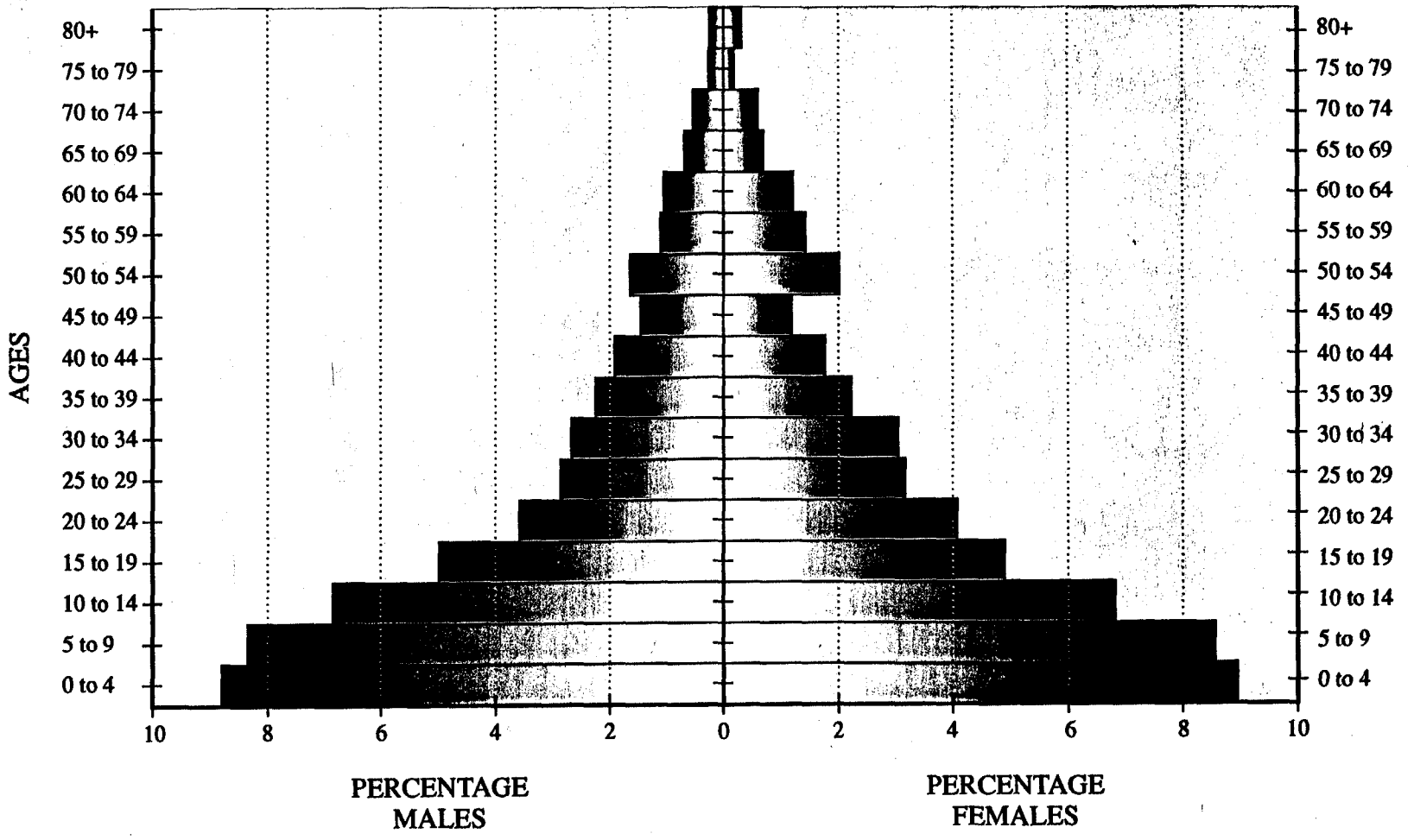

Source: CDHS, 1992

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POPULATION PYRAMID BY AGE
CAMEROON - 1991

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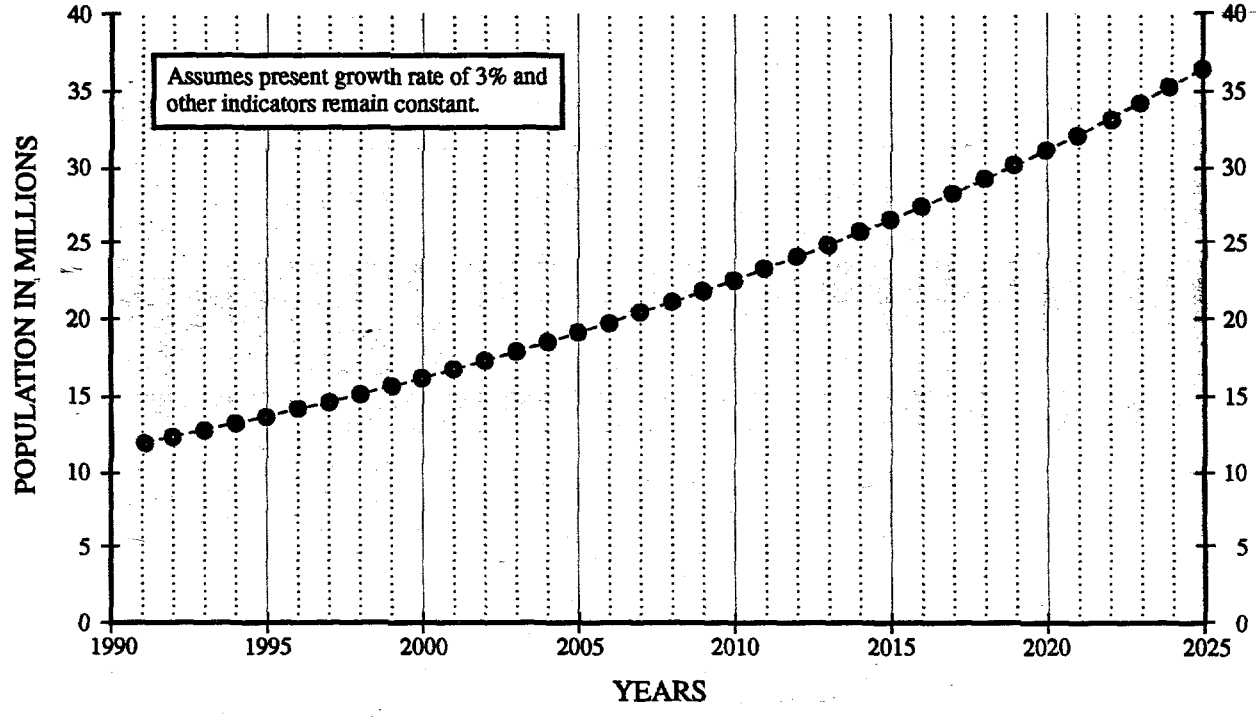
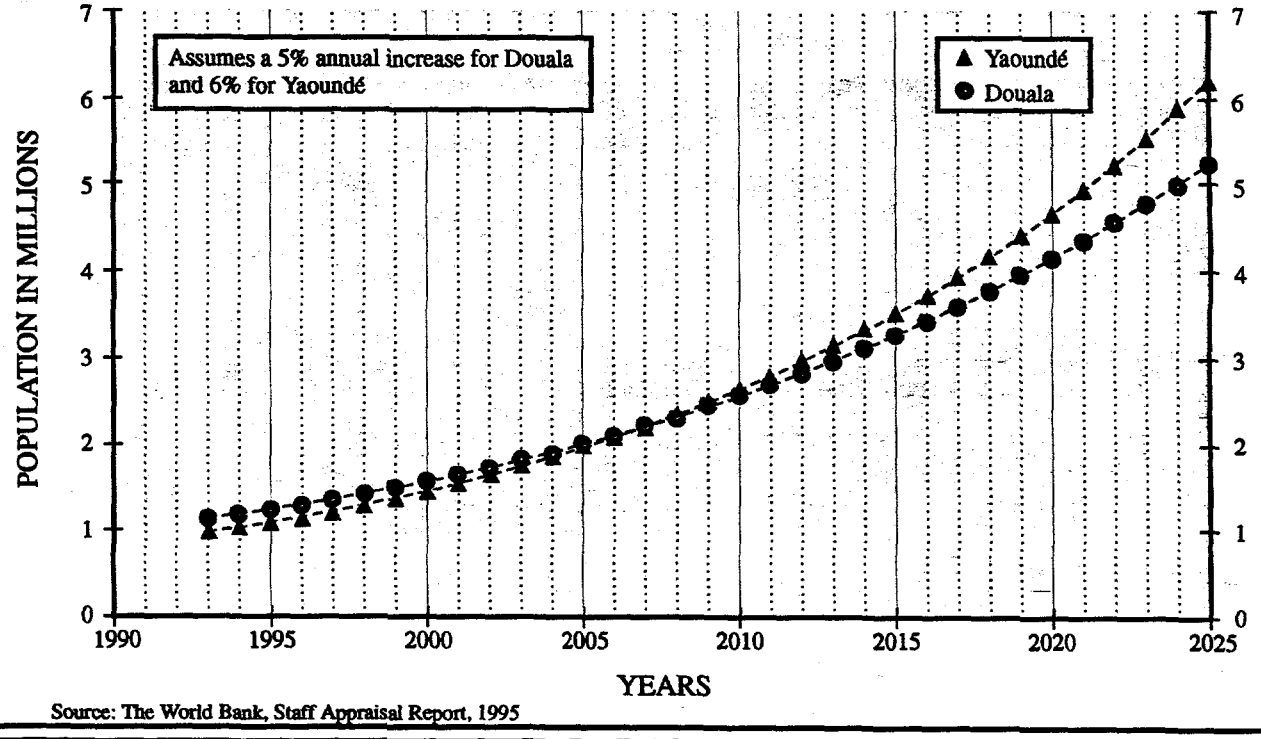
FIGURE D-6

CAMEROON



YAOUNDÉ AND DOUALA



Source: The World Bank, Staff Appraisal Report, 1995

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POPULATION PROJECTIONS

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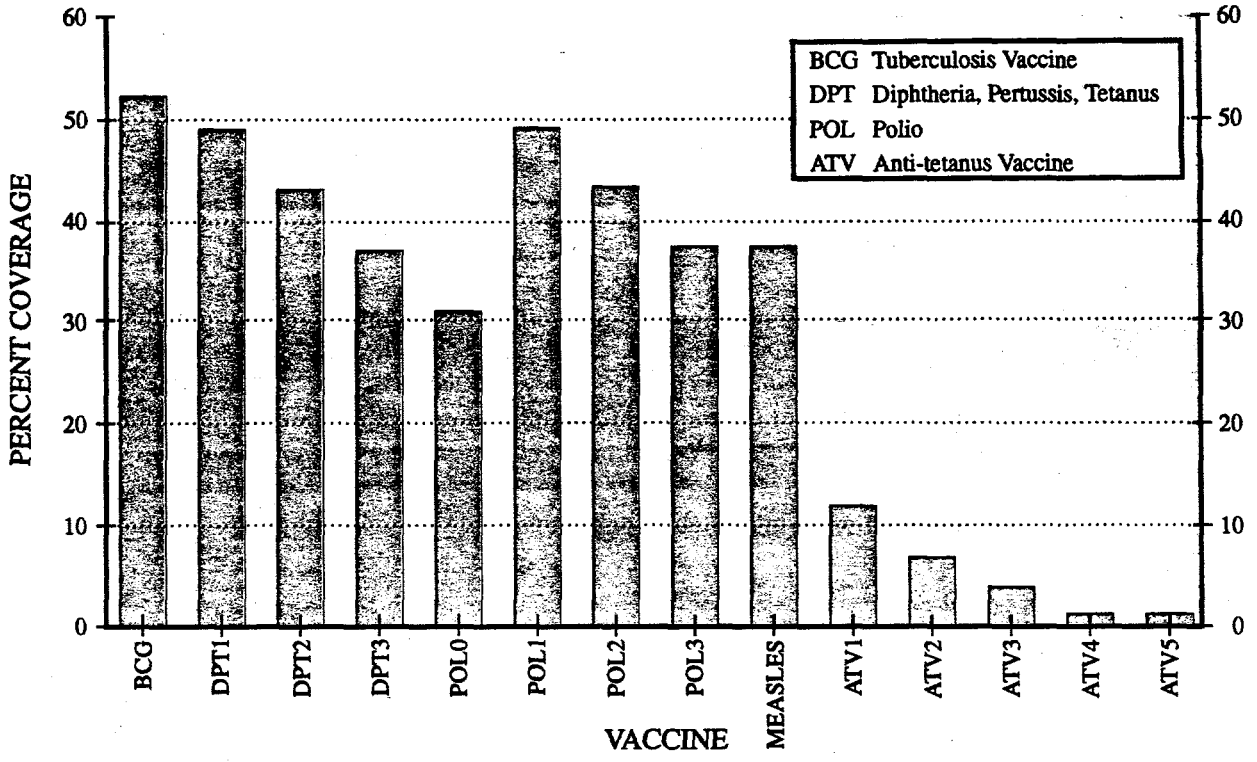
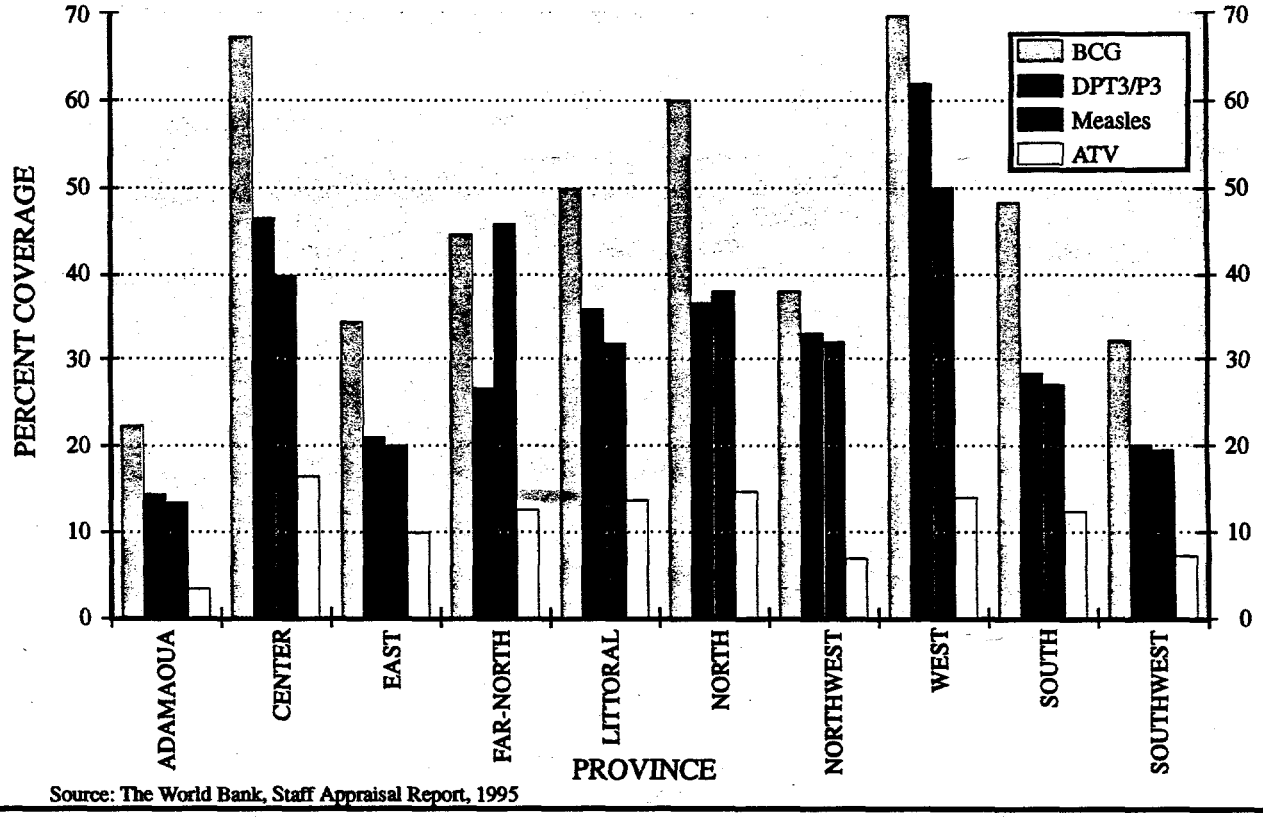
FIGURE D-7

NATIONAL VACCINATION COVERAGE, 1992



VACCINATION COVERAGE BY PROVINCE, 1992



Source: The World Bank, Staff Appraisal Report, 1995

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VACCINATION COVERAGE

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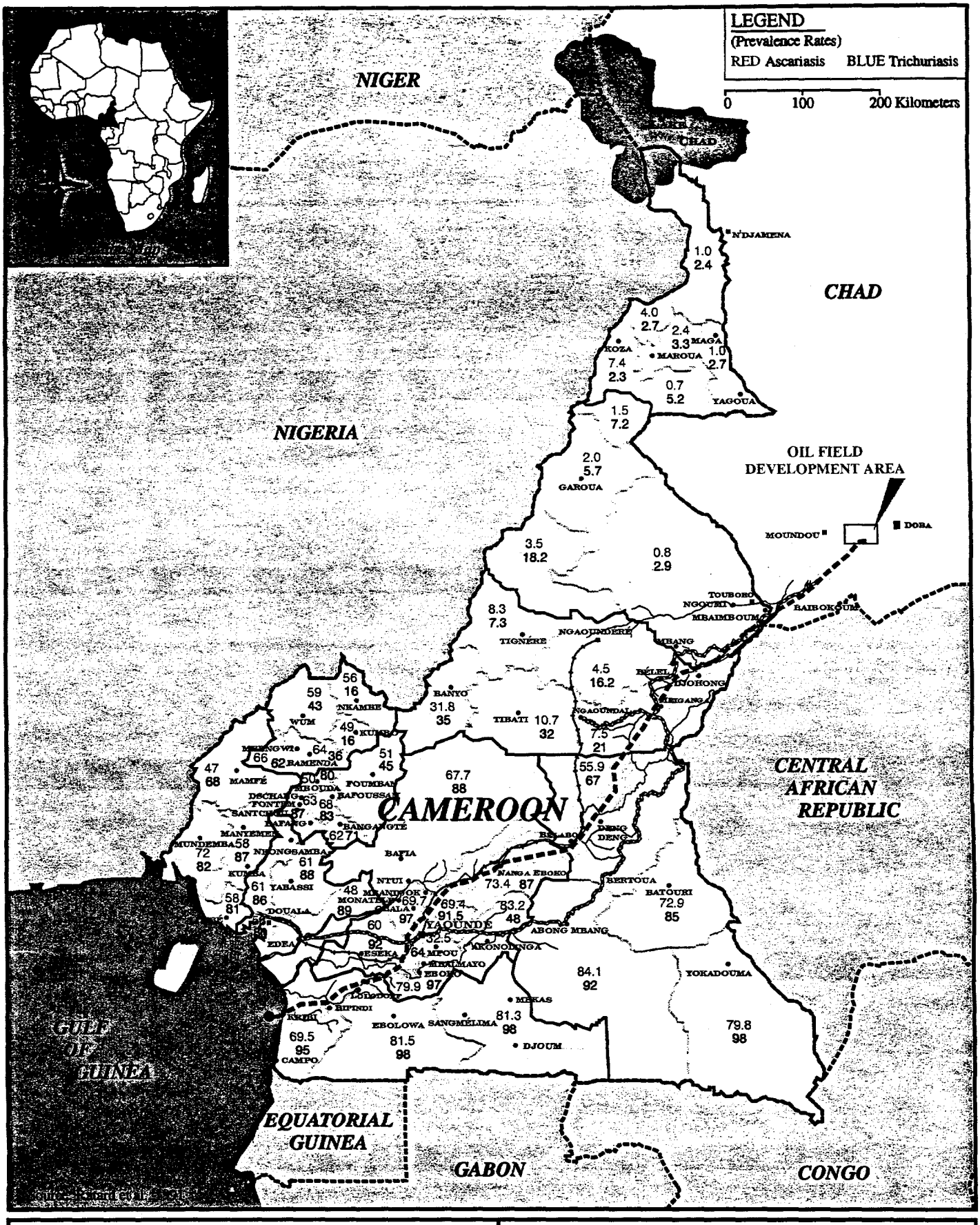
FIGURE D-8



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PREVALENCE RATES OF ASCARIASIS & TRICHURIASIS IN 5TH GRADE SCHOOL CHILDREN

DAMES & MOORE
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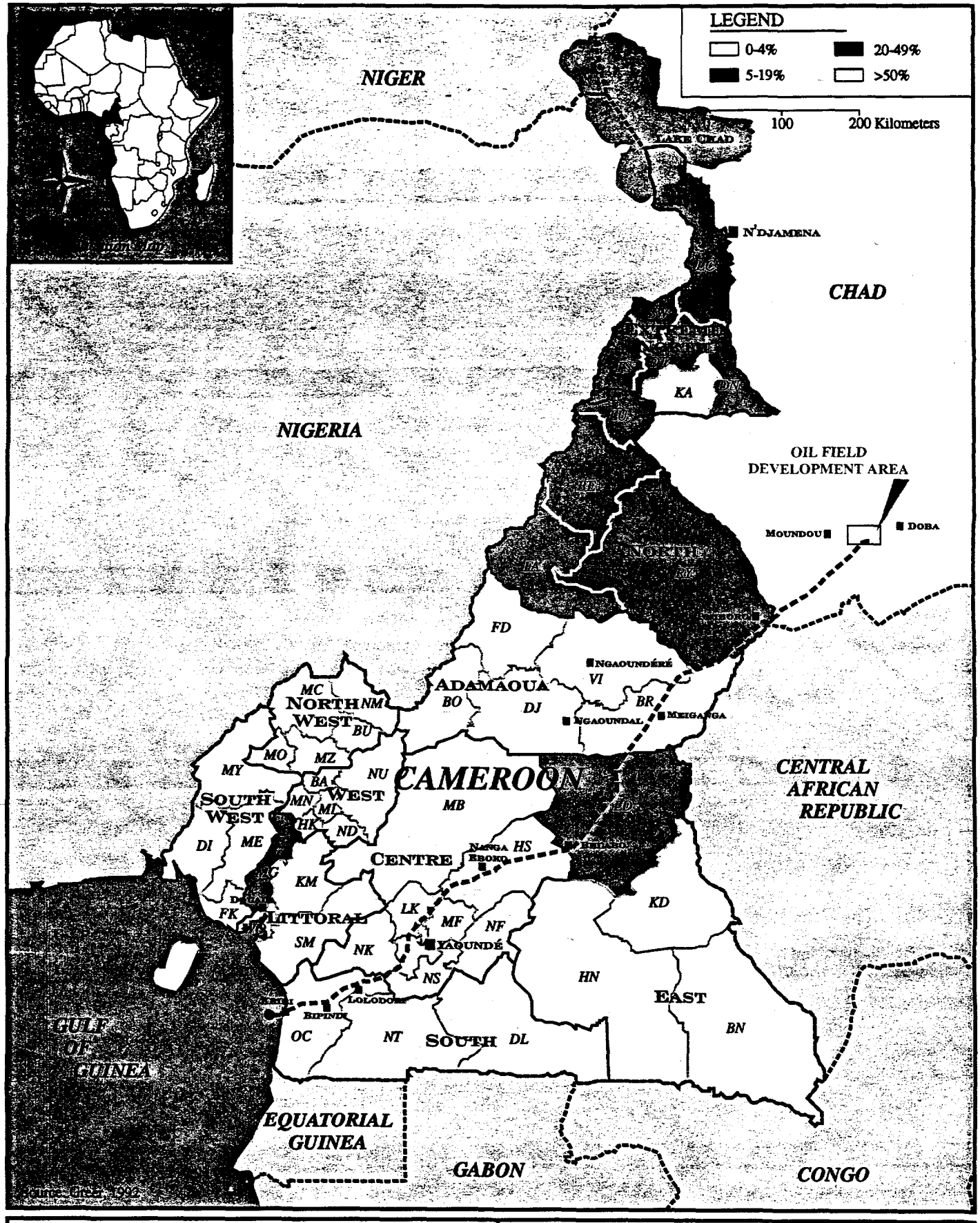
FIGURE D-9



ESSO Exploration and Production Chad Inc.

PREVALENCE OF SCHISTOSOMA HEMATOBIUM IN 5TH GRADE SCHOOL CHILDREN

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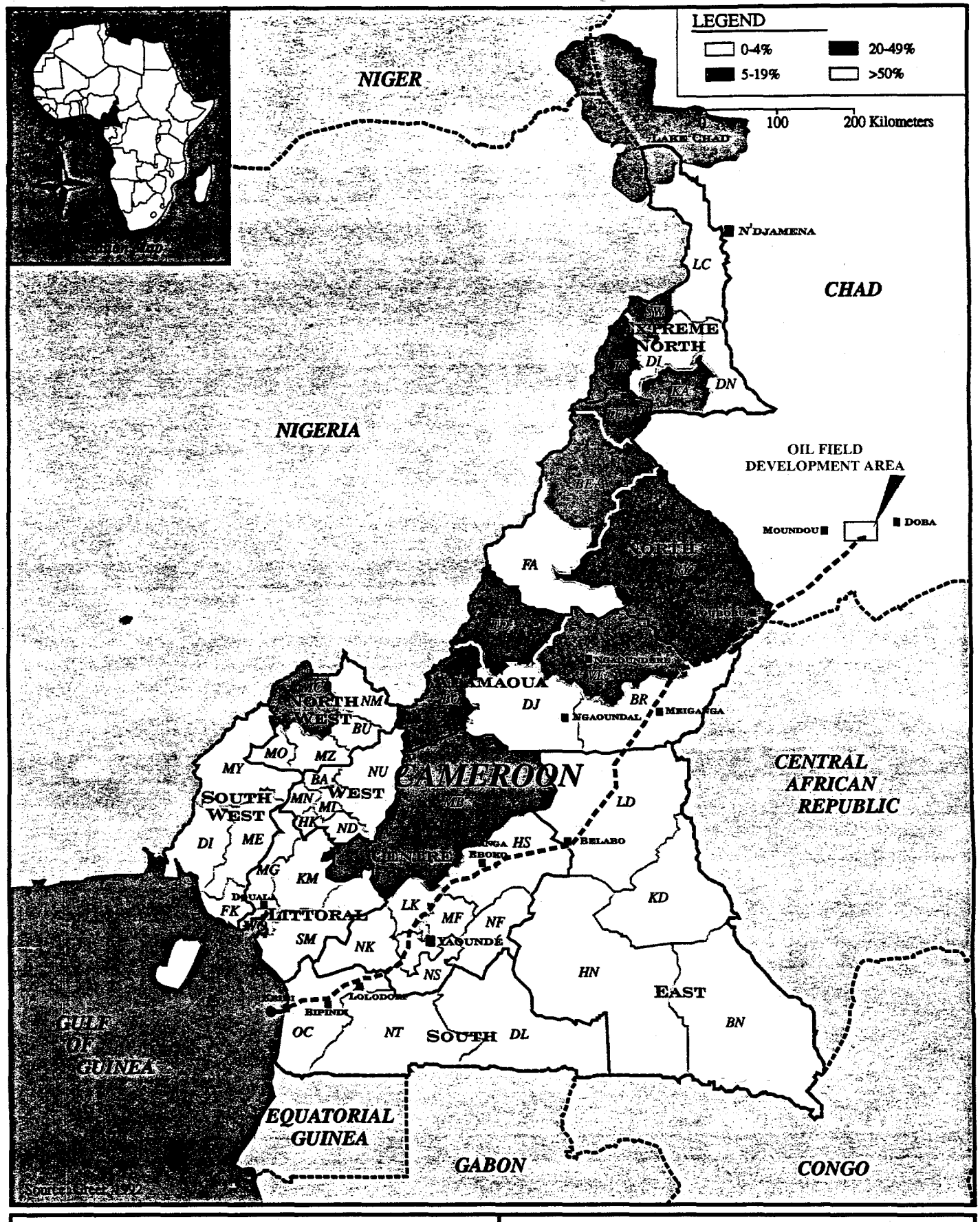
FIGURE D-10



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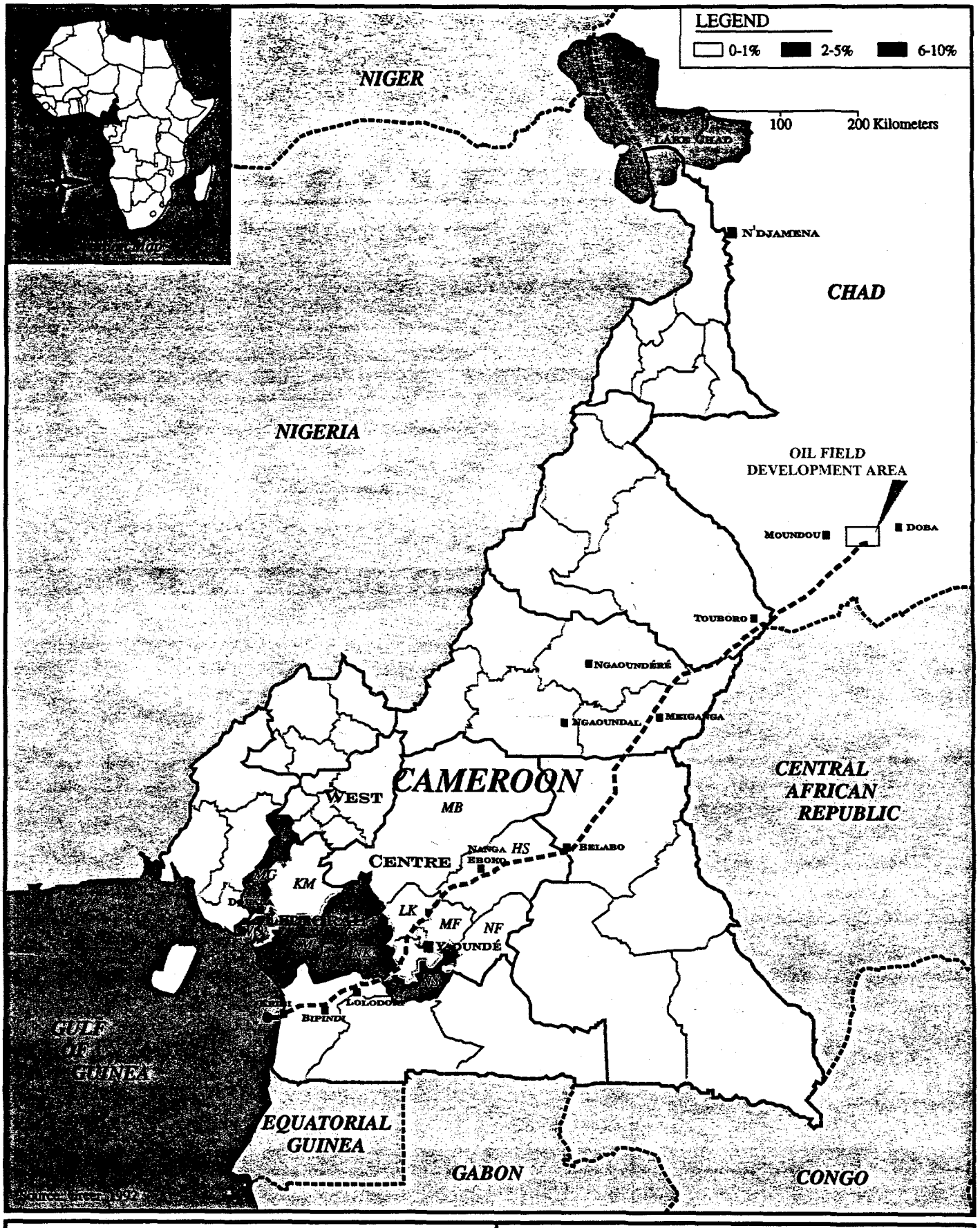
PREVALENCE OF SCHISTOSOMA MANSONI IN 5TH GRADE SCHOOL CHILDREN

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-11



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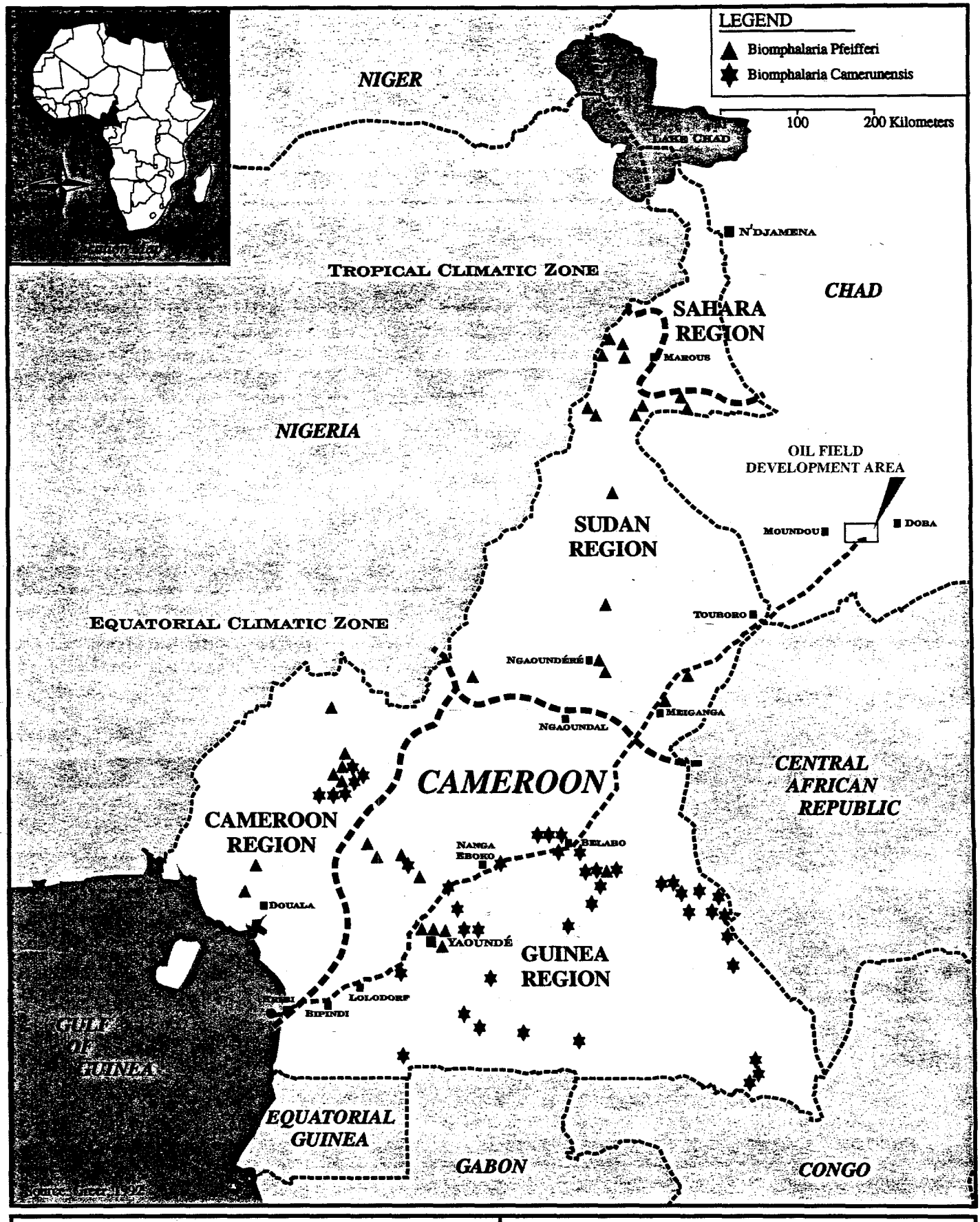
PREVALENCE OF SCHISTOSOMA INTERCALATUM IN 5TH GRADE SCHOOL CHILDREN

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-12

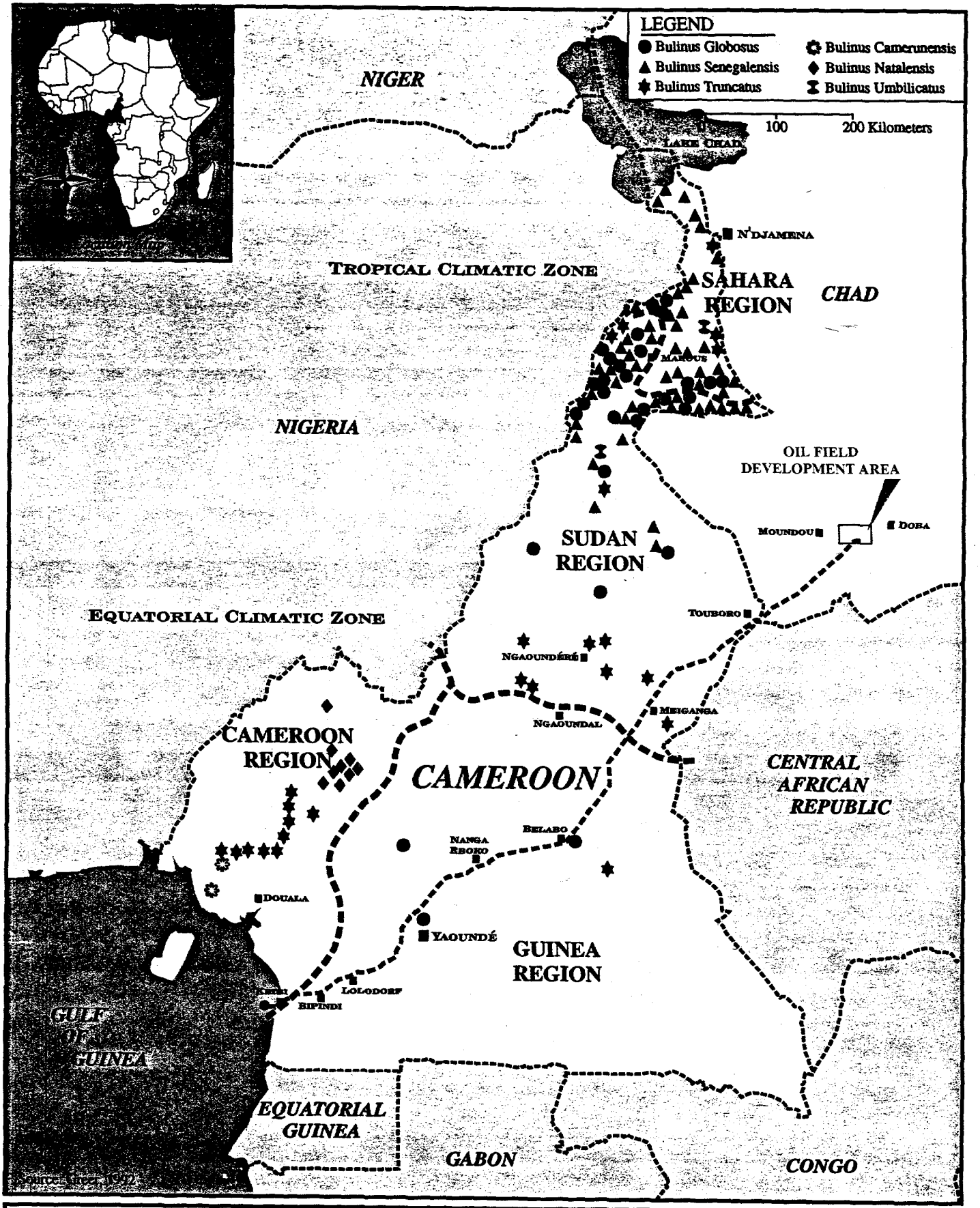


ESSO Exploration and Production Chad Inc.

DISTRIBUTION OF SNAIL HOSTS OF SCHISTOSOMA MANSONI IN CAMEROON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-13

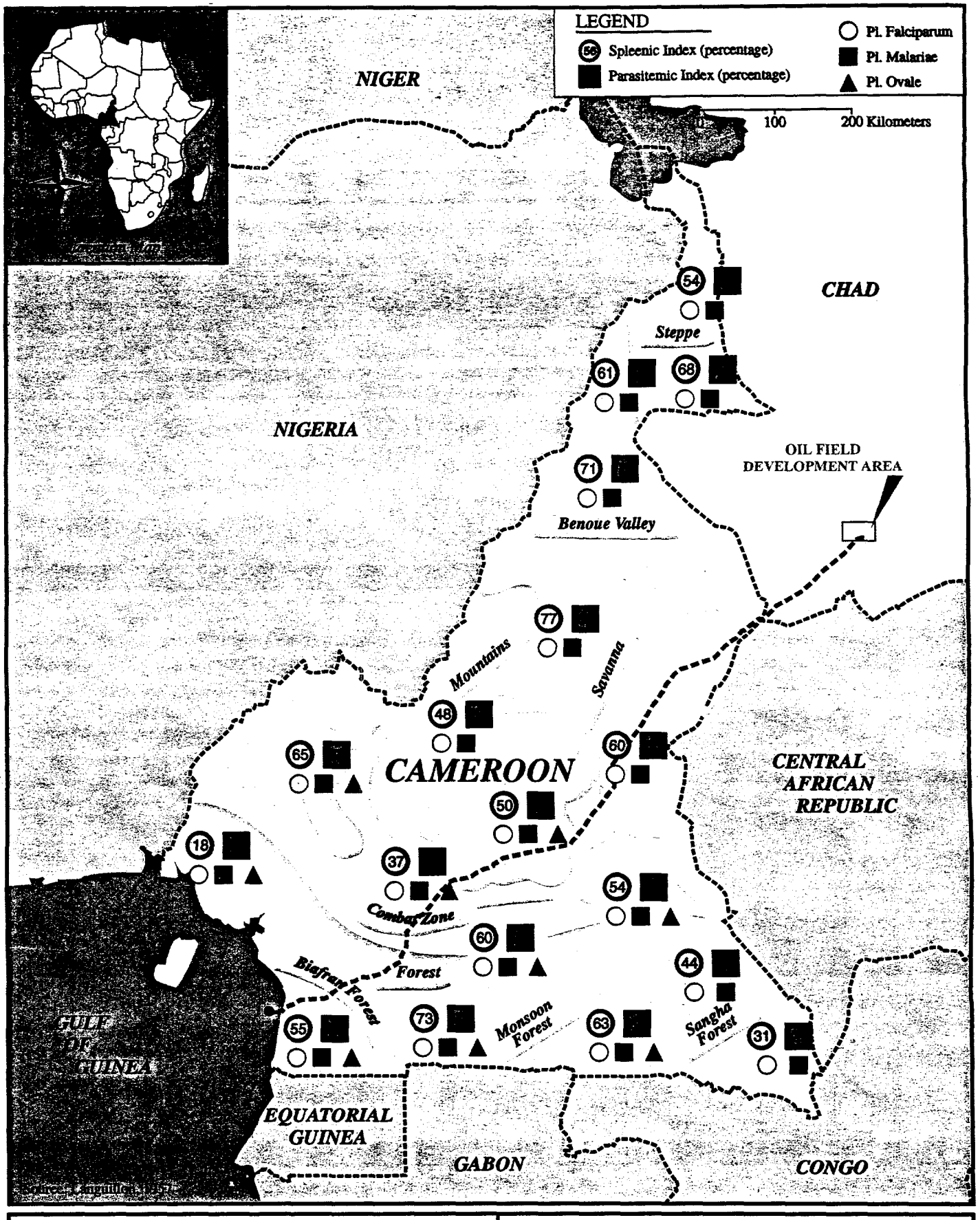


ESSO Exploration and Production Chad Inc.

DISTRIBUTION OF SNAIL HOSTS OF SCHISTOSOMA HEMATOBIUM IN CAMEROON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-14

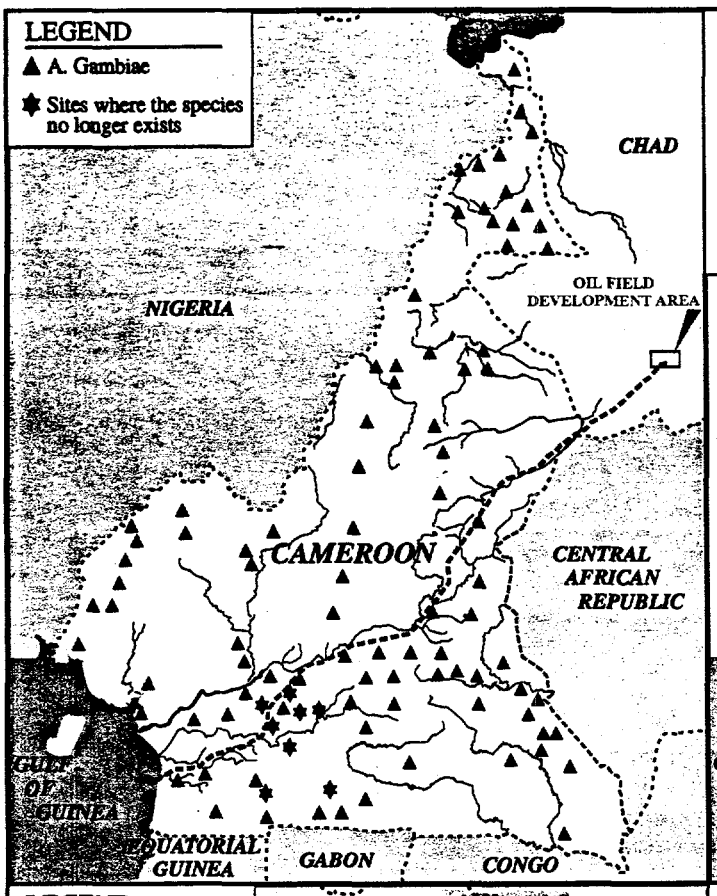


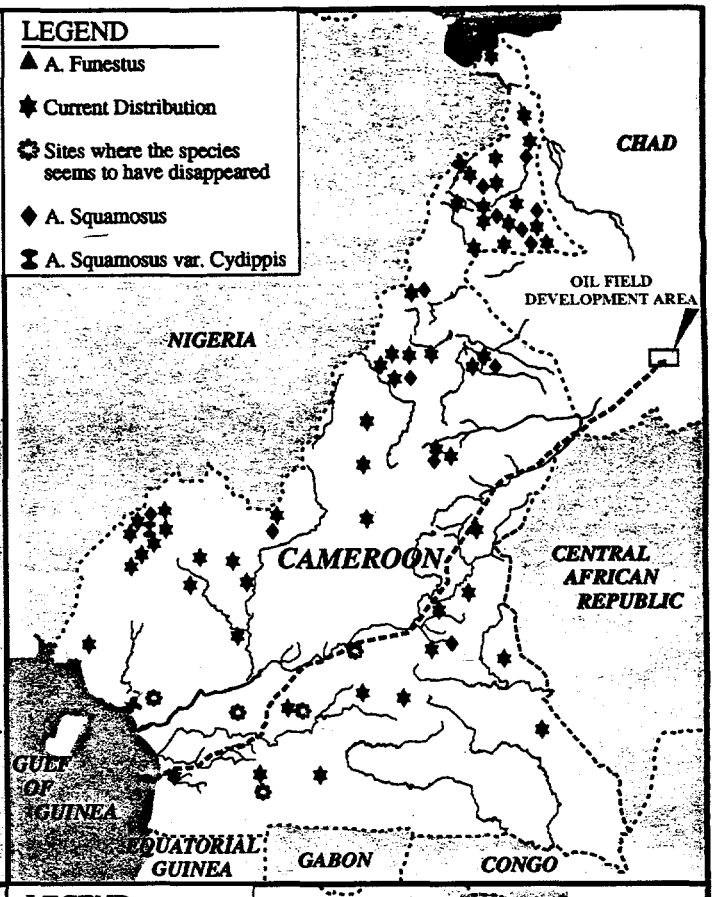
ESSO Exploration and Production Chad Inc.

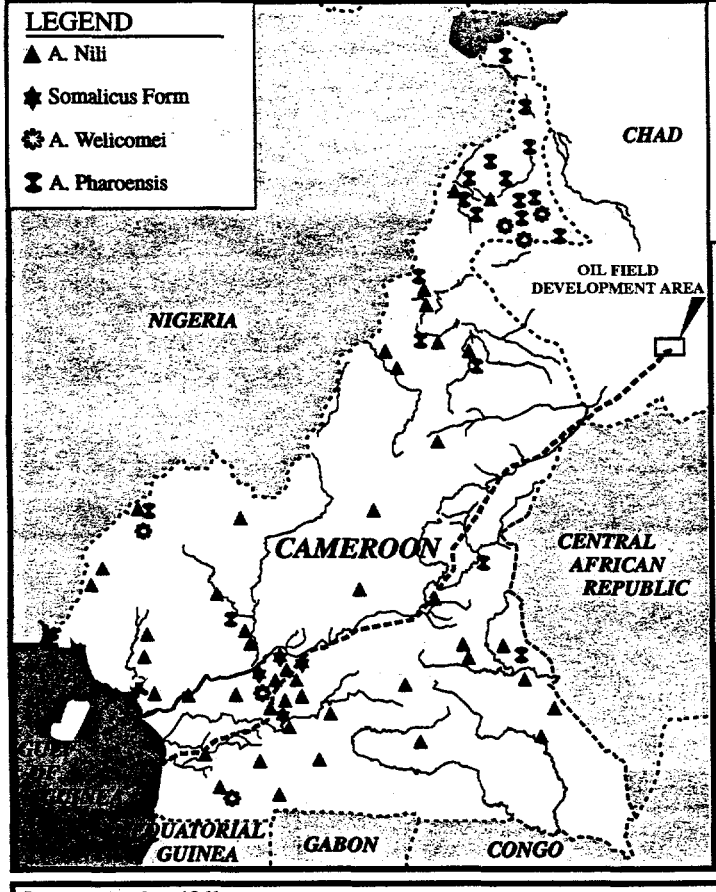
MALARIA INDICES AND SPECIES IN CAMEROON

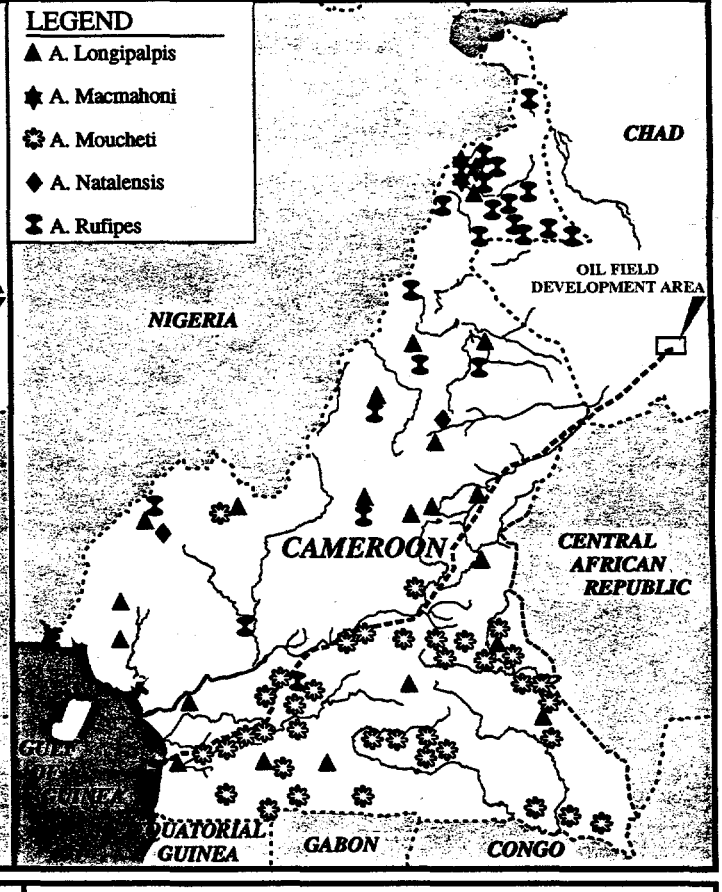
DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-15









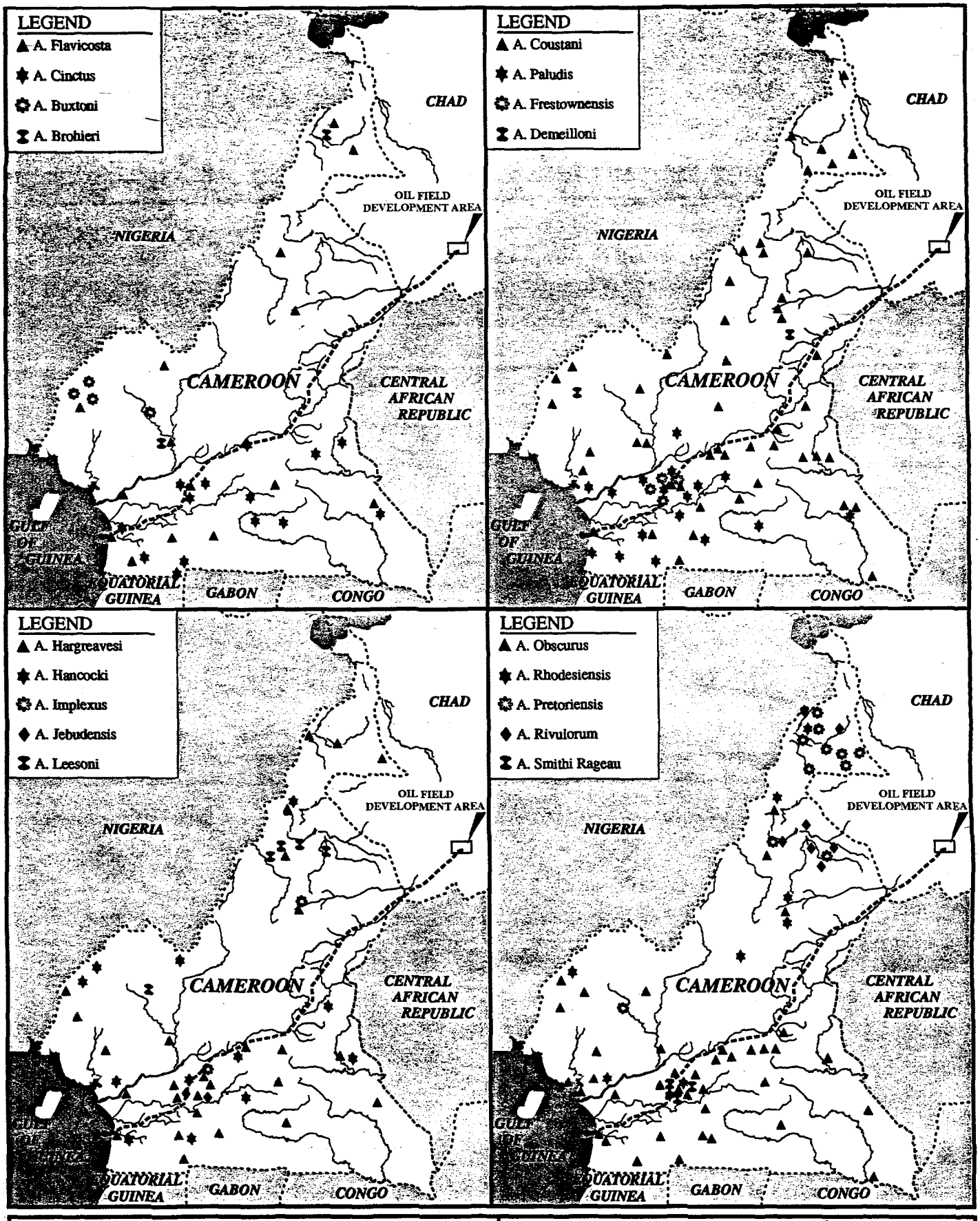
Source: Mouchet, 1961

ESSO Exploration and Production Chad Inc.

DISTRIBUTION OF ANOPHELES IN CAMEROON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-16



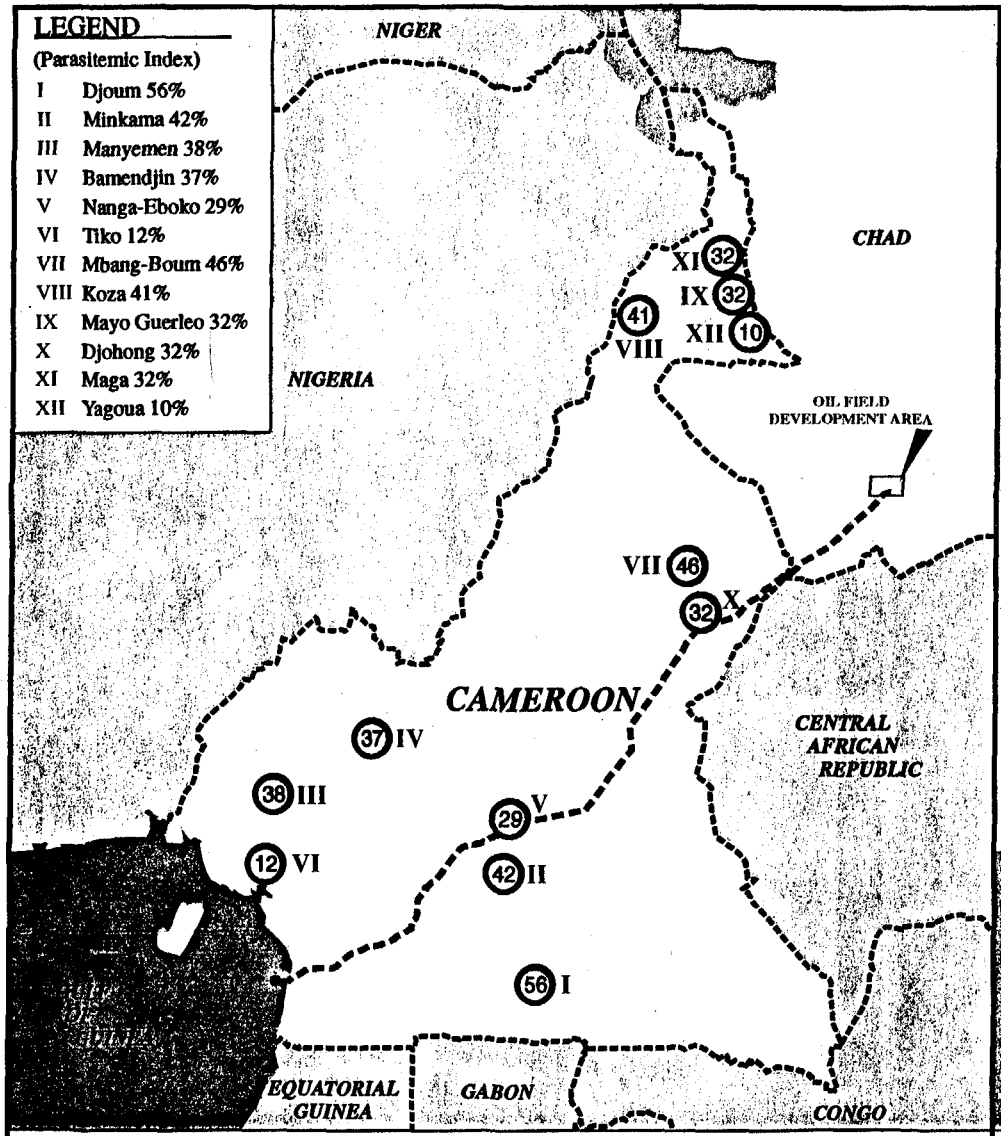
Source: Mouchet, 1961

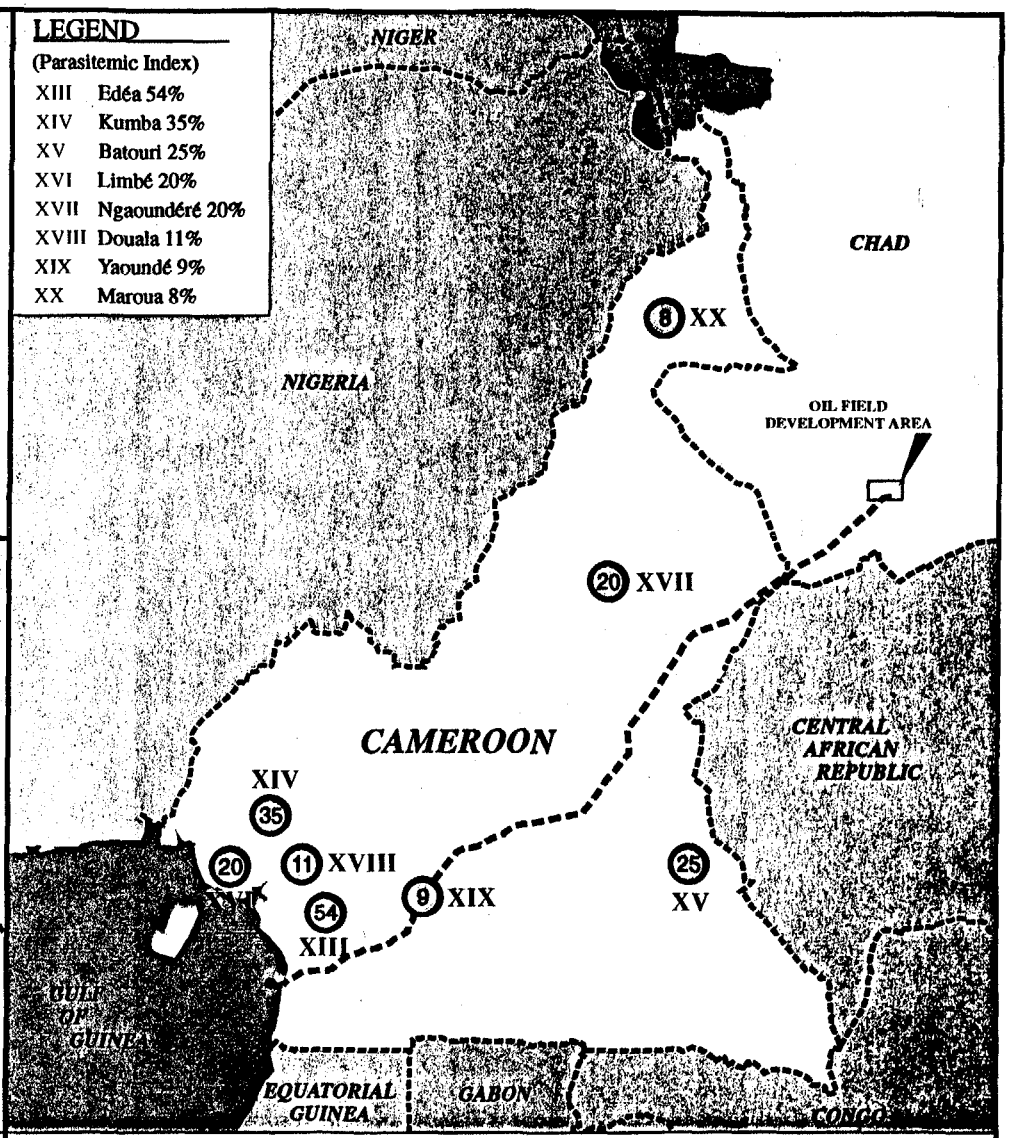
ESSO Exploration and Production Chad Inc.

DISTRIBUTION OF ANOPHELES IN CAMEROON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-17





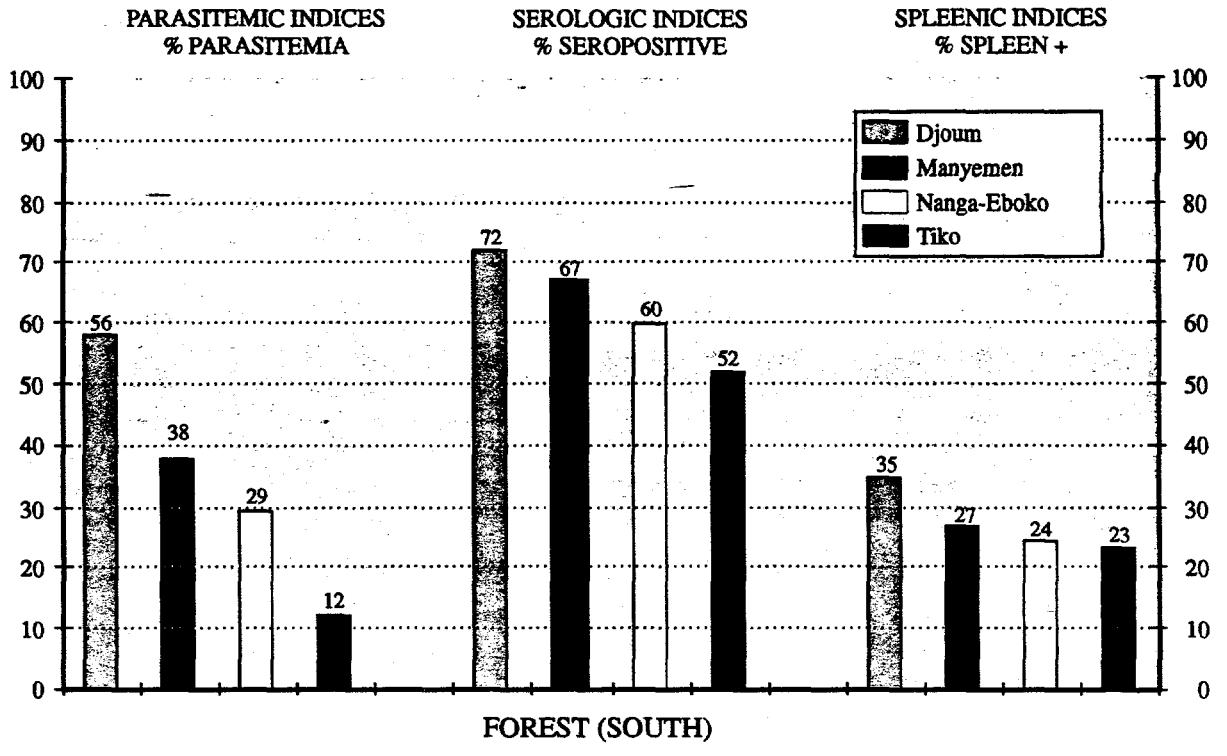
Source: Ripert, 1990

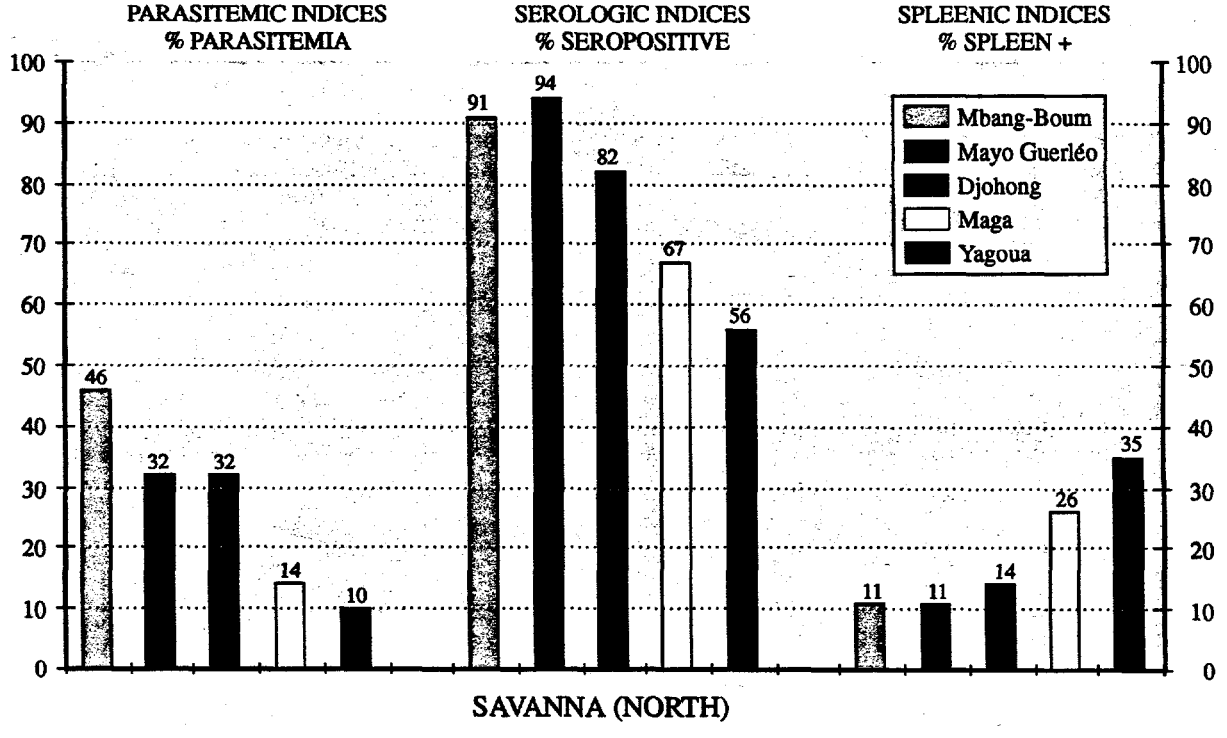
ESSO Exploration and Production Chad Inc.

MALARIA MAPS - CAMEROON 1990 (BASED ON PARASITEMIC INDICES)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-18





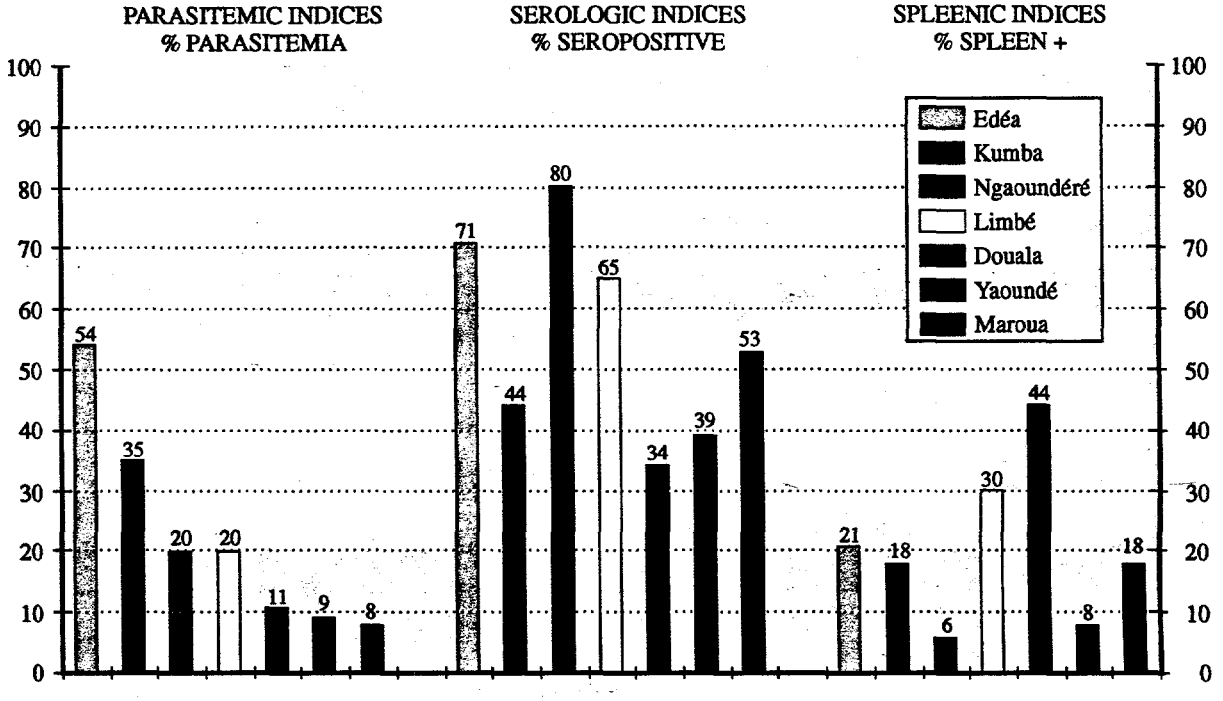
Source: Ripert, 1990

ESSO Exploration and Production Chad Inc.

MALARIA INDICES IN RURAL FOREST AND SAVANNA REGIONS

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-19



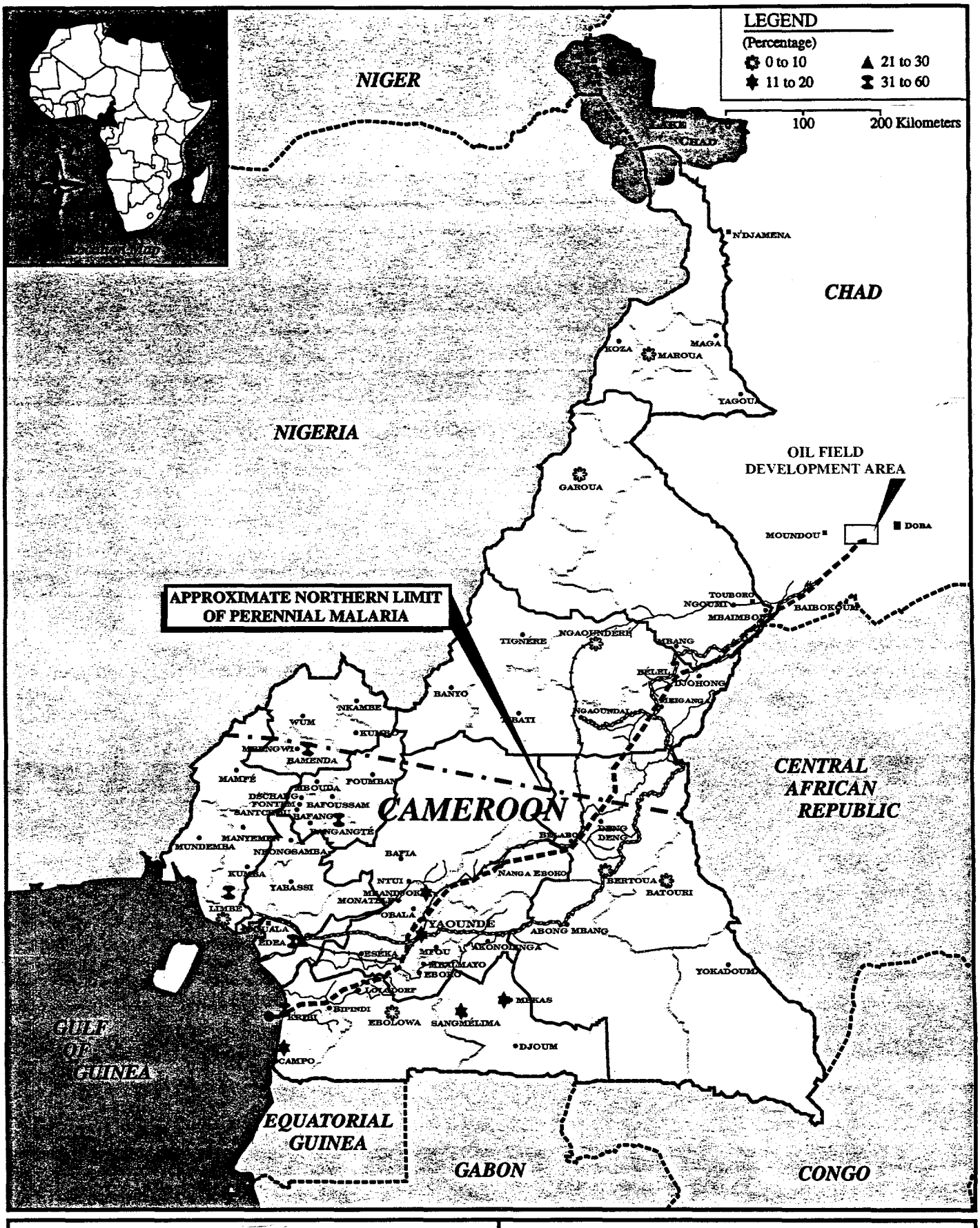
Source: Ripert, 1990

ESSO Exploration and Production Chad Inc.

MALARIA INDICES IN CITY LOCATIONS

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-20

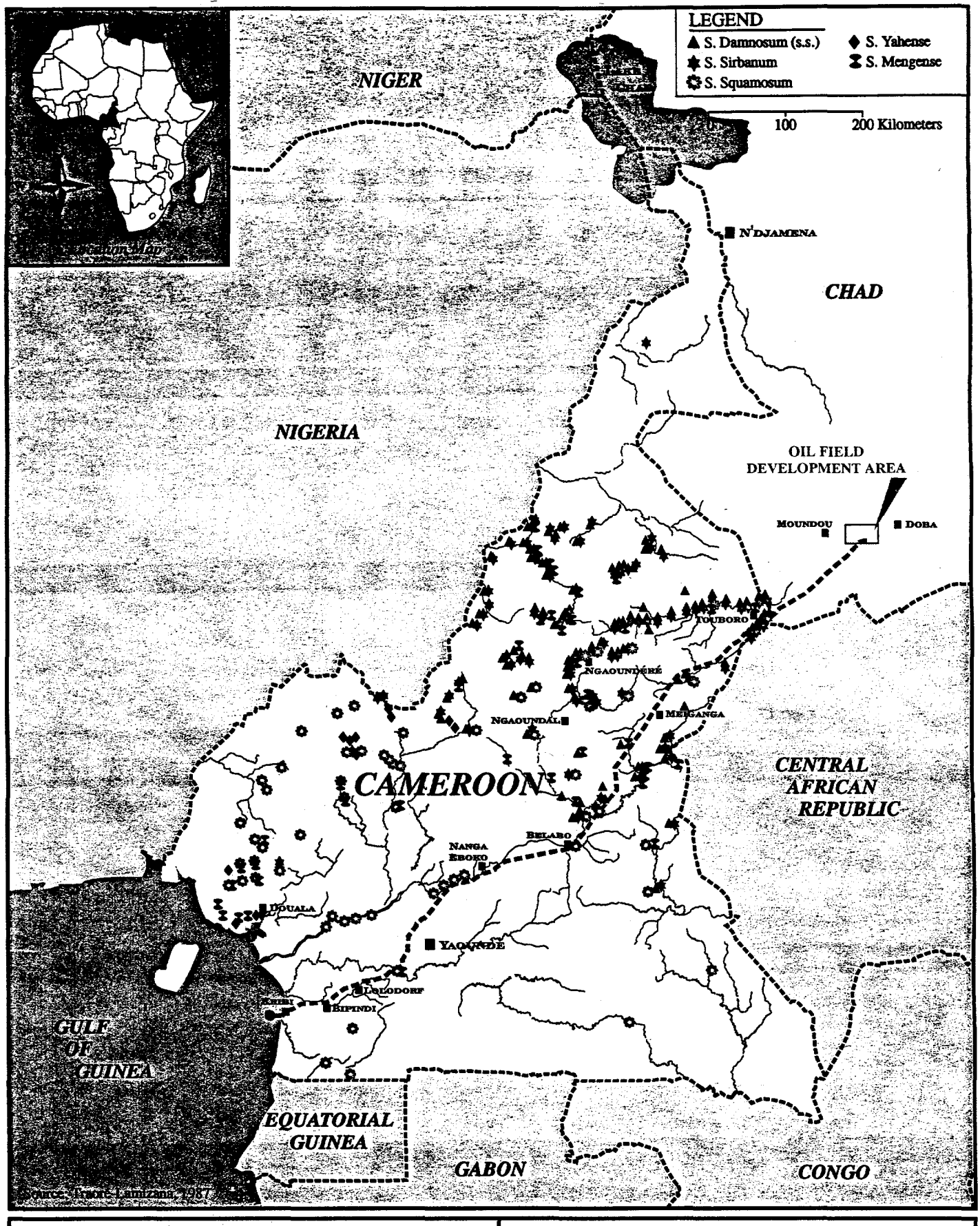


ESSO Exploration and Production Chad Inc.

MALARIA - CHLOROQUINE RESISTANCE 1985-1995

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-21

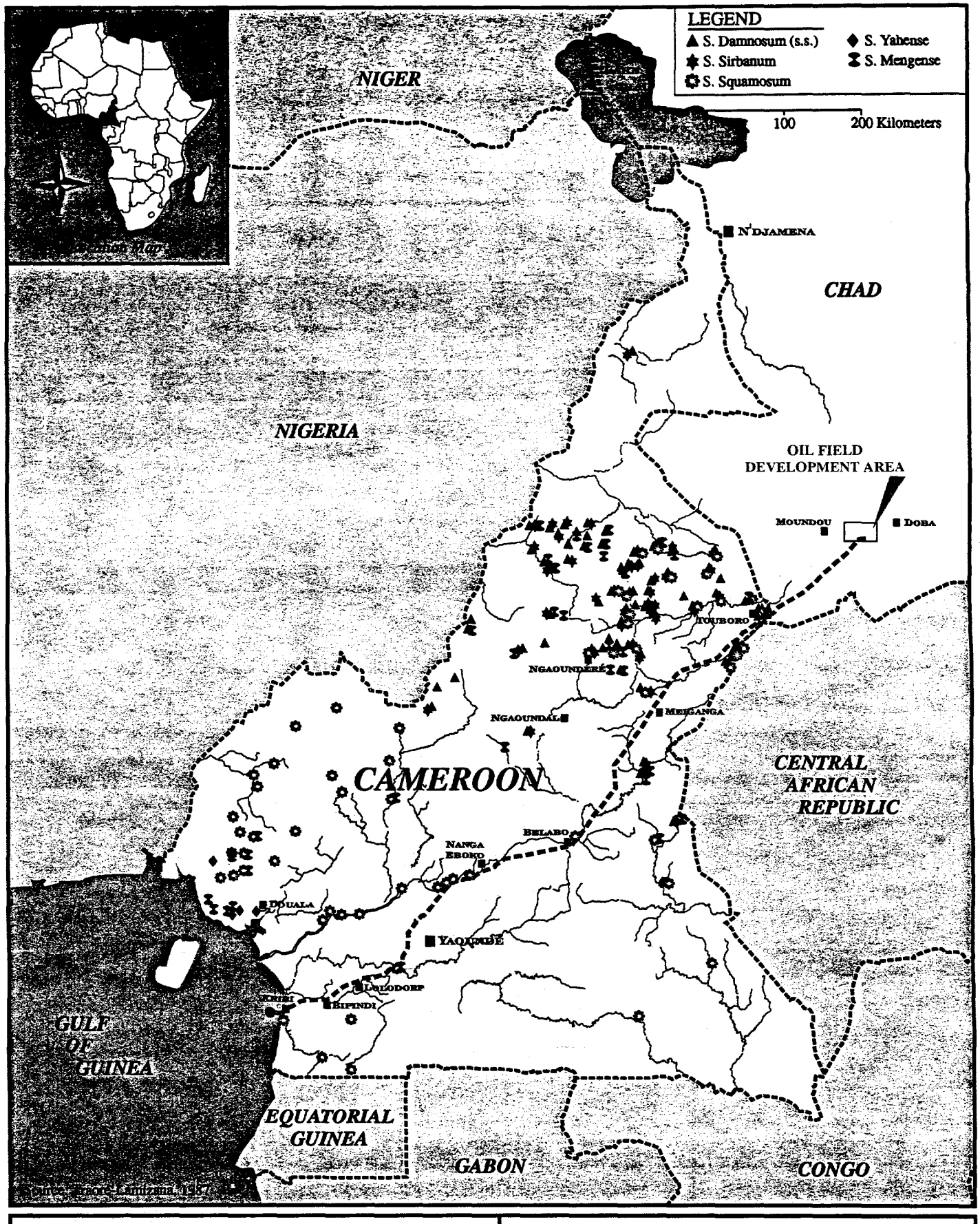


ESSO Exploration and Production Chad Inc.

DISTRIBUTION MAP FOR THE SIMULIUM DAMNOSUM COMPLEX IN CAMEROON DRY SEASON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-22

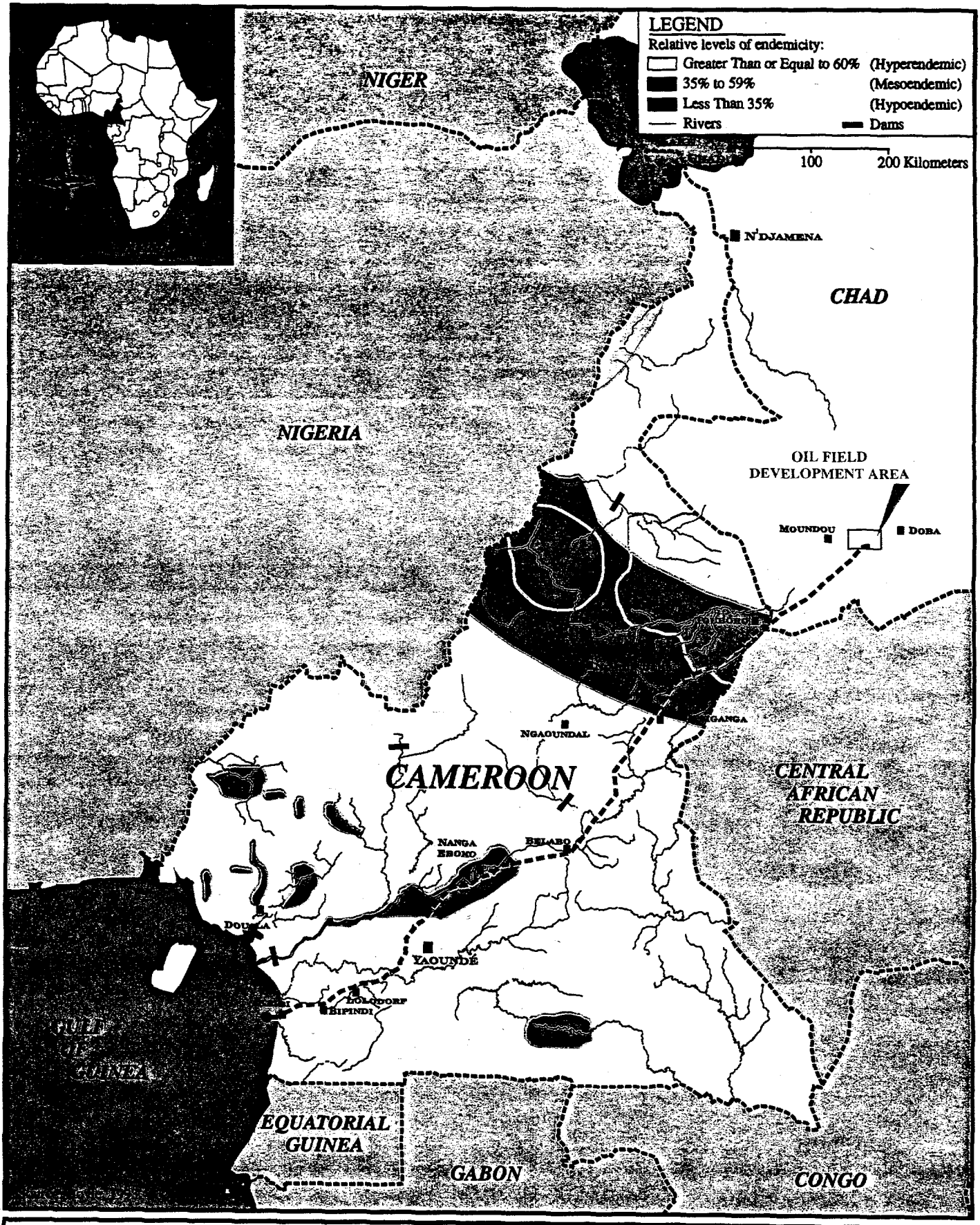


ESSO Exploration and Production Chad Inc.

DISTRIBUTION MAP FOR THE SIMULIUM DAMNOSUM COMPLEX IN CAMEROON WET SEASON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-23

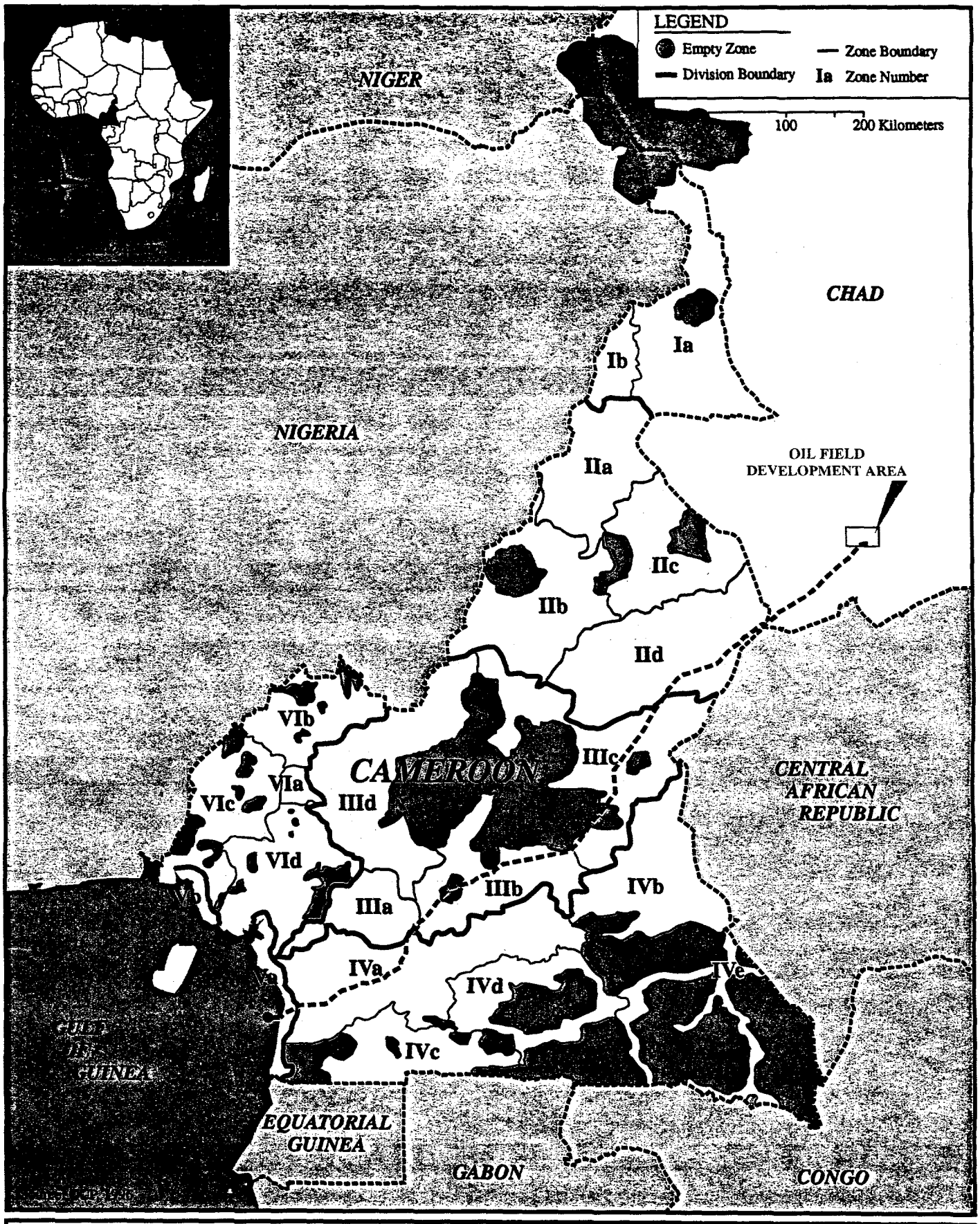


ESSO Exploration and Production Chad Inc.

MAJOR KNOWN FOCI OF ONCHOCERCIASIS IN CAMEROON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-24

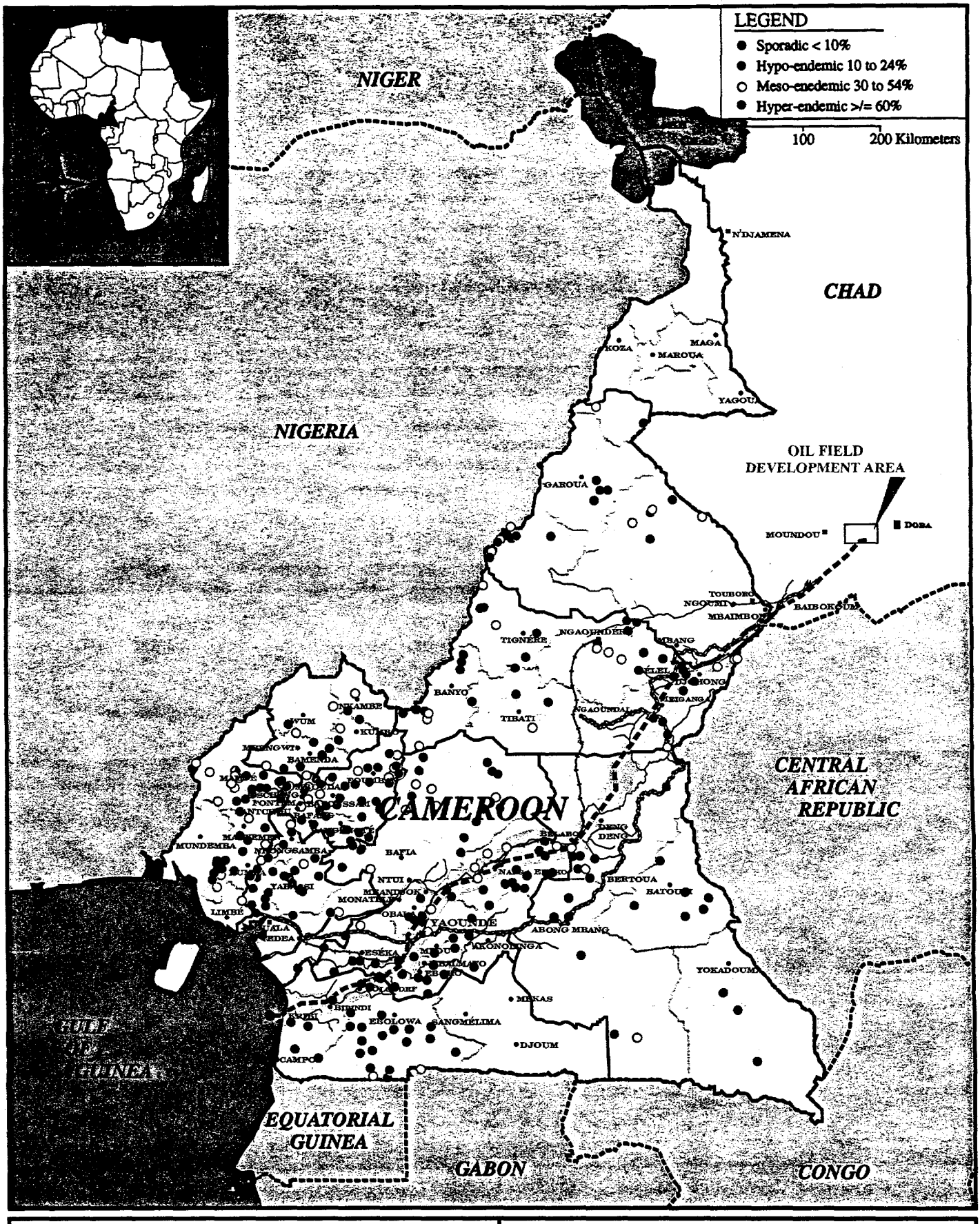


ESSO Exploration and Production Chad Inc.

SUBDIVISION OF CAMEROON INTO ZONES FOR ONCHOCERCIASIS MAPPING

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-25

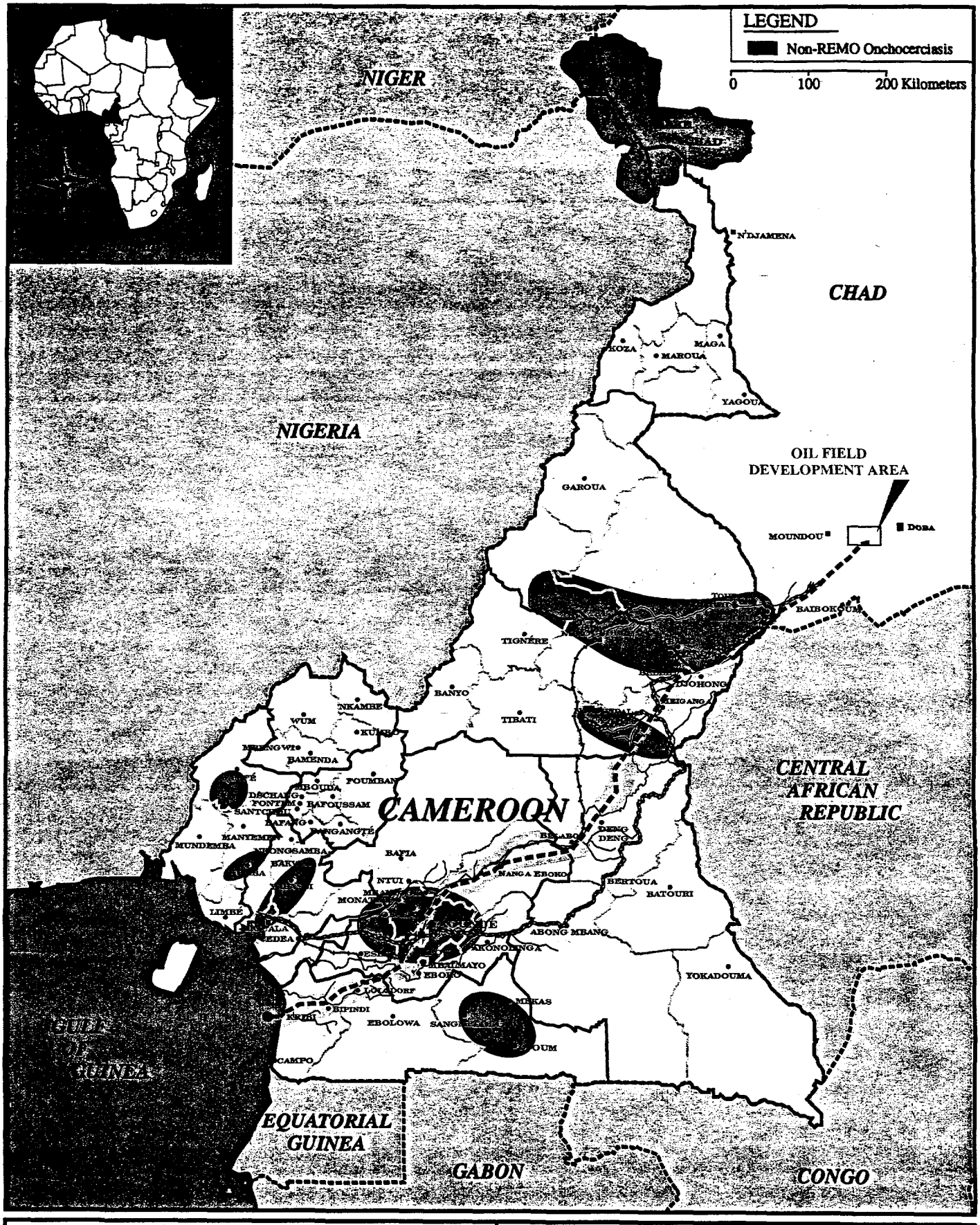


ESSO Exploration and Production Chad Inc.

REMO ONCHOCERCIASIS 1994 - 1996

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-26

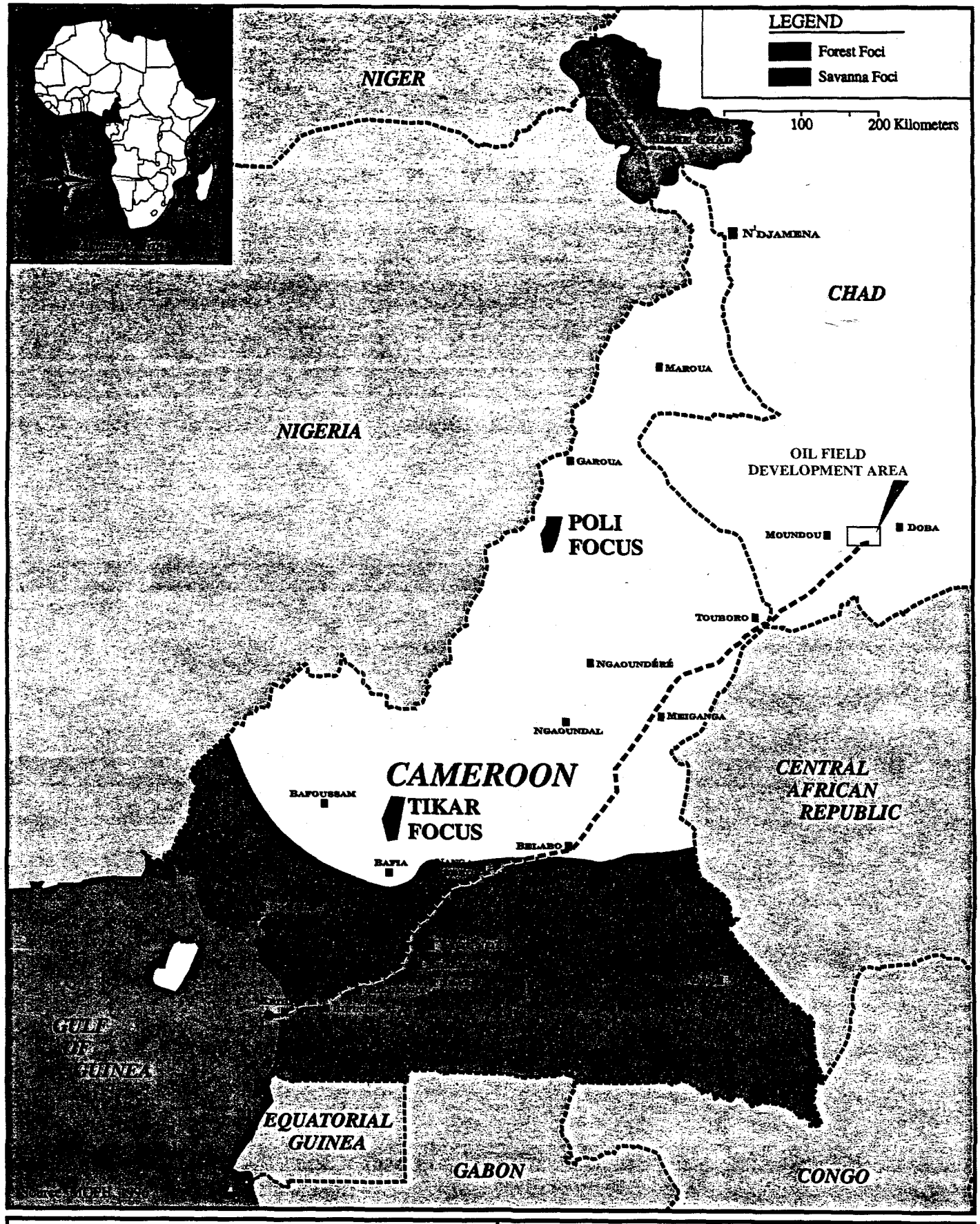


ESSO Exploration and Production Chad Inc.

NON-REMO ONCHOCERCIASIS PREVALENCE STUDIES 1987 - 1997

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-27

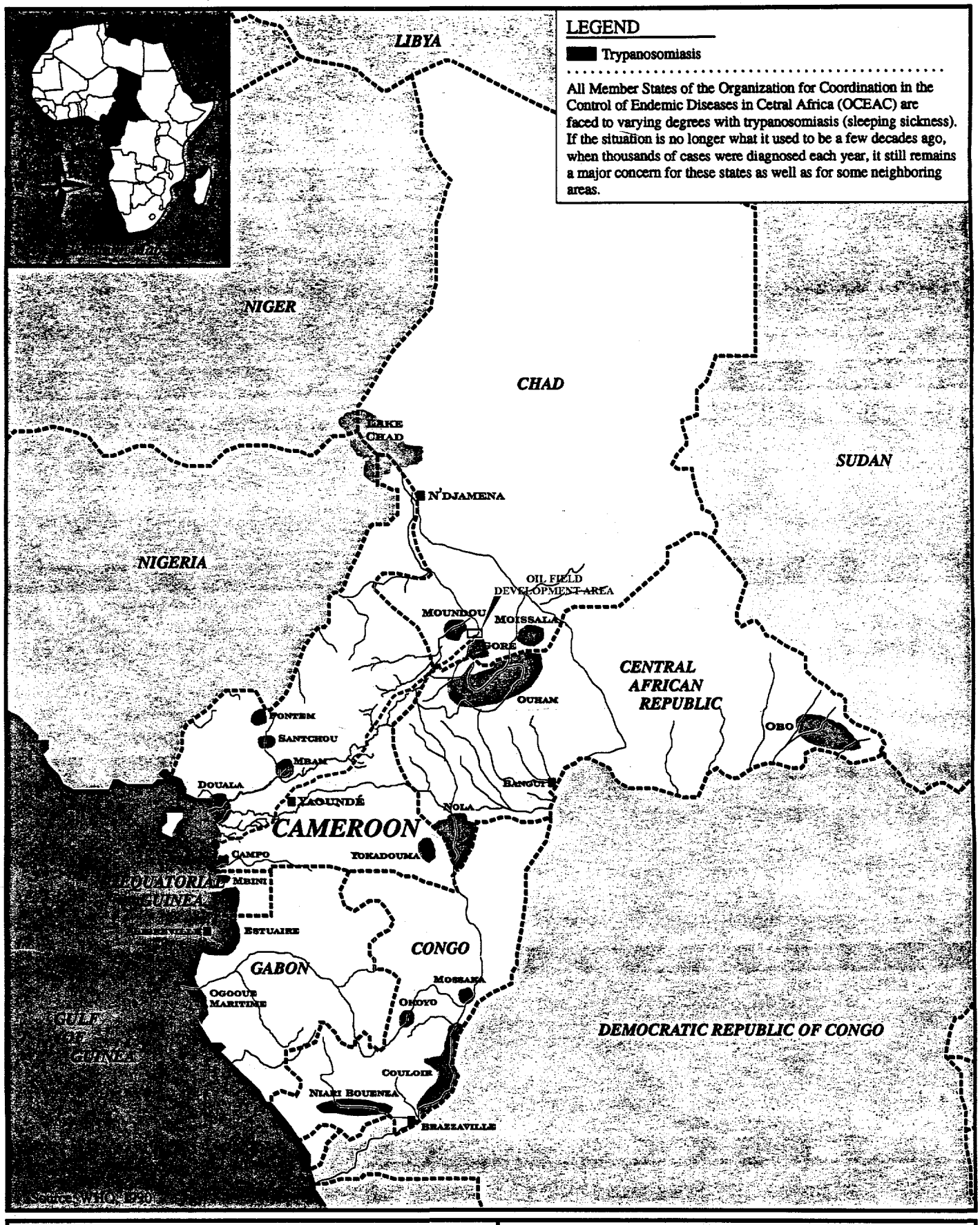


ESSO Exploration and Production Chad Inc.

LOASIS DISTRIBUTION MAP

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-28

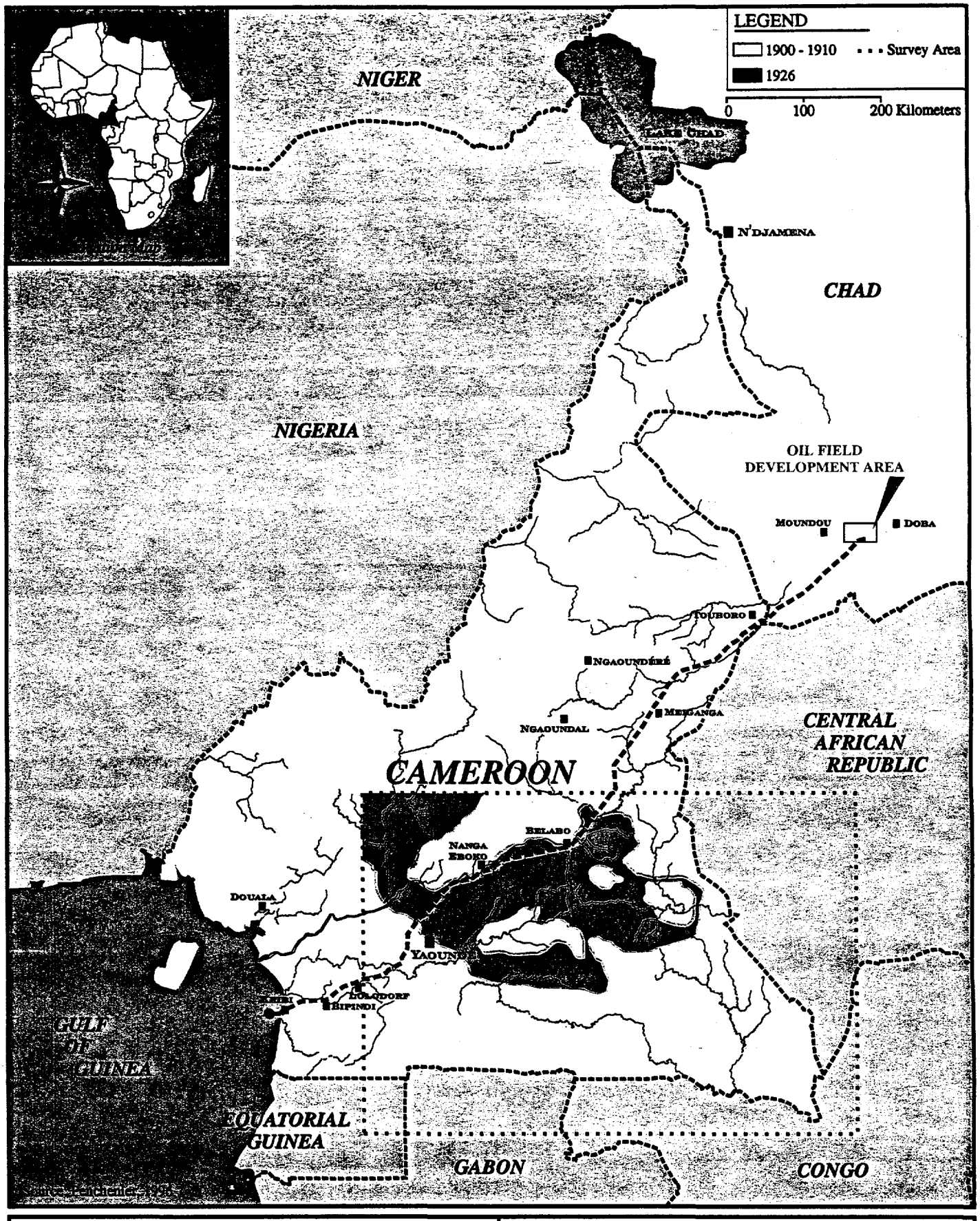


ESSO Exploration and Production Chad Inc.

TRYPANOSOMIASIS (SITUATION IN THE OCEAC MEMBER STATES)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-29

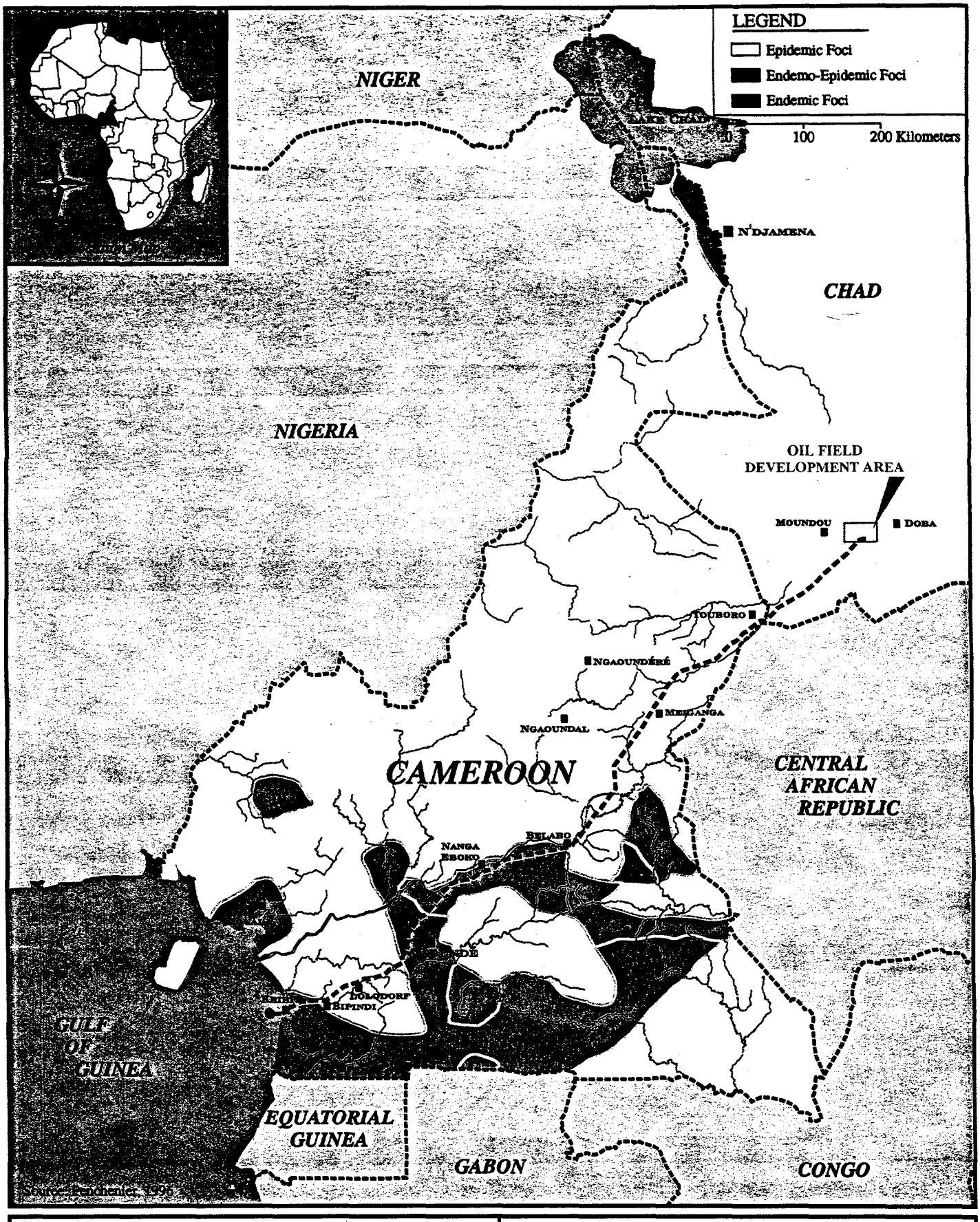


ESSO Exploration and Production Chad Inc.

HUMAN TRYPANOSOMIASIS FOCI IN CAMEROON FROM 1900 TO 1926

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-30

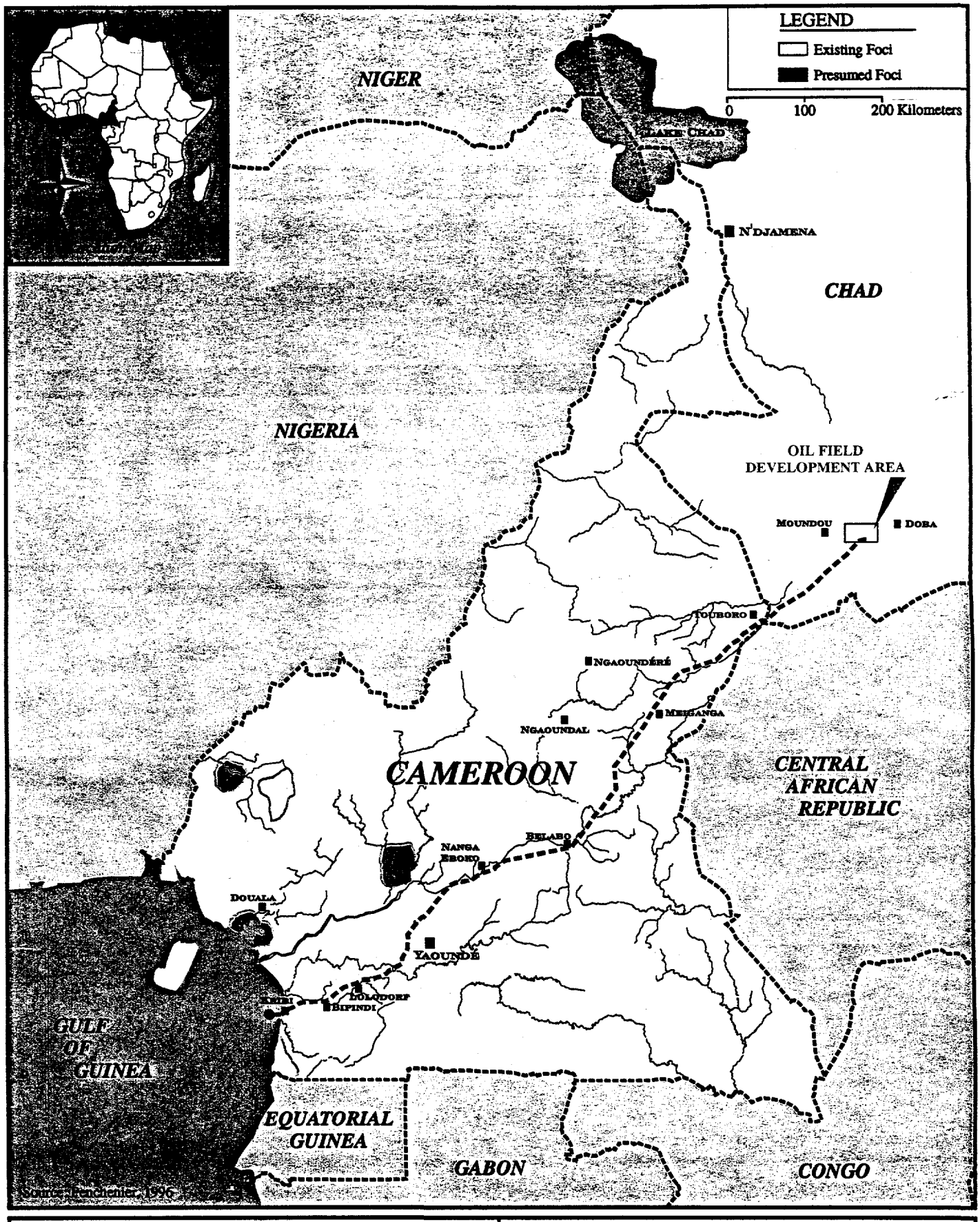


ESSO Exploration and Production Chad Inc.

HUMAN TRYPANOSOMIASIS IN CAMEROON IN 1930

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-31

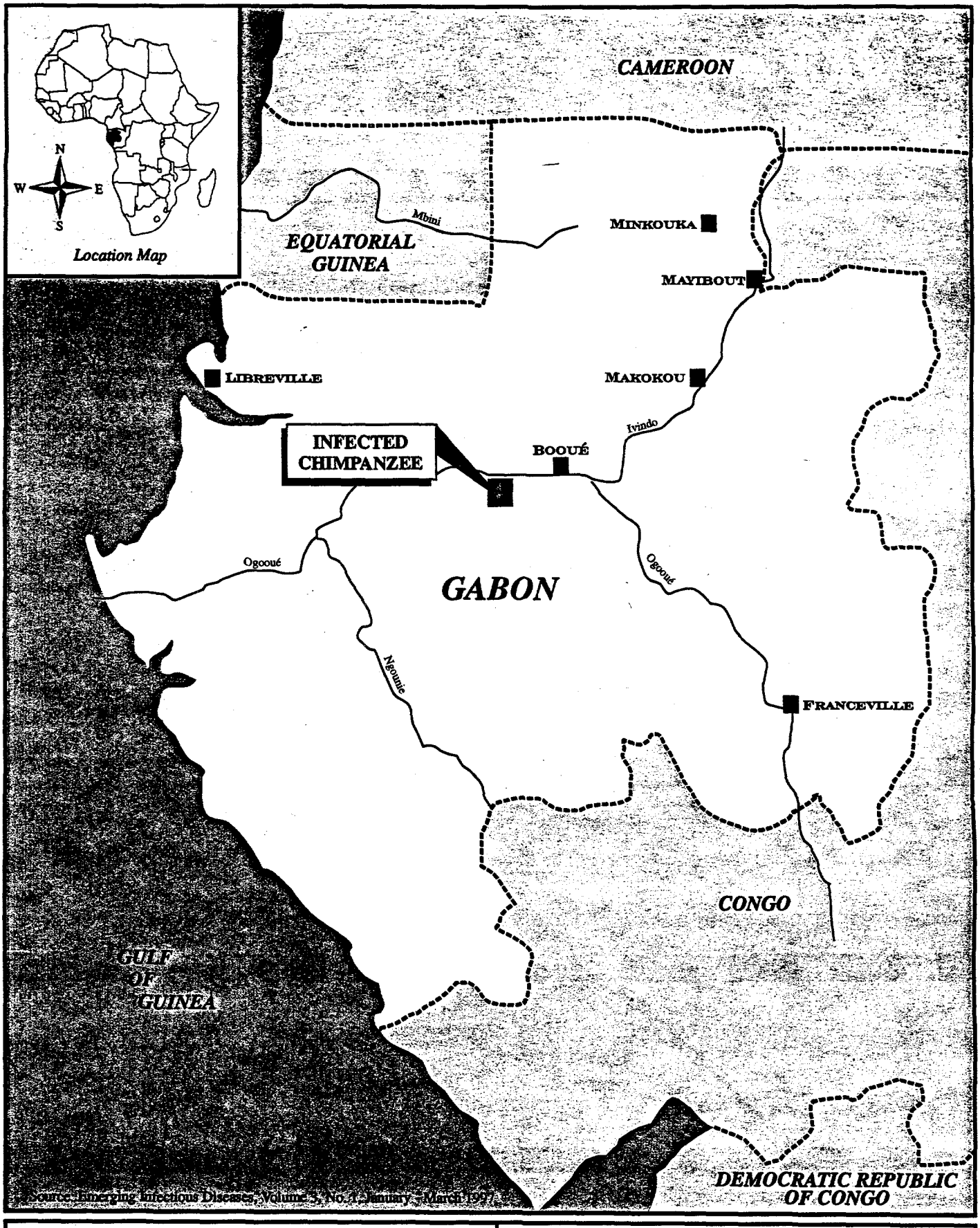


ESSO Exploration and Production Chad Inc.

PRESUMED FOCI FOR HUMAN TRYPANOSOMIASIS IN CAMEROON - 1996

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-32

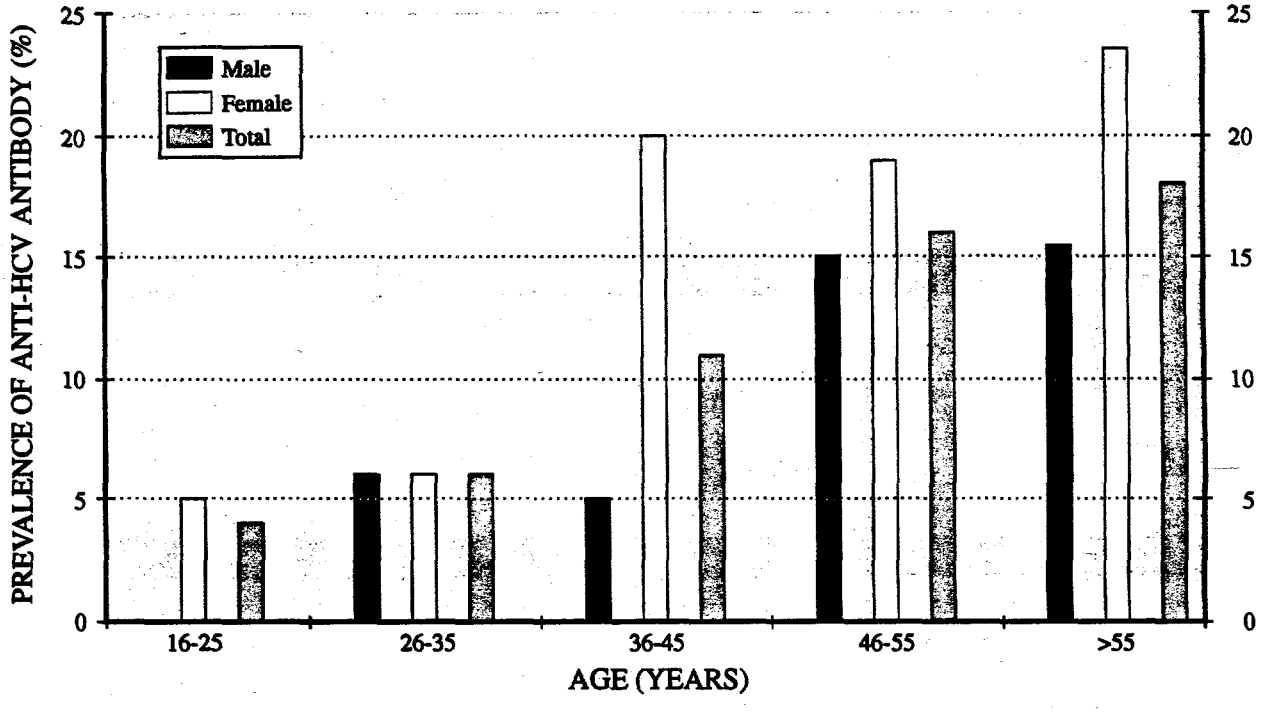


ESSO Exploration and Production Chad Inc.

EBOLA EPIDEMIC GABON 1994 -1996

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-33



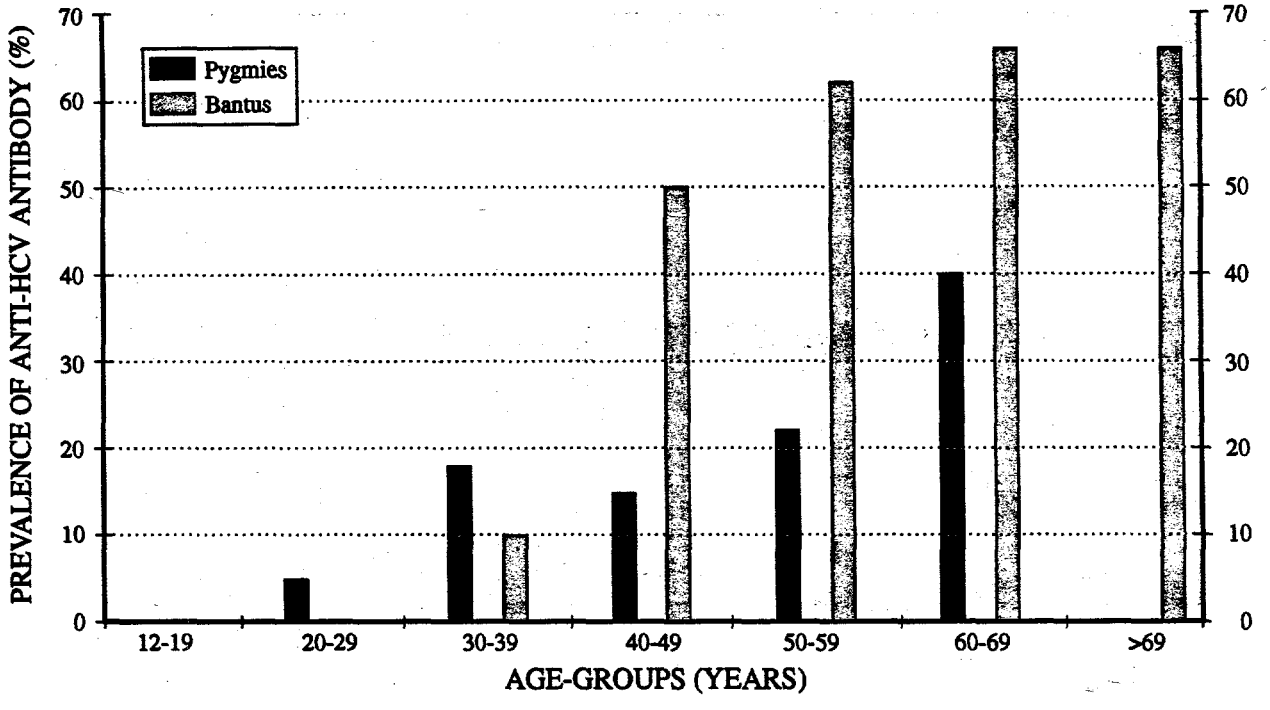
Source: Mencarini et al., 1991

ESSO Exploration and Production Chad Inc.

PREVALENCE OF ANTI-HEPATITIS C VIRUS ANTIBODY IN CAMEROON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-34



PYGMIES	(39)	(21)	(11)	(13)	(13)	(10)	(1)
BANTUS	(16)	(4)	(9)	(8)	(16)	(3)	(3)

NUMBER TESTED IN PARENTHESES

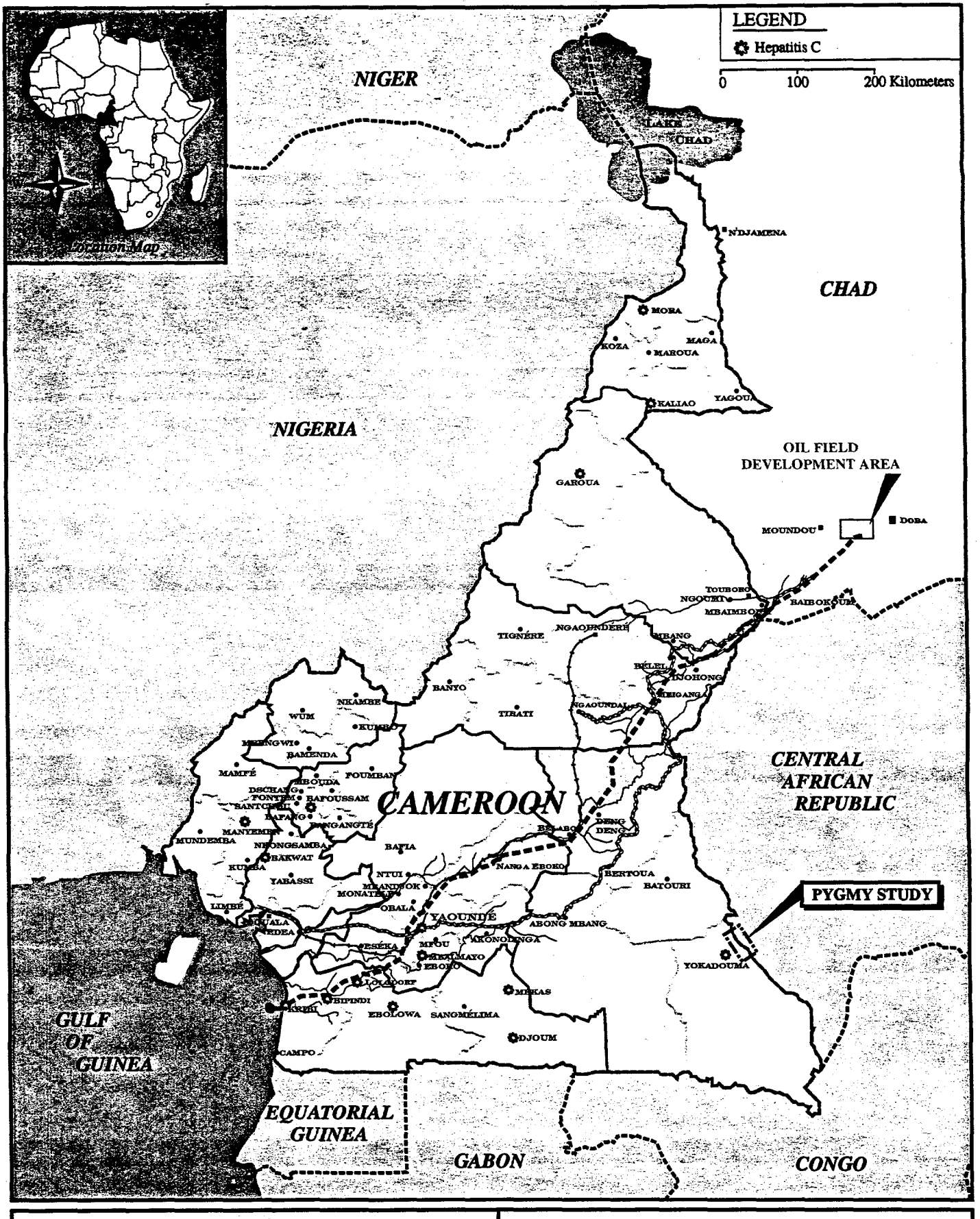
Source: Kowo et al., 1995

ESSO Exploration and Production Chad Inc.

HCV IN PYGMY & BANTU POPULATIONS IN CAMEROON

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-35

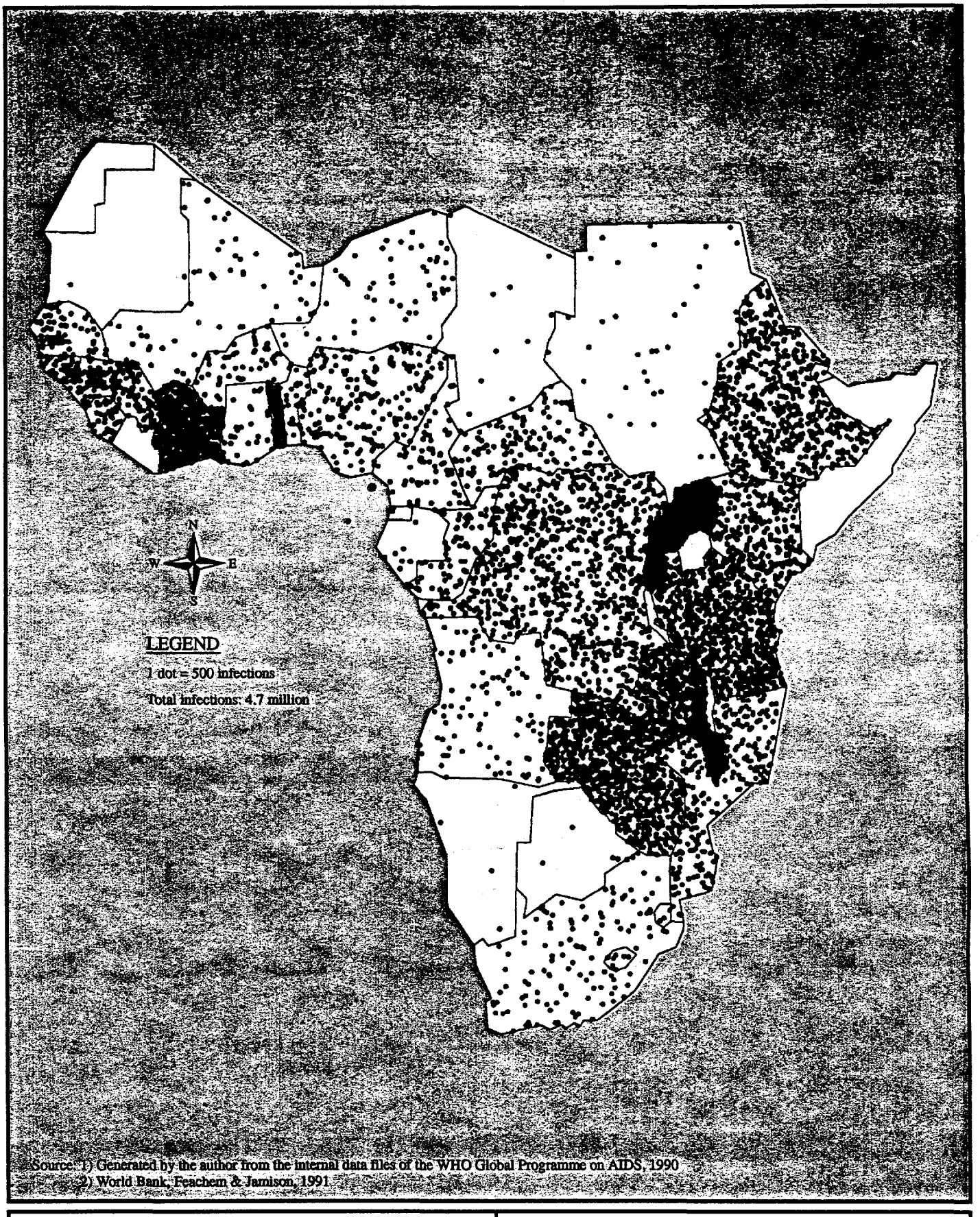


ESSO Exploration and Production Chad Inc.

HEPATITIS C STUDY LOCATIONS

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-36



Source: 1) Generated by the author from the internal data files of the WHO Global Programme on AIDS, 1990
2) World Bank, Feachem & Jamison, 1991

ESSO Exploration and Production Chad Inc.

ESTIMATED HIV INFECTIONS JANUARY 1990

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-37

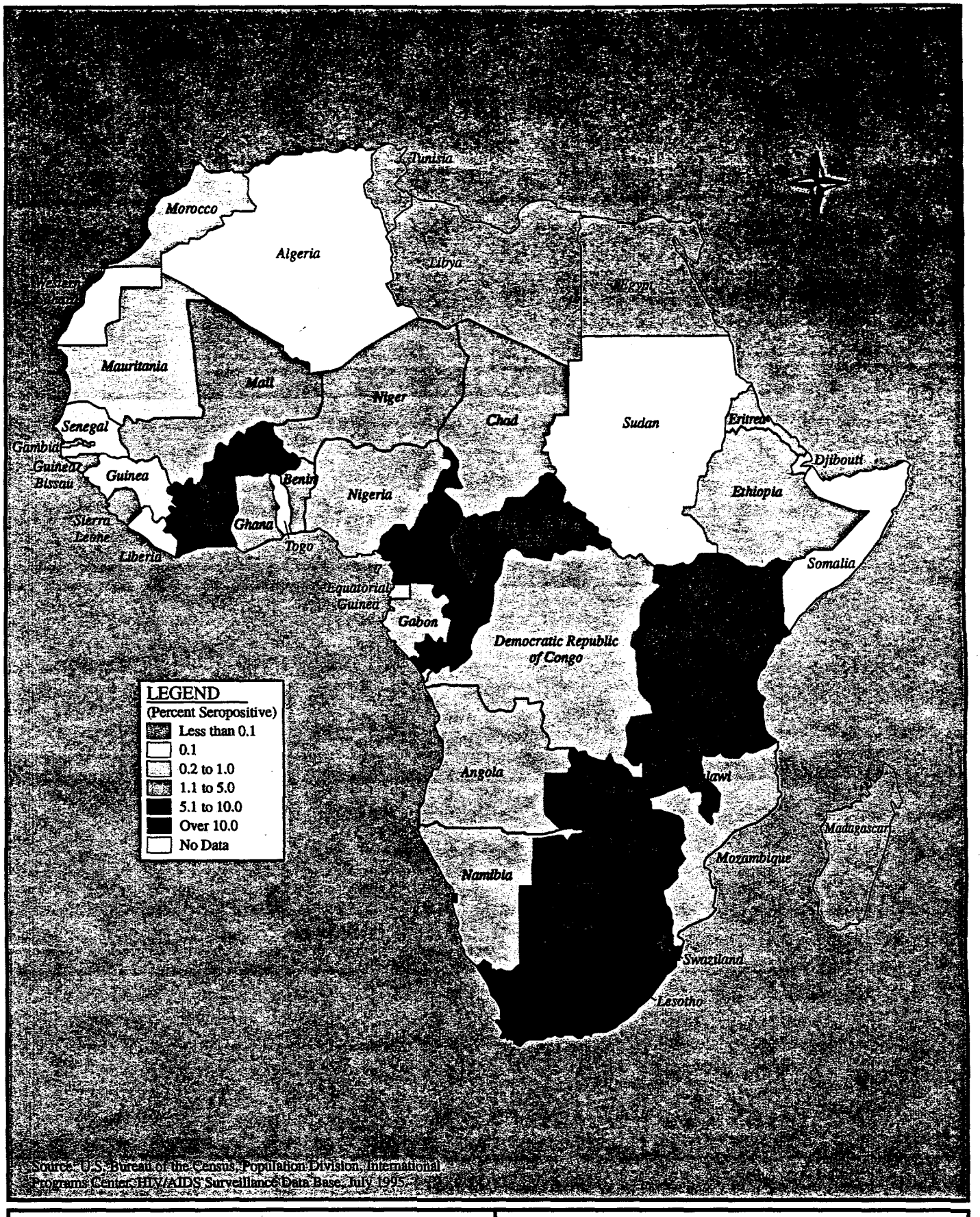
Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, July 1995

ESSO Exploration and Production Chad Inc.

AFRICAN HIV-1 SEROPREVALENCE FOR HIGH-RISK URBAN POPULATIONS (MAP 1 - 1995)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-38



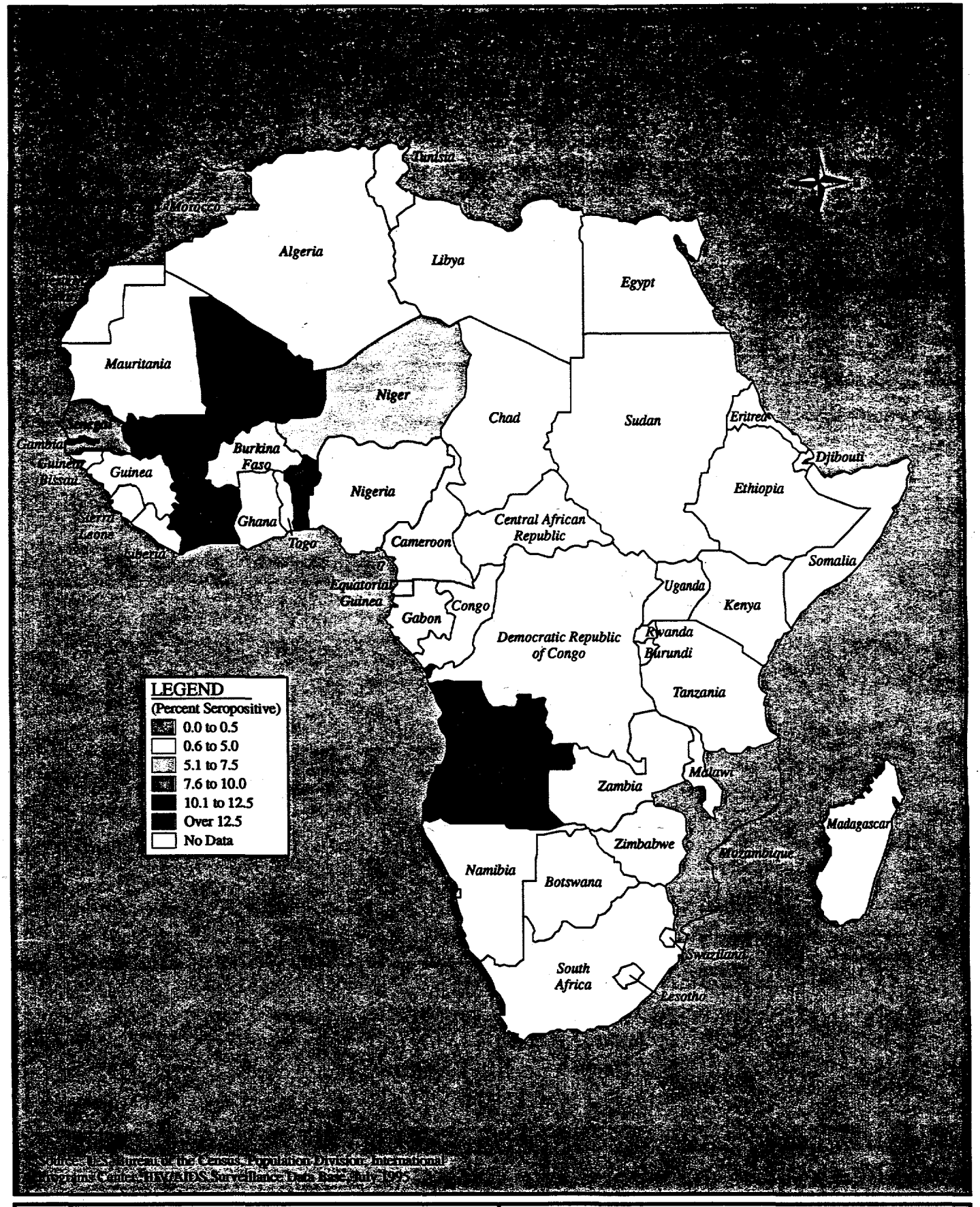
Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, July 1995.

ESSO Exploration and Production Chad Inc.

AFRICAN HIV-1 SEROPREVALENCE FOR LOW-RISK URBAN POPULATIONS (MAP 2 - 1995)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-39



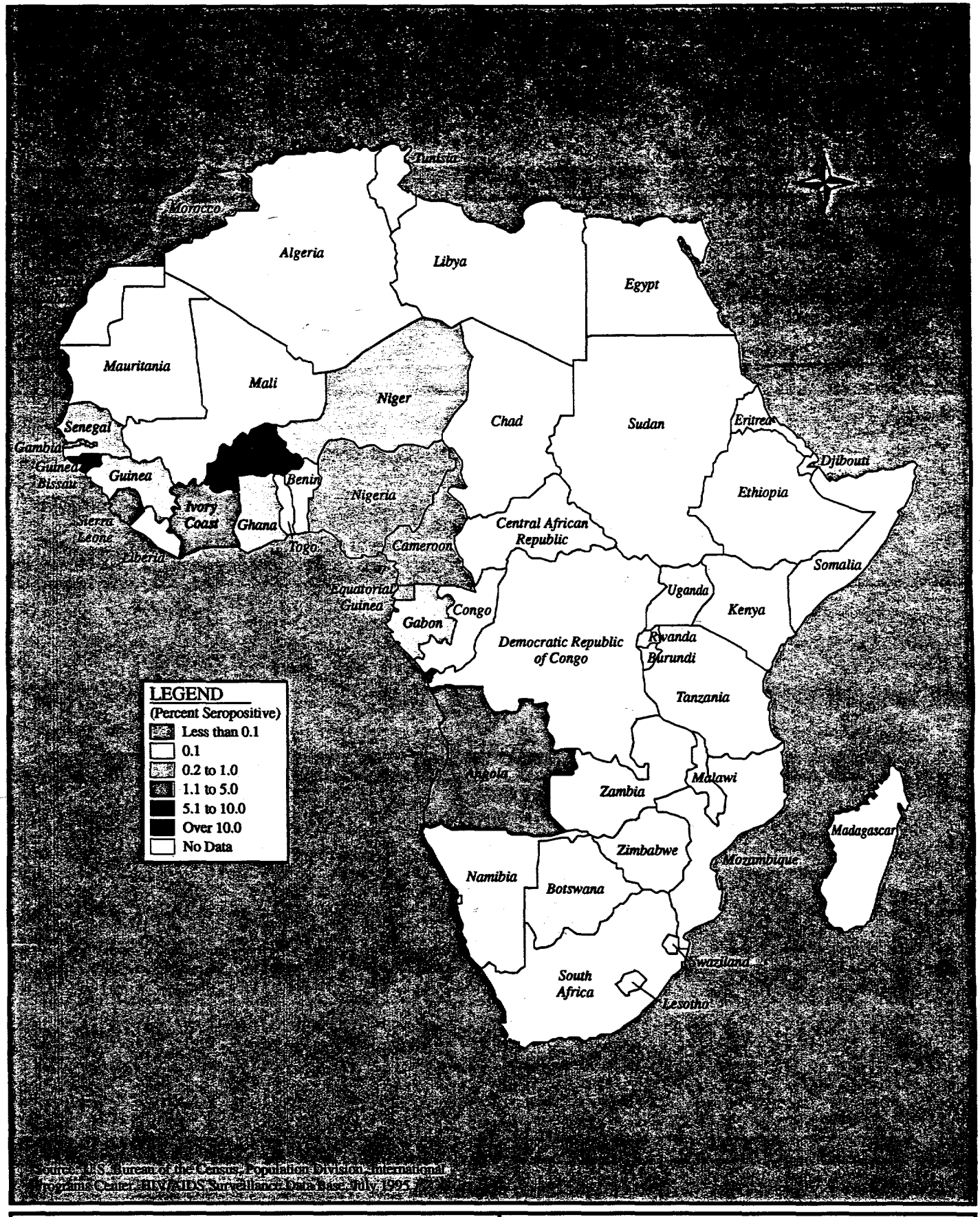
Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, July 1995

ESSO Exploration and Production Chad Inc.

AFRICAN HIV-2 SEROPREVALENCE FOR HIGH-RISK URBAN POPULATIONS (MAP 3 - 1995)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-40



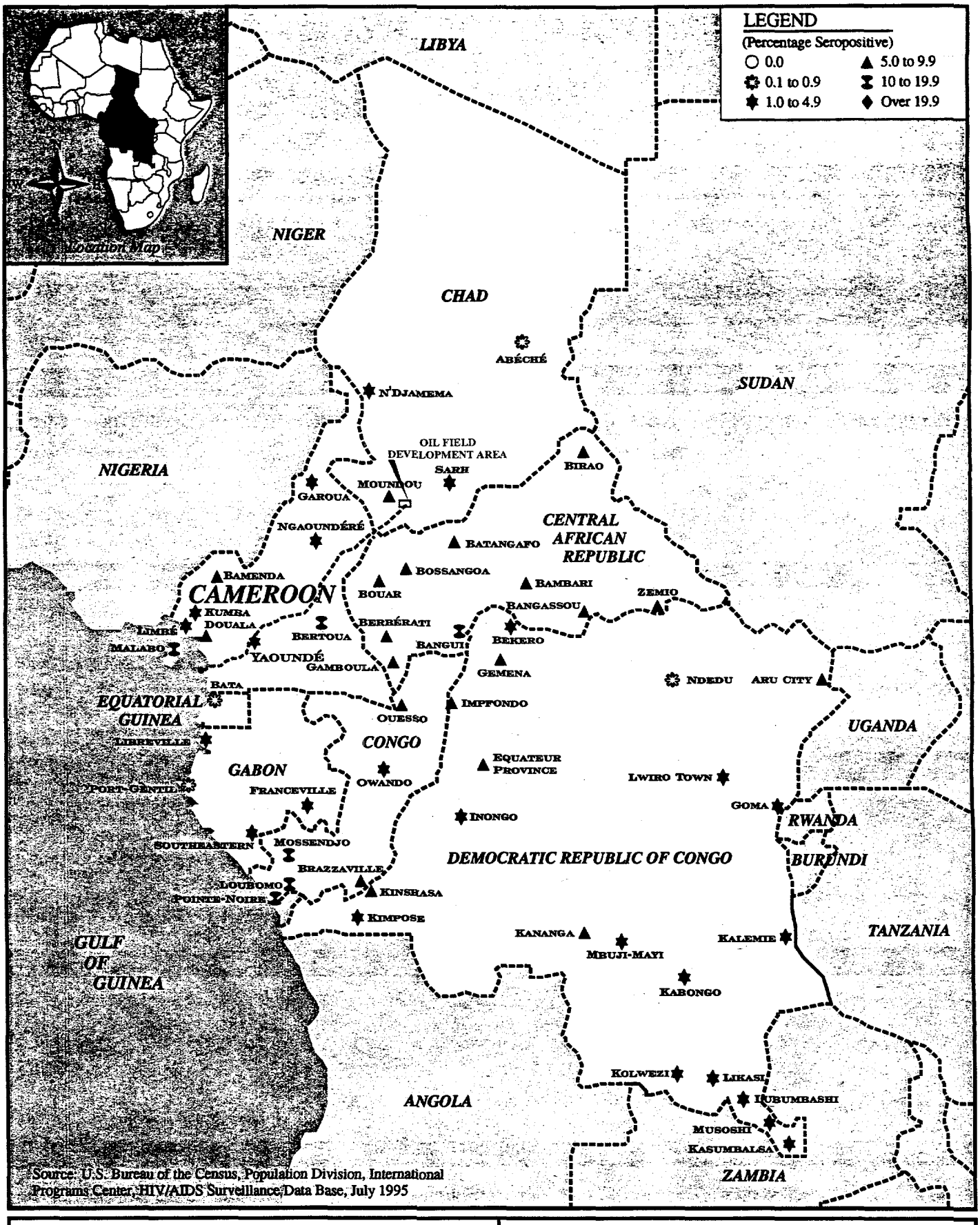
Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, July 1995

ESSO Exploration and Production Chad Inc.

AFRICAN HIV-2 SEROPREVALENCE FOR LOW-RISK URBAN POPULATIONS (MAP 4 - 1995)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-41



Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, July 1995

ESSO Exploration and Production Chad Inc.

CENTRAL AFRICAN HIV-1 SEROPREVALENCE FOR LOW-RISK POPULATIONS (MAP 5 - 1995)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-42

Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, January 1997

ESSO Exploration and Production Chad Inc.

AFRICAN HIV-1 SEROPREVALENCE FOR HIGH-RISK URBAN POPULATIONS (MAP 1 - 1997)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-43

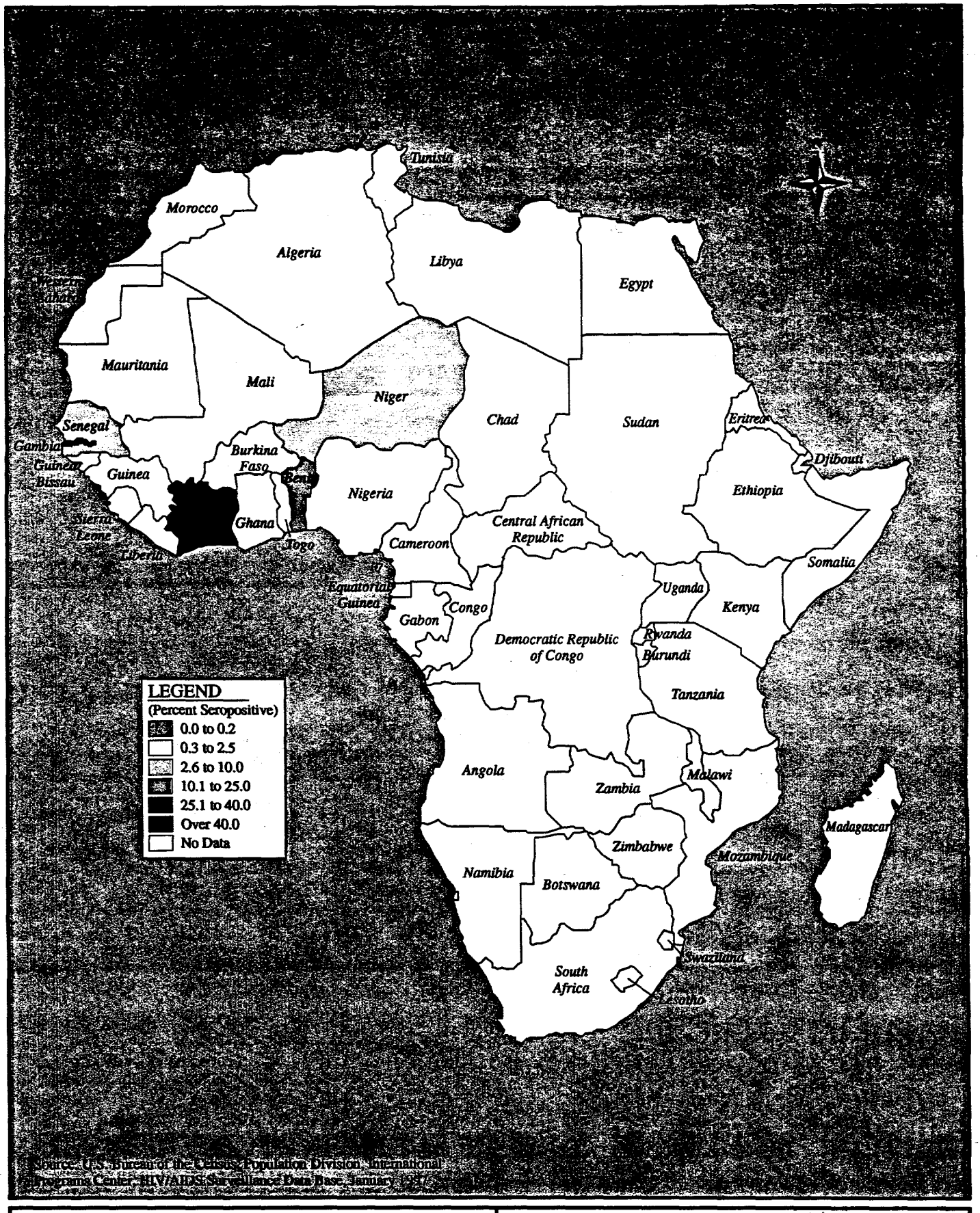
Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base - January 1997

ESSO Exploration and Production Chad Inc.

AFRICAN HIV-1 SEROPREVALENCE FOR LOW-RISK URBAN POPULATIONS (MAP 2 - 1997)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-44



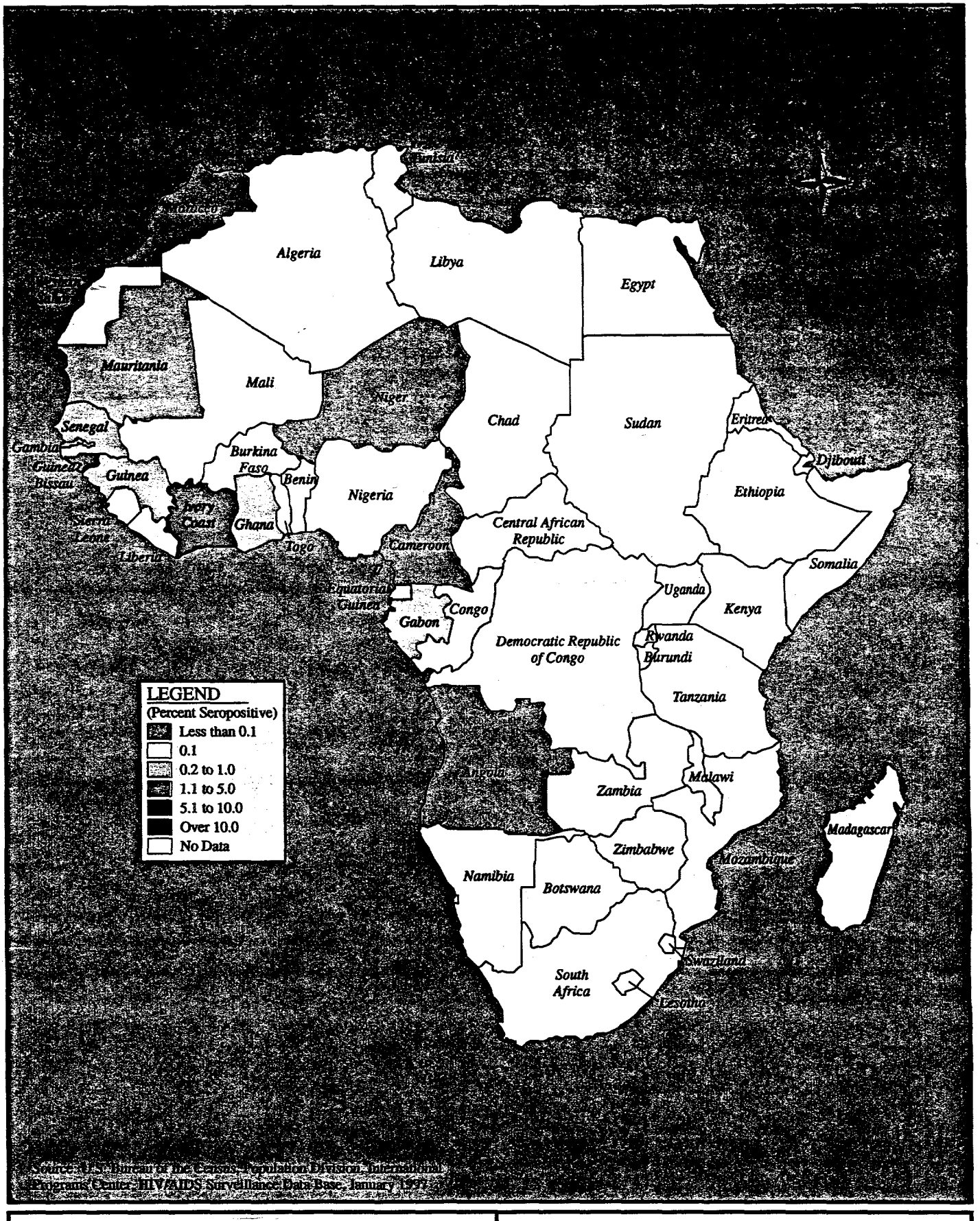
Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, January 1997.

ESSO Exploration and Production Chad Inc.

AFRICAN HIV-2 SEROPREVALENCE FOR HIGH-RISK URBAN POPULATIONS (MAP 3 - 1997)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-45



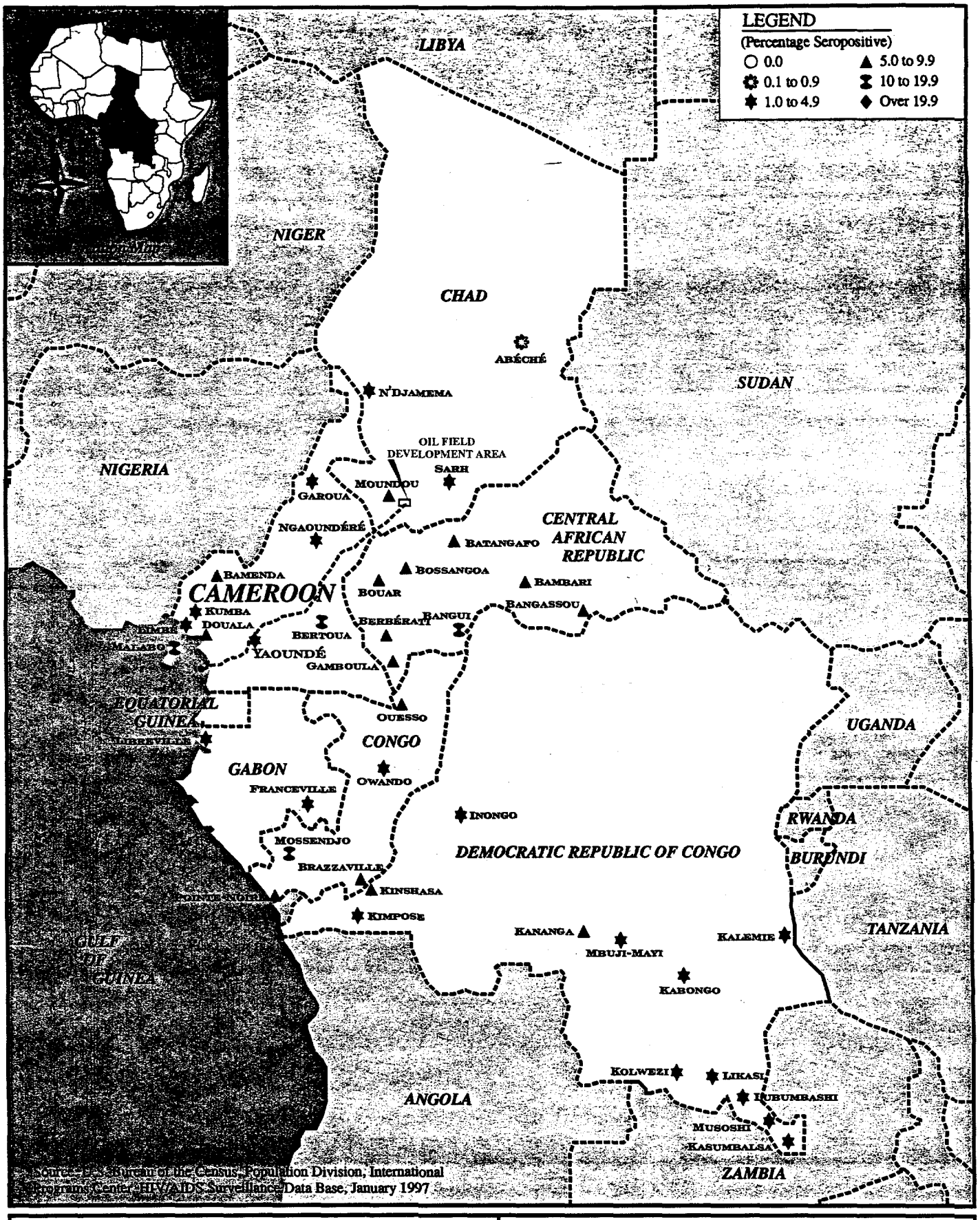
Source: U.S. Bureau of the Census - Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, January 1997

ESSO Exploration and Production Chad Inc.

AFRICAN HIV-2 SEROPREVALENCE FOR LOW-RISK URBAN POPULATIONS (MAP 4 - 1997)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-46



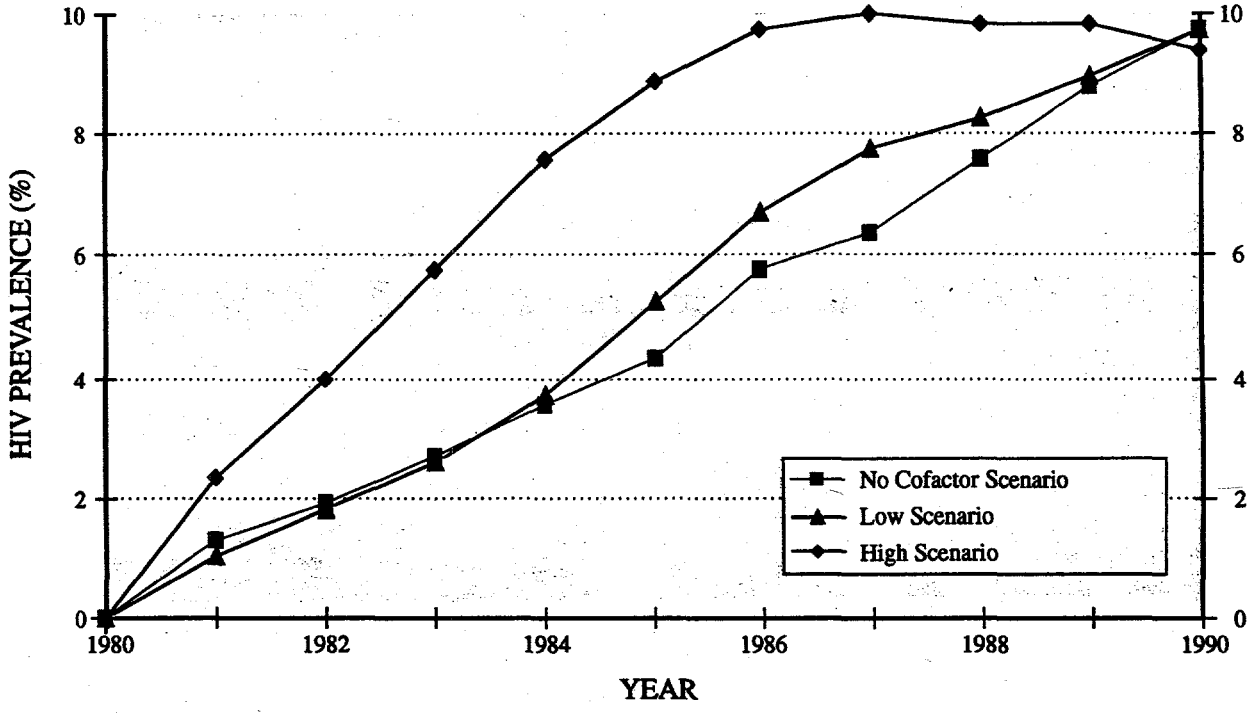
Source: U.S. Bureau of the Census, Population Division, International Programs Center, HIV/AIDS Surveillance Data Base, January 1997

ESSO Exploration and Production Chad Inc.

CENTRAL AFRICAN HIV-1 SEROPREVALENCE FOR LOW-RISK POPULATIONS (MAP 5 - 1997)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-47



Source: Robinson, 1994 (Ugandan data set)

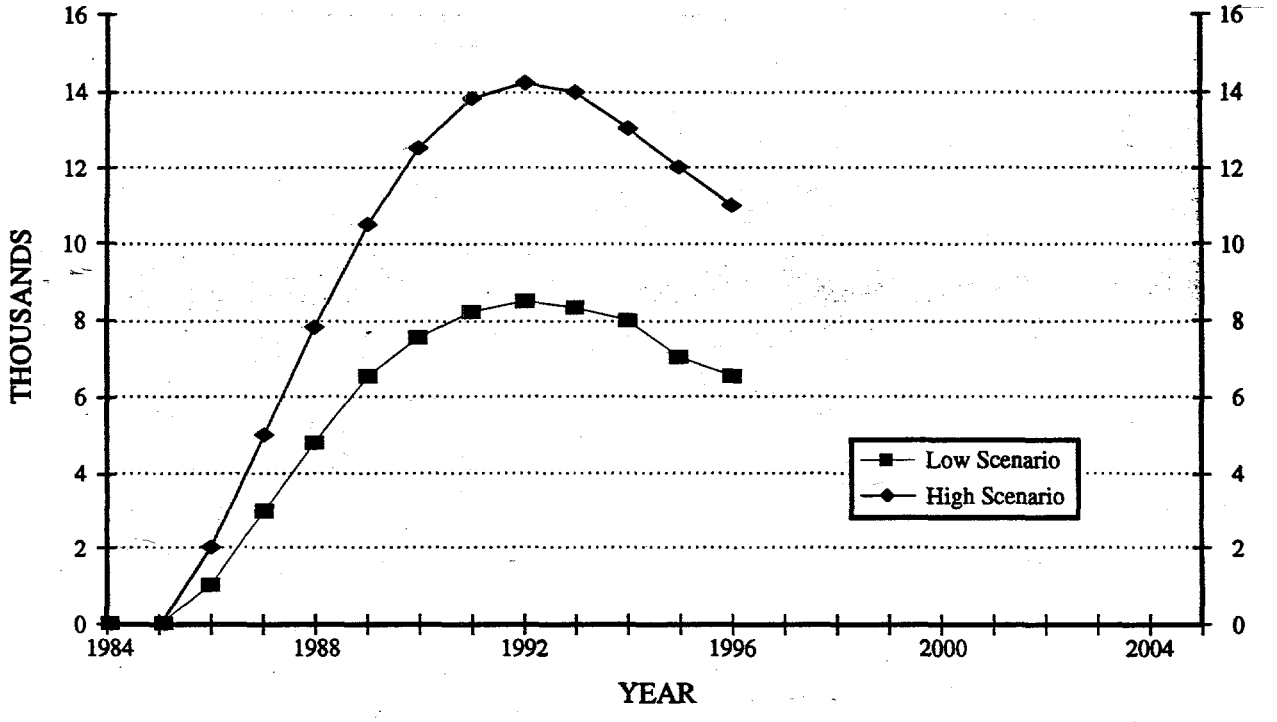
ESSO Exploration and Production Chad Inc.

HIV PREVALENCE IN ADULTS
(MEAN OF 10 RUNS FOR EACH SCENARIO)

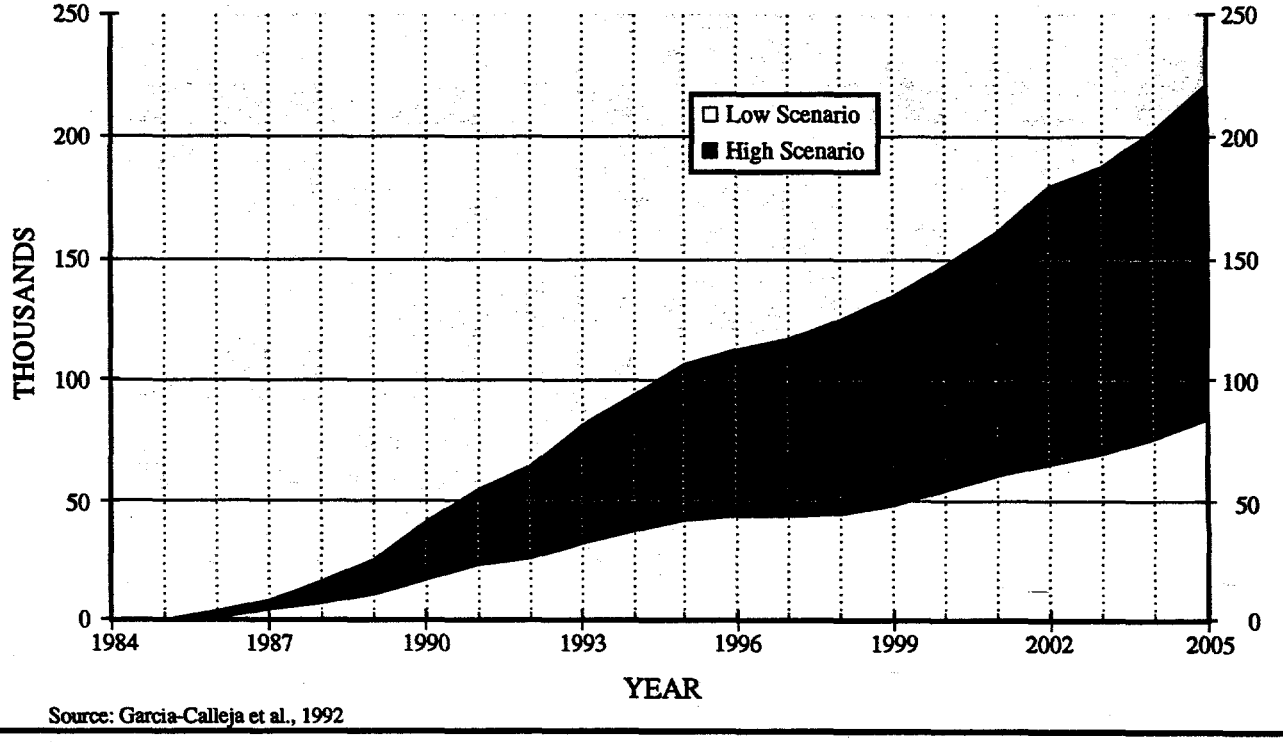
DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-48

HIV ANNUAL INCIDENCE SHOWING 1991 AS THE PEAK OF THE EPIDEMIC



HIV CUMULATIVE INCIDENCE



Source: Garcia-Calleja et al., 1992

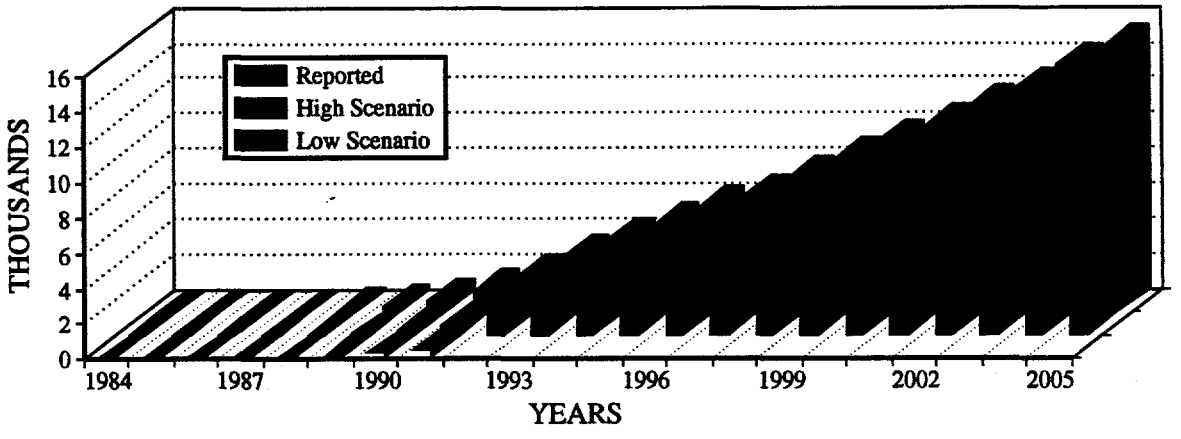
ESSO Exploration and Production Chad Inc.

HIV INCIDENCE: CAMEROON PROJECTIONS

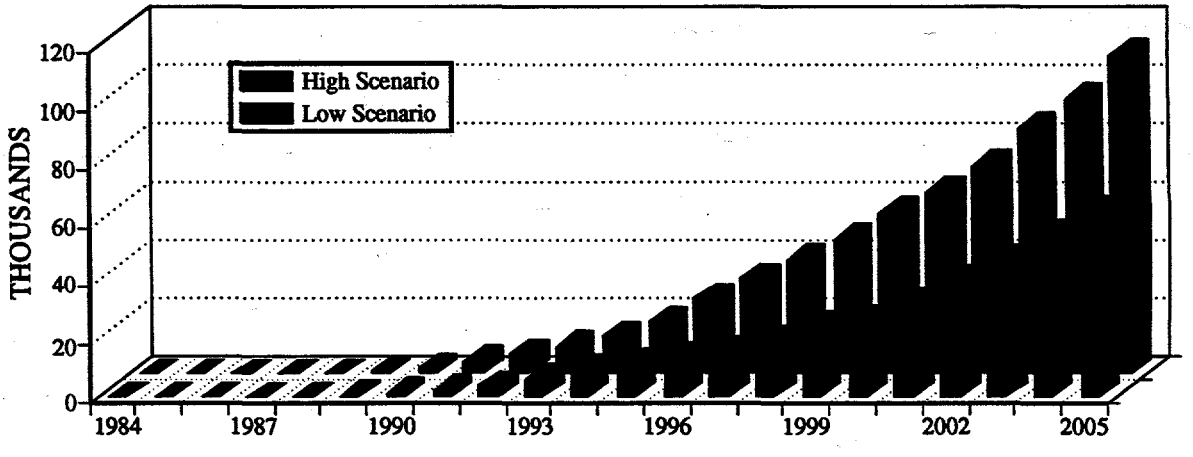
DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-49

AIDS CASES REPORTED VERSUS AIDS PROJECTED



CUMULATIVE AIDS CASES



Source: Garcia-Calleja et al., 1992

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AIDS CASES: CAMEROON DATA
(REPORTED VERSUS PROJECTED & CUMULATIVE)

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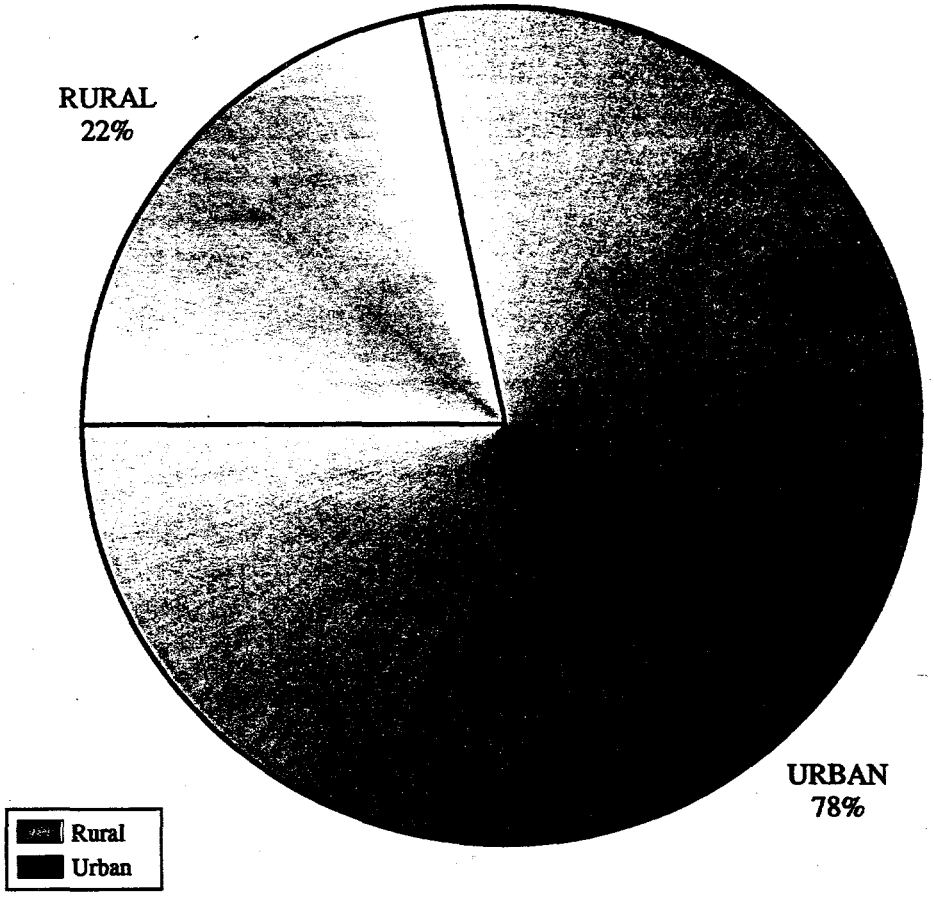
FIGURE D-50



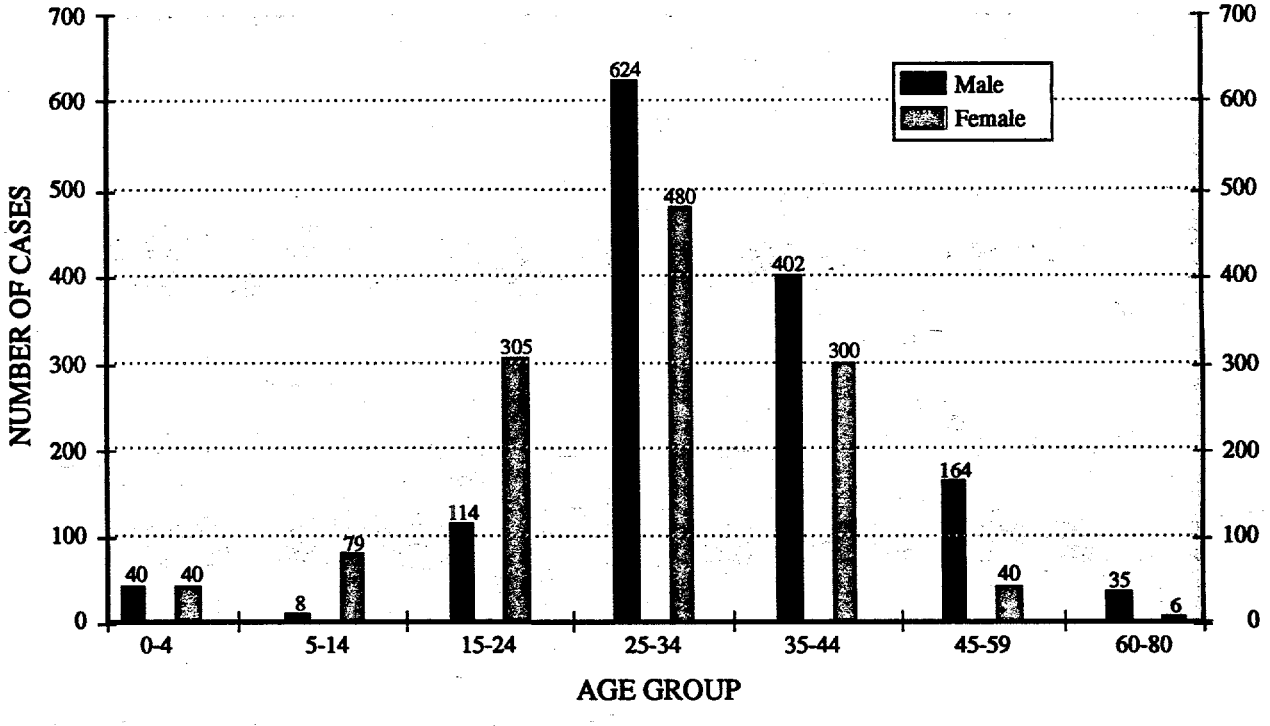
Source: MOPH, June 1996

ESSO Exploration and Production Chad Inc.

URBAN-RURAL DISTRIBUTION OF REPORTED AIDS CASES IN CAMEROON, 1995

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-51



Source: MOPH, June 1996

ESSO Exploration and Production Chad Inc.

NUMBER OF REPORTED AIDS CASES IN CAMEROON BY AGE AND SEX, 1995

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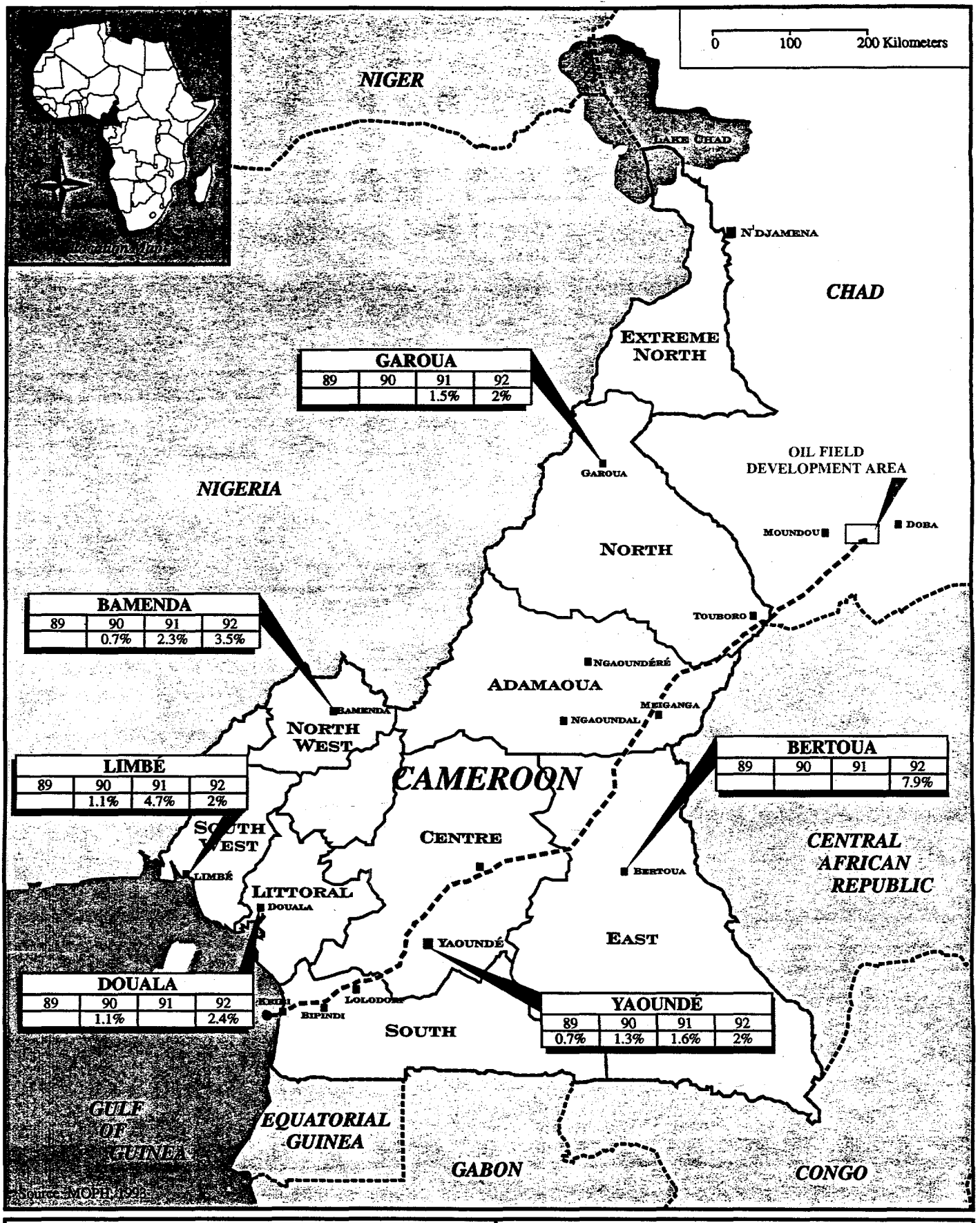
FIGURE D-52



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SENTINEL SURVEILLANCE CENTERS: PREGNANT FEMALES CAMEROON, 1989-1992

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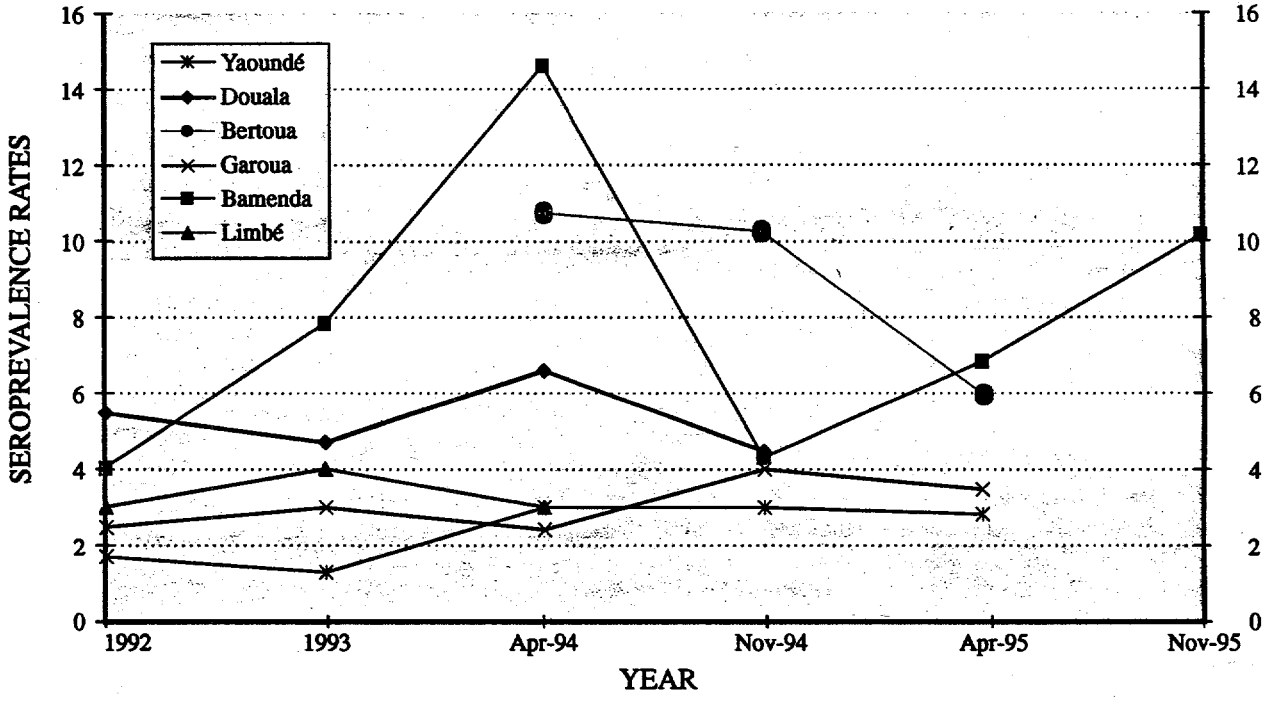
FIGURE D-53



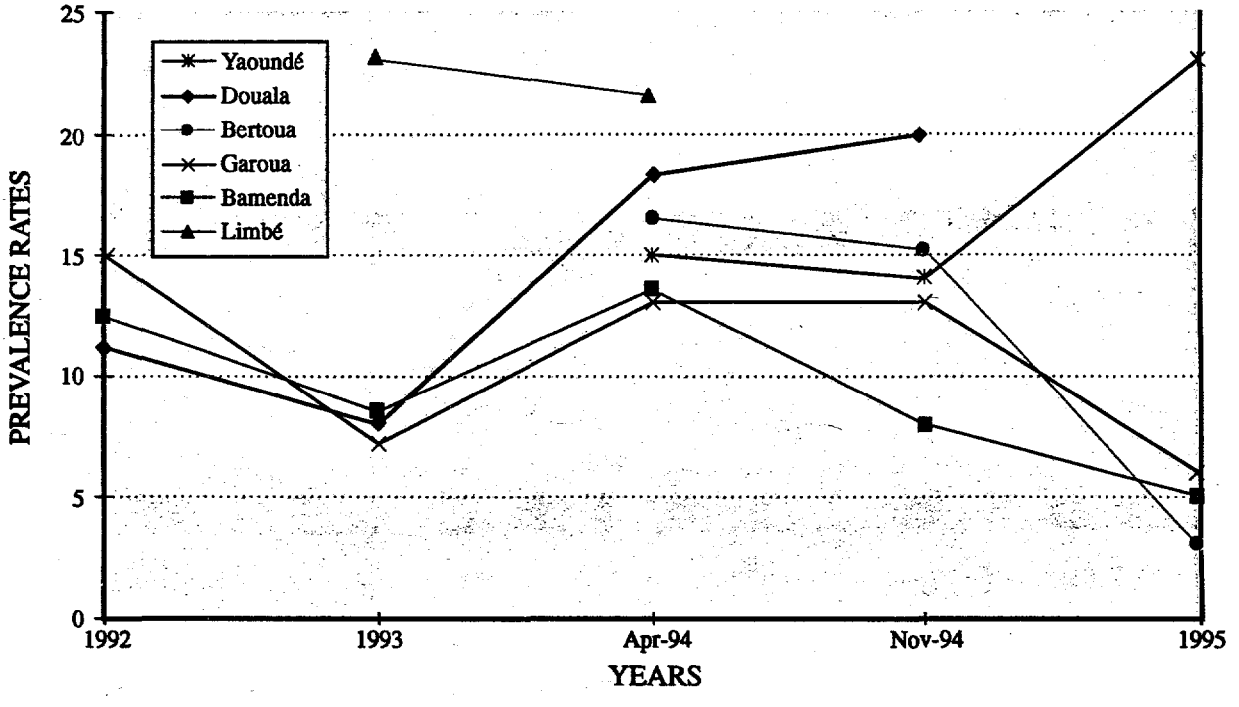
Source: MOPH, 1996

ESSO Exploration and Production Chad Inc.

TRENDS IN HIV SEROPREVALENCE RATES IN 6 SENTINEL SURVEILLANCE SITES IN CAMEROON, 1992-1995

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-54



Source: MOPH, 1996

ESSO Exploration and Production Chad Inc.

TRENDS IN SYPHILLIS PREVALENCE RATES AMONG PREGNANT WOMEN IN 6 SENTINEL SURVEILLANCE SITES IN CAMEROON, 1992-1995

DAMES & MOORE
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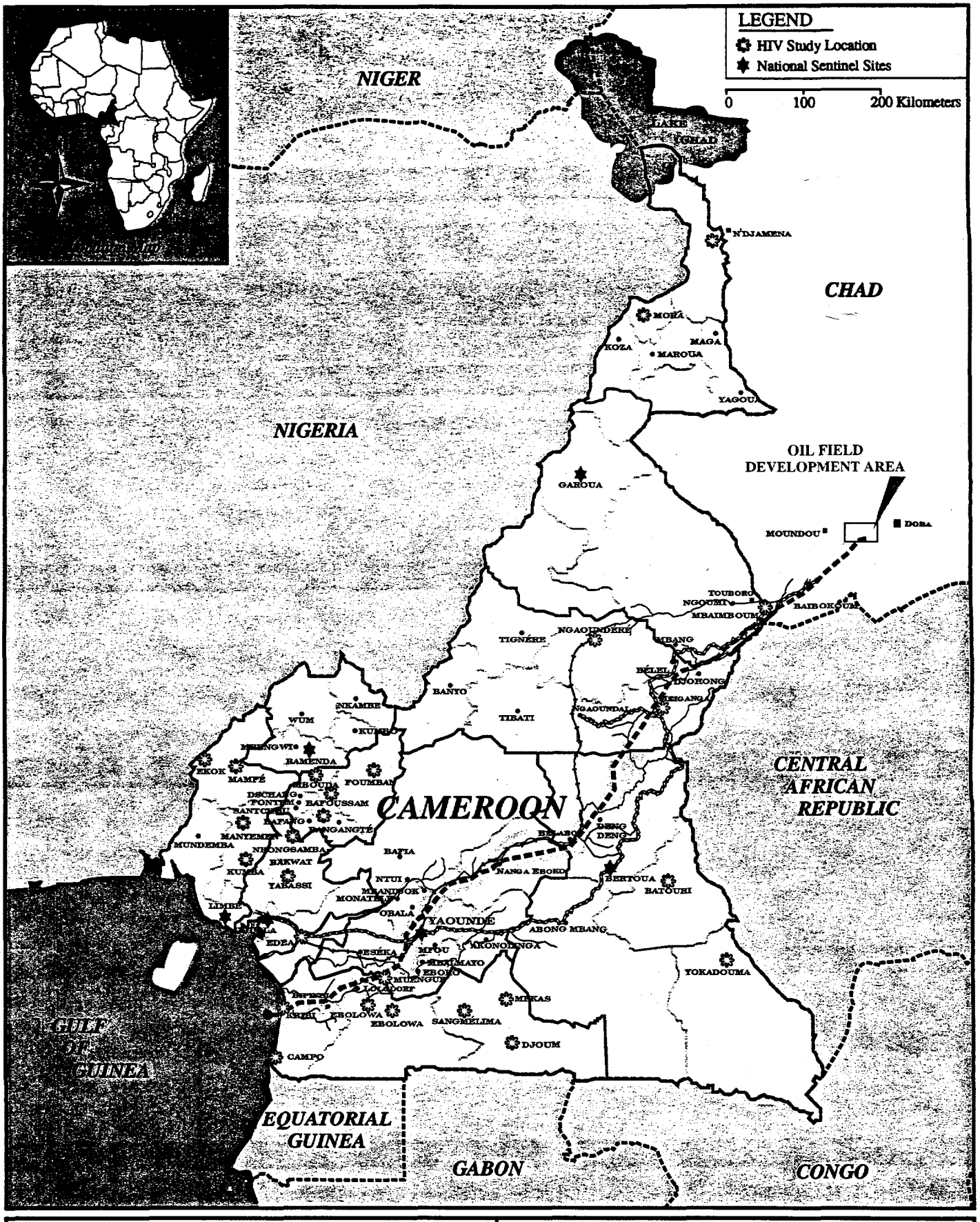
FIGURE D-55



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HIV SEROPREVALENCE STUDY SITES

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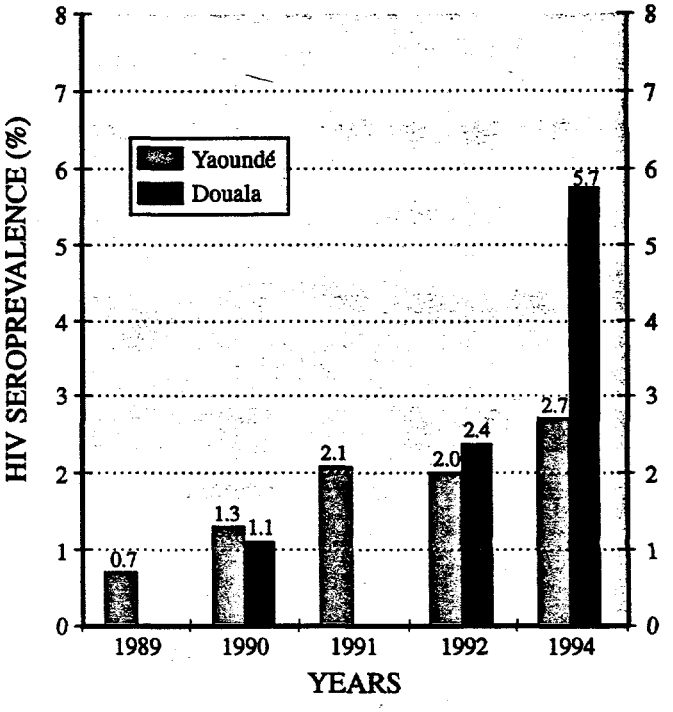
FIGURE D-56

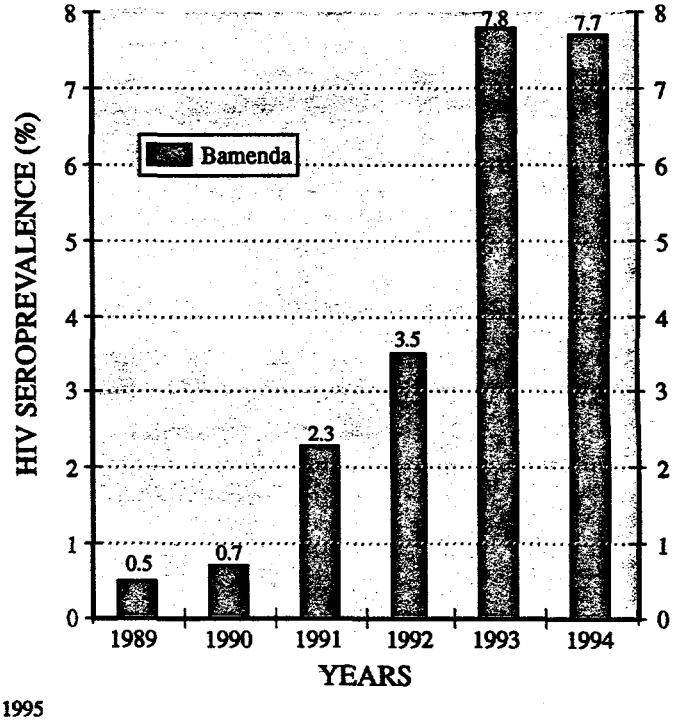
Two Cities, 1989-1994

►Since 1989, the percent of pregnant women testing HIV positive in Yaoundé has nearly quadrupled. HIV prevalence increased from 0.7 percent in 1989 to 2.7 percent in 1994. Pregnant women testing HIV-positive in Douala increased from 1.1 percent in 1990 to nearly 6 percent in 1994.



Bamenda, 1989-1994

►In Bamenda, the Northwest Province capital, HIV infection levels among pregnant women tested increased dramatically over the 5-year period 1989-1994 from less than 1 percent to nearly 8 percent.



Source: International Programs Center, Population Division, U.S. Bureau of the Census, HIV/AIDS Surveillance Data Base, July 1995

ESSO Exploration and Production Chad Inc.

HIV SEROPREVALENCE FOR PREGNANT WOMEN IN CAMEROON 1989-1994

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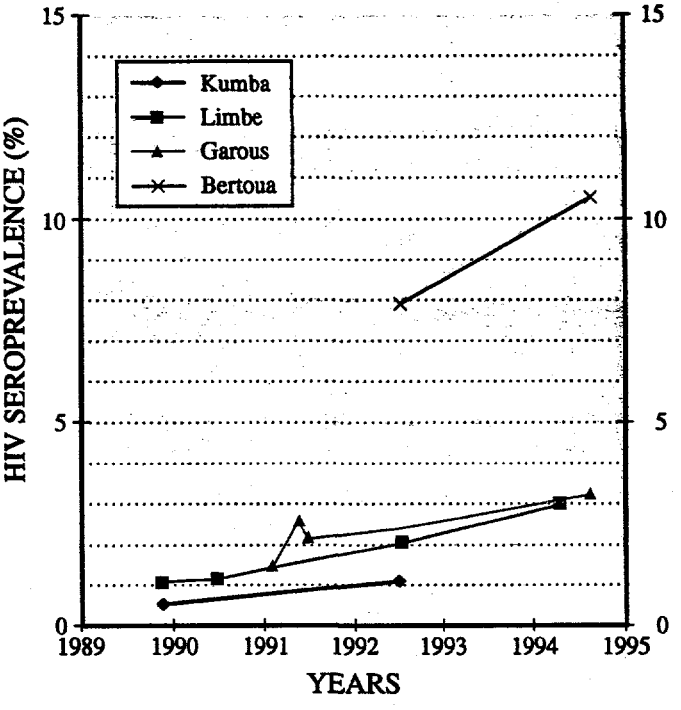
FIGURE D-57

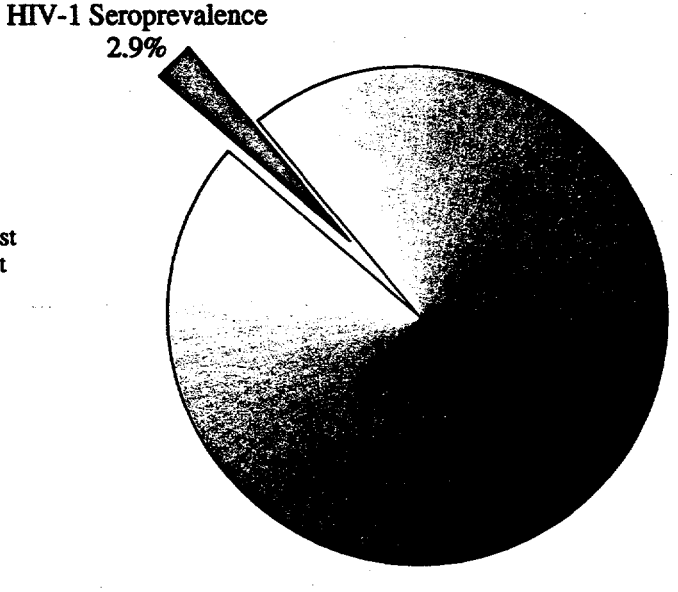
Selected Cities, 1989-1994

►HIV-1 infection levels among pregnant women in Bertoua, Garoua, Kumba, and Limbe increased from 1989-1994. HIV infection in Kumba and Limbe, two cities in the Southwest Province, more than doubled in 2 and 4 year periods, respectively. Much higher seroprevalance levels were seen among pregnant women in Bertoua than in the other three cities.



Manyemen, 1991-1992

►In Manayemen, a rural area located in Southwest Province, HIV-1 infection levels among pregnant women were just as high as HIV levels in some cities of Cameroon. There was no evidence of HIV-2 among these rural pregnant women.



Source: International Programs Center, Population Division, U.S. Bureau of the Census, HIV/AIDS Surveillance Data Base, July 1995

ESSO Exploration and Production Chad Inc.

HIV-1 SEROPREVALENCE FOR PREGNANT WOMEN IN CAMEROON

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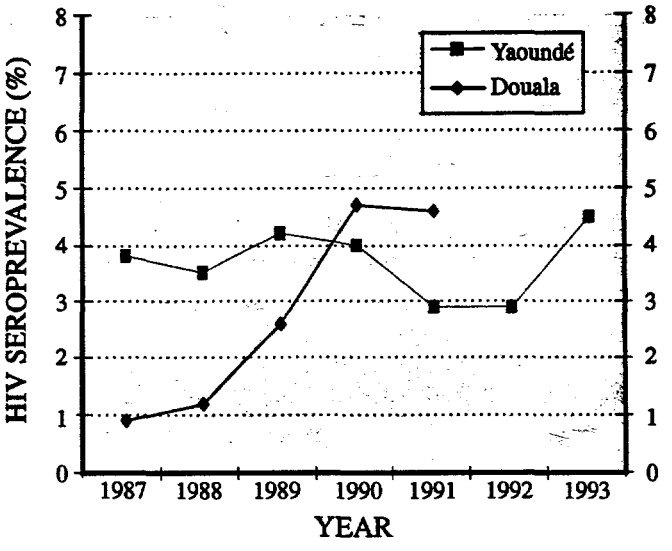
FIGURE D-58

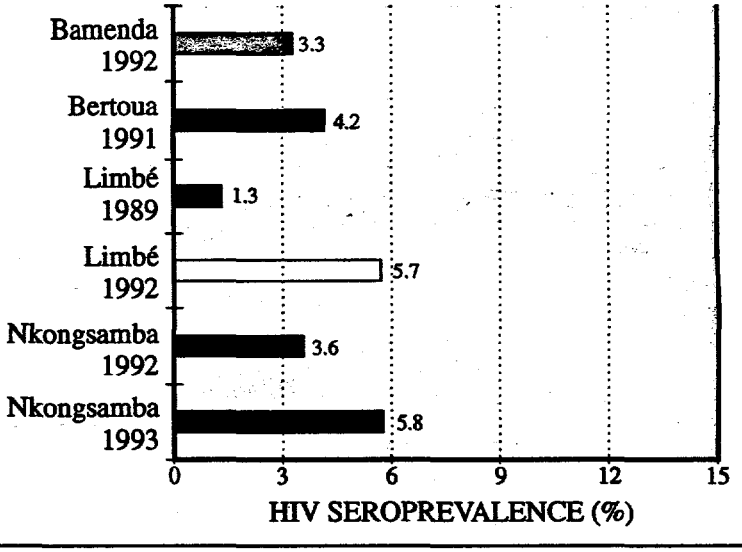
Blood Donors in Two Areas, 1987-1993

▸The level of HIV infection among blood donors in Yaoundé has remained virtually the same over the 7-year period 1987- 1993, fluctuating around 3 - 4 percent. The percent of blood donors testing HIV positive in Douala increased from less than 1 percent in 1987 to nearly 5 percent in 1990-1991.



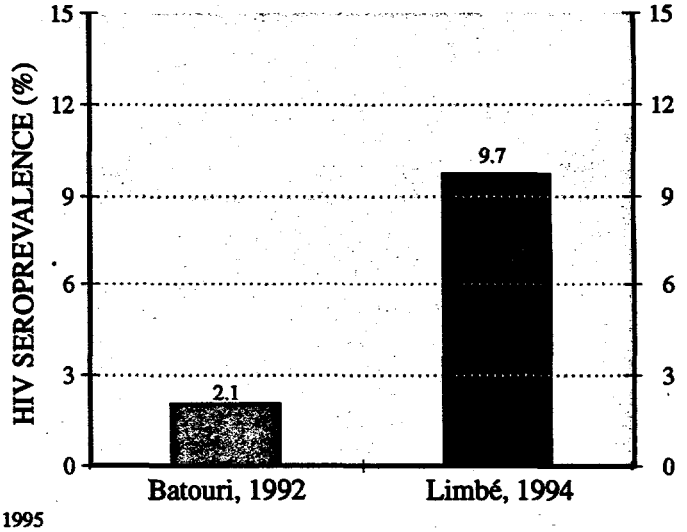
Blood Donors in Selected Cities, 1989-1993

▸HIV infection levels among blood donors in other areas vary. In Limbé and Nkongsamba, HIV levels increased to nearly 6 percent. In Bamenda, 1992, and in Bertoua, 1991, HIV infection levels were 3.3 percent and 4.2 percent, respectively. Data from Batouri in 1991 and Bafoussam in 1992 show no evidence of HIV infection.



General Population in Two Areas, 1992-1994

▸HIV infection has also been documented among low-risk populations in Cameroon. A 1992 study in the city of Batouri reported 2 percent of the general population tested were HIV-1 infected. Another study of individuals selected among the general population in Limbé, an industrial harbor in the Southwest Province, reported HIV-1 infection level of 9.7 percent in 1994.



Source: International Programs Center, Population Division, U.S. Bureau of the Census, HIV/AIDS Surveillance Data Base, July 1995

ESSO Exploration and Production Chad Inc.

HIV SEROPREVALENCE IN CAMEROON

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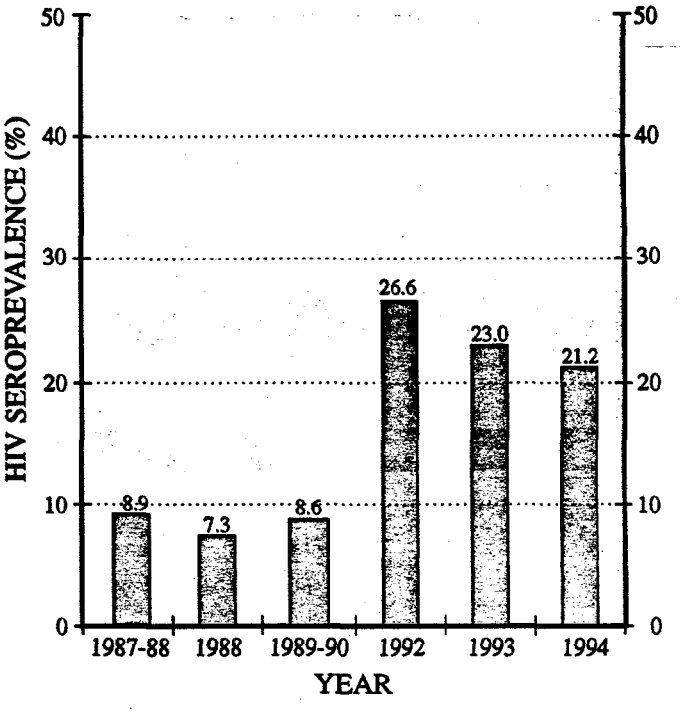
FIGURE D-59

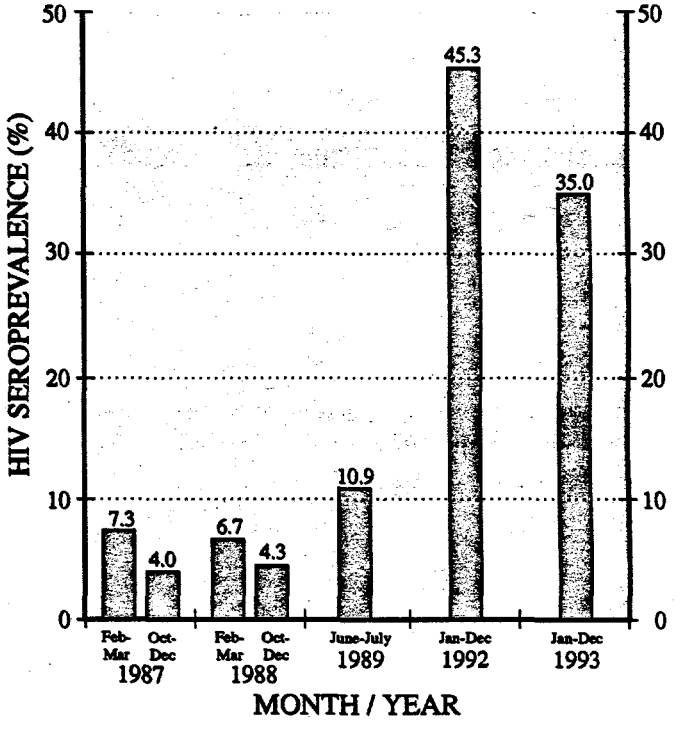
Yaoundé, 1987-1994

- HIV-1 infection dramatically increased among commercial sex workers in the capital city of Yaoundé from less than 10 percent in the late 1980s to over 25 percent in 1992. Studies conducted in the mid-1990s document seroprevalence of over 20 percent among commercial sex workers tested.



Douala, 1987-1993

- Similar to Yaoundé, HIV infection among commercial sex workers tested in the port city of Douala increased to 45 percent in 1992. A study conducted among commercial sex workers in 1993 documented HIV seroprevalence levels at 35 percent.



Source: International Programs Center, Population Division, U.S. Bureau of the Census, HIV/AIDS Surveillance Data Base, July 1995

ESSO Exploration and Production Chad Inc.

HIV SEROPREVALENCE FOR COMMERCIAL SEX WORKERS IN CAMEROON 1987-1994

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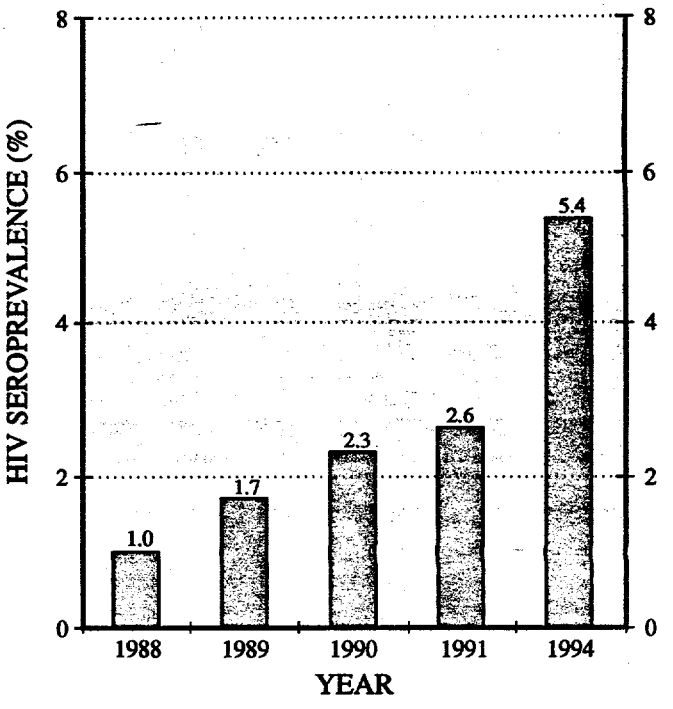
FIGURE D-60

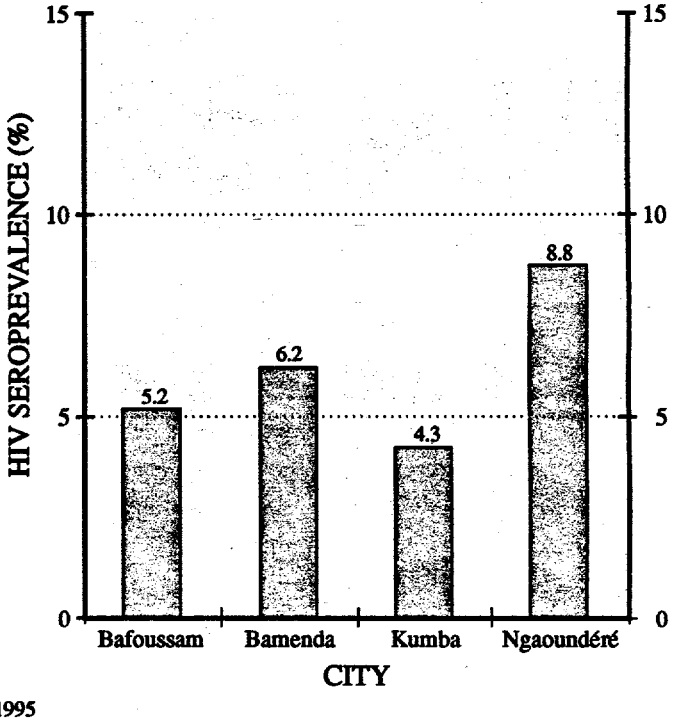
Yaoundé, 1988-1994

➤Among sexually transmitted disease patients tested in Yaoundé, HIV-1 infection levels have been increasing, reaching 5.4 percent in 1994. There was no evidence of HIV-2 infection in this population over the 1988-1994 period.



Selected Cities, 1992

➤In selected cities, HIV seroprevalence among STD clinic patients tested in 1992 ranged from 4.3 percent in Kumba to 8.8 percent in Ngaoundéré.



Source: International Programs Center, Population Division, U.S. Bureau of the Census, HIV/AIDS Surveillance Data Base, July 1995

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HIV SEROPREVALENCE FOR STD CLINIC PATIENTS IN CAMEROON 1988-1994

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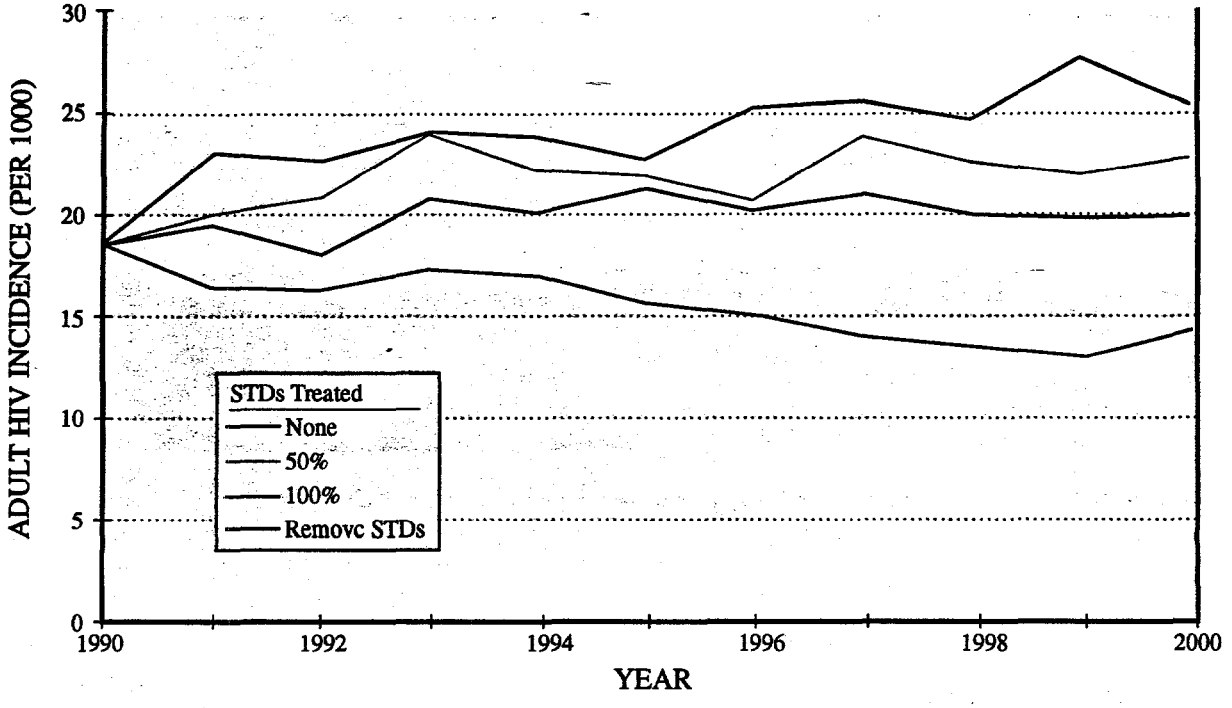
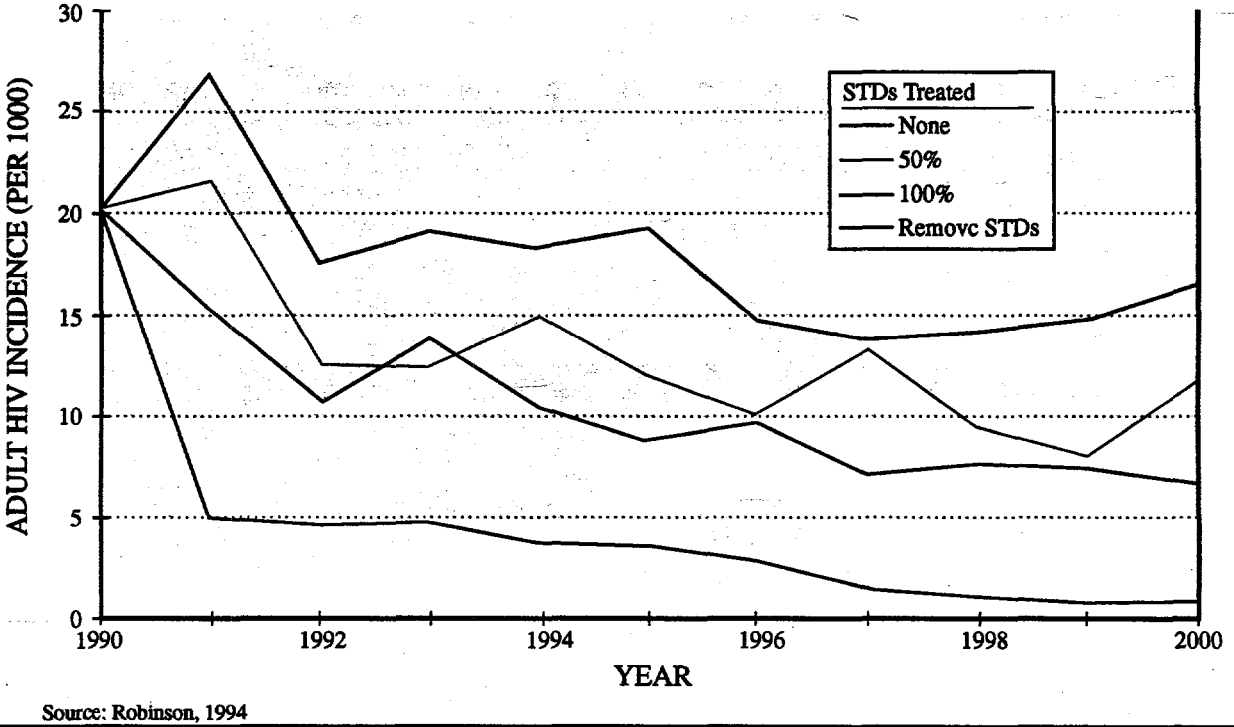
FIGURE D-61

LOW COFACTOR SCENARIO



HIGH COFACTOR SCENARIO



Source: Robinson, 1994

ESSO Exploration and Production Chad Inc.

SIMULATED PROJECTIONS FOR MEAN ADULT HIV INCIDENCE
(ASSUMING THE DURATION OF ALL STD EPISODES REDUCED BY 50% IN A SPECIFIED PROPORTION OF CASES)

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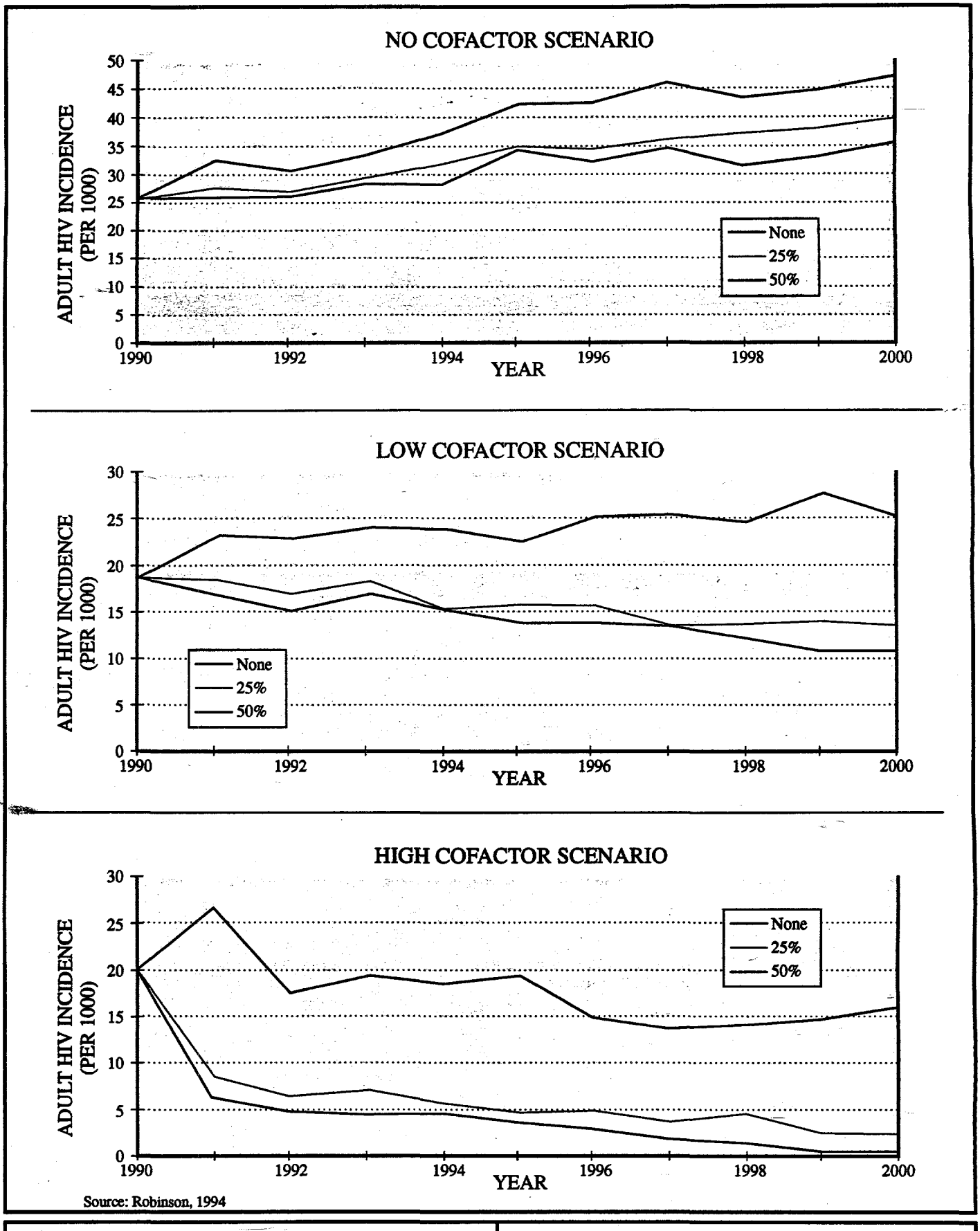
FIGURE D-62



Source: Robinson, 1994

ESSO Exploration and Production Chad Inc.

SIMULATED PROJECTIONS FOR MEAN ADULT HIV INCIDENCE
(ASSUMING A FULL PACKAGE OF INTERVENTIONS)

DAMES & MOORE
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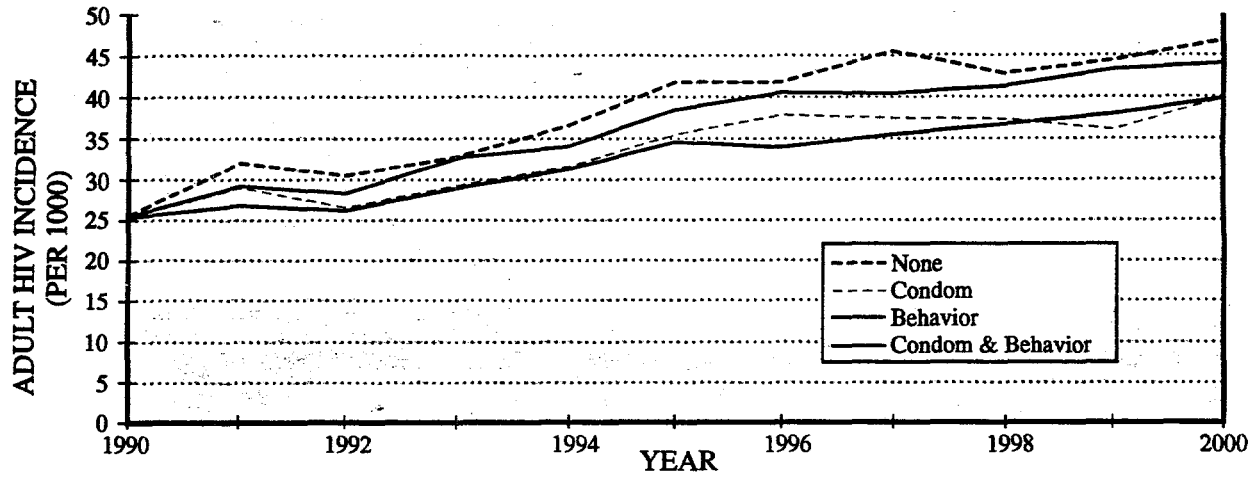
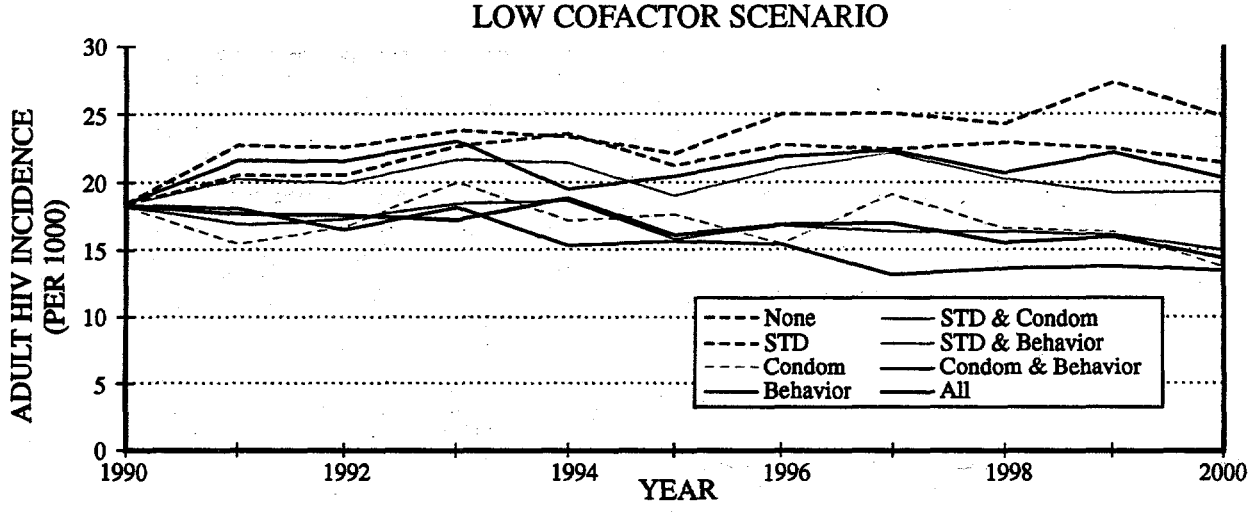
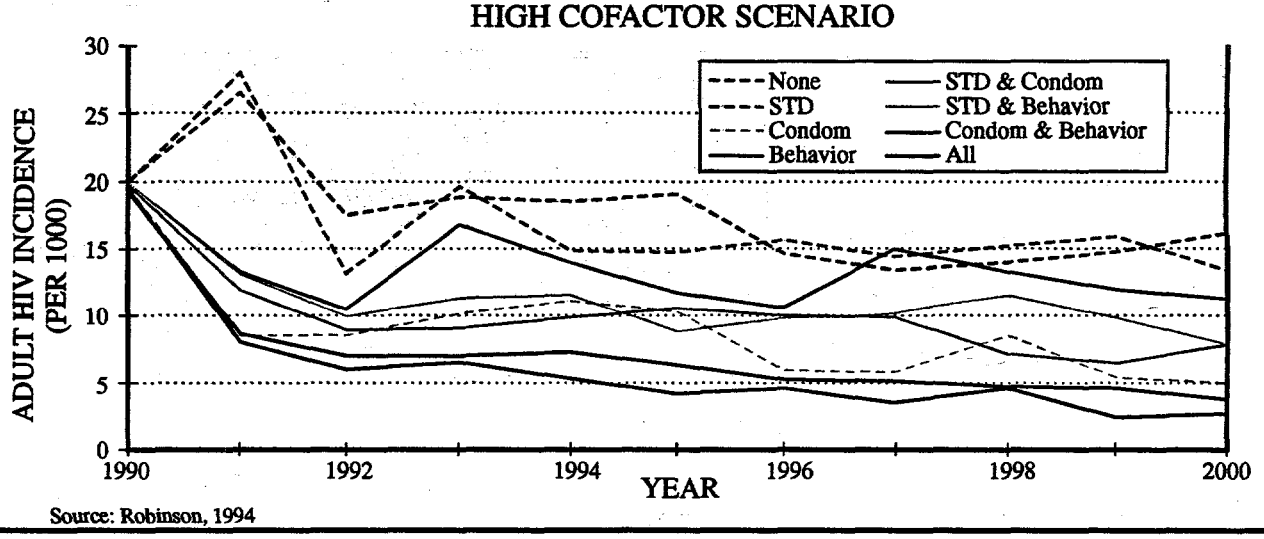
FIGURE D-63







Source: Robinson, 1994

ESSO Exploration and Production Chad Inc.

SIMULATED PROJECTIONS FOR MEAN ADULT HIV INCIDENCE
(ASSUMING A PART PACKAGE OF INTERVENTIONS AT THE 25% LEVEL)

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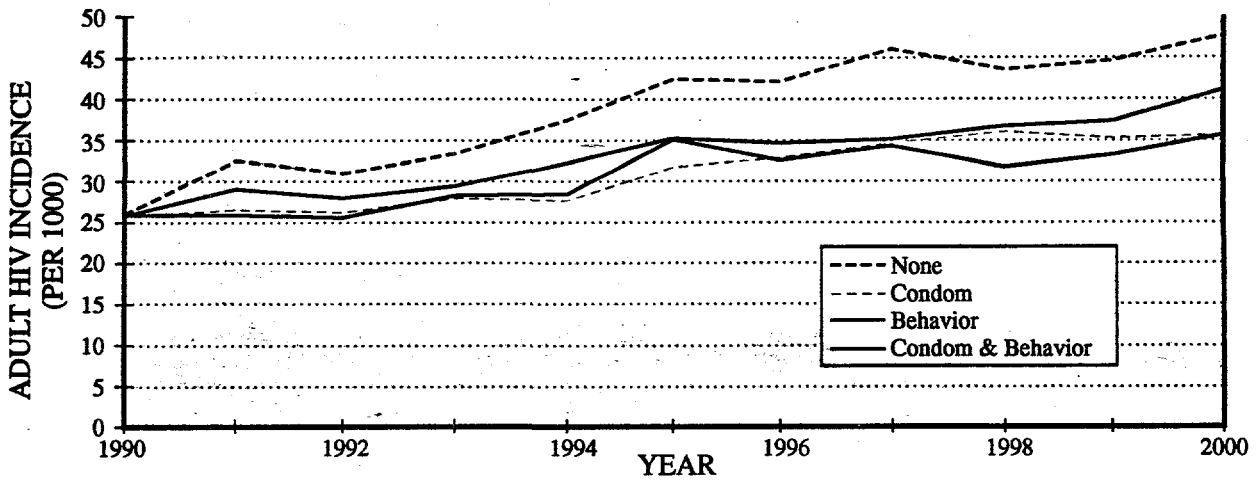
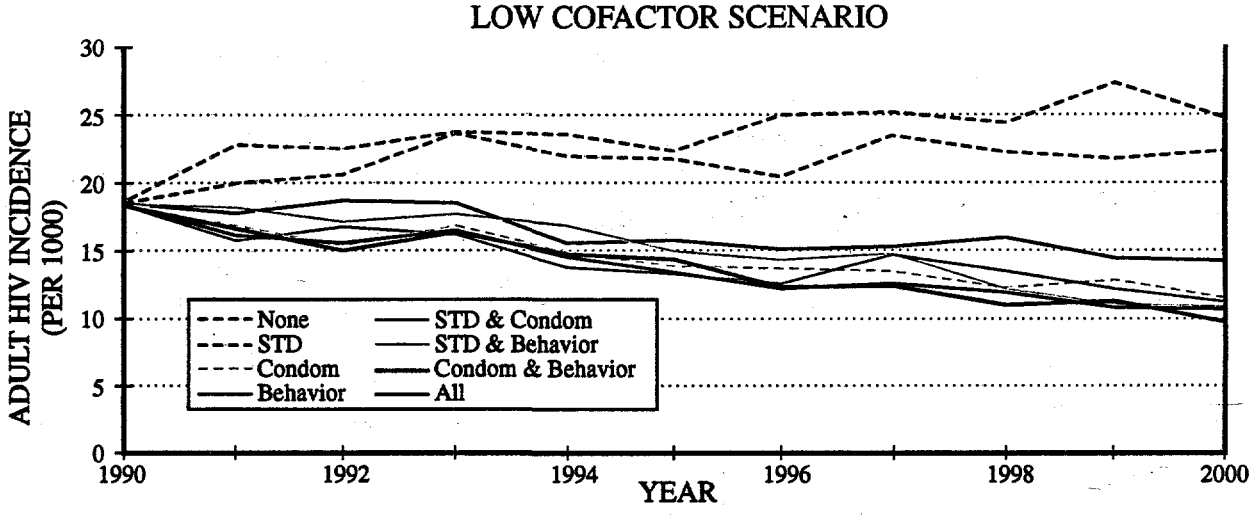
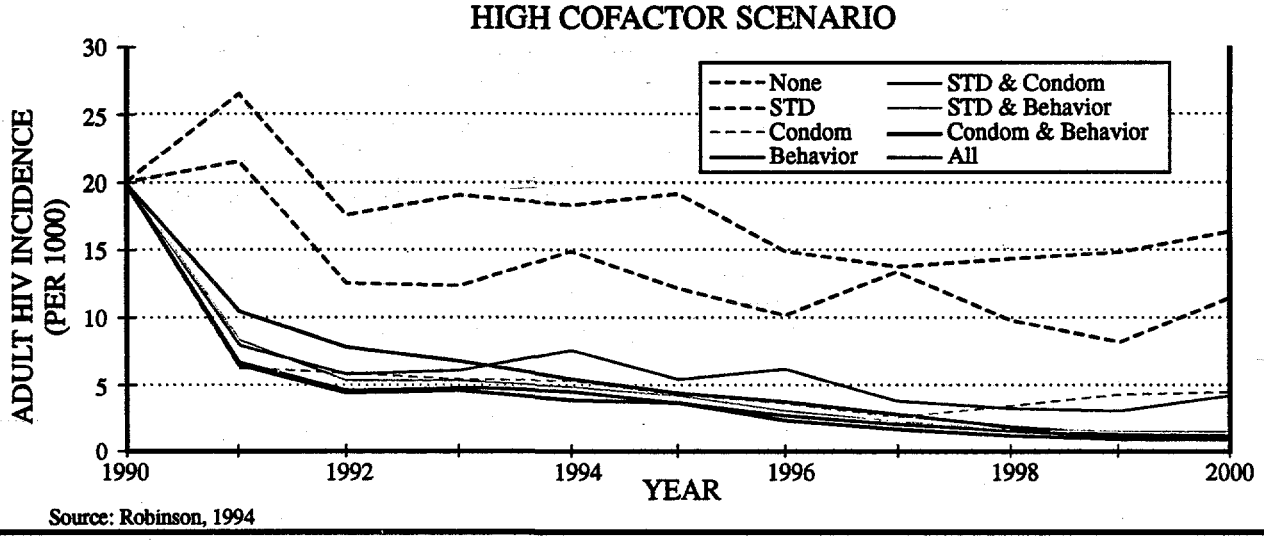
FIGURE D-64







Source: Robinson, 1994

ESSO Exploration and Production Chad Inc.

SIMULATED PROJECTIONS FOR MEAN ADULT HIV INCIDENCE
(ASSUMING A PART PACKAGE OF INTERVENTIONS AT THE 50% LEVEL)

DAMES & MOORE
A DAMES & MOORE GROUP COMPANY

FIGURE D-65