

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 1 through 4). Cameroon can be divided into four general geographic/climatic regions that encompass the ten defined Provinces (Figure 5). The Provinces are divided into Divisions and each Division is further parsed into Sub-Divisions. There are 58 Divisions and 269 Sub-Divisions. 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 North). 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 Adamoua Provinces. The latter is also included in the Central region. The direct course of the pipeline is associated with the most southeastern area of this region (Province: North).
- Central region - extensive savanna-covered plateau (Adamoua) with an average elevation of approximately 1,400 meters (4,500 feet). The project provinces include Adamoua, Center, and East. Two of these Provinces, Center 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 (Center, 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 meters (1,000 feet) (Province: South).
- Western region - an area of mountainous forests that is also home to Mt. 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 (Provinces: West, Northwest, Littoral, and Southwest).

There are substantial variations in the climatic conditions across the regions that are strong predictors 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: Adamoua, North, and Extreme North. This is a region of savannas and steppes. Except for Adamoua 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: Center, East, Littoral, South and Southwest. This area is equatorial and is characterized by dense vegetation with a hot, 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 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, as previously noted, Cameroon is divided into 10 Provinces. (See also Section 6.2.4 of the EA.) The project traverses four of these Provinces: North, Adamoua, Center, and South. 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 are 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
- Climatic 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 database 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. The MOPH 1997 Annual Activity Report was used as the most current internal source of provincial level health data.

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

The World Bank has issued (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 pretransitional 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 non-communicable conditions of adults and the elderly." Under this paradigm, health transition is associated with two phases, a demographic and an epidemiological transition. These two phases and their relationship to each other are illustrated in Figure 6.

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.