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DRAFT ENVIRONMENTAL PROFILE  
ON  
UNITED REPUBLIC OF CAMEROON

PREPARED BY THE  
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An Introductory Note on Draft Environmental Profiles:

The attached draft environmental report has been prepared under a contract between the U.S. Agency for International Development (A.I.D.), Office of Science and Technology (DS/ST) and the U.S. Man and the Biosphere (MAB) Program. It is a preliminary review of information available in the United States on the status of the environment and the natural resources of the identified country and is one of a series of similar studies now underway on countries which receive U.S. bilateral assistance.

This report is the first step in a process to develop better information for the A.I.D. Mission, for host country officials, and others on the environmental situation in specific countries and begins to identify the most critical areas of concern. A more comprehensive study may be undertaken in each country by Regional Bureaus and/or A.I.D. Missions. These would involve local scientists in a more detailed examination of the actual situations as well as a better definition of issues, problems and priorities. Such "Phase II" studies would provide substance for the Agency's Country Development Strategy Statements as well as justifications for program initiatives in the areas of environment and natural resources.

Comments on the attached draft report would be welcomed by USMAB and DS/ST and should be addressed to either:

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## 1.0 Introduction

This draft environmental profile is the result of an eight week review of information in the United States on the natural resources and environment of the United Republic of Cameroon. This is the first step in the process of developing an environmental profile for use by the U.S. Agency for International Development and government officials of Cameroon. The next step in this process should be a field study to evaluate the information in this draft, obtain additional information, define issues, problems, and priorities, and provide direction for future efforts in the management, conservation and rehabilitation of environmental resources in Cameroon.

The information and interpretations presented in this report are preliminary and are not intended to be sufficiently detailed or accurate for development planning. Most of the background documents for this survey were gathered in Washington, D.C. by Peter Hazlewood. Additional information was gathered in Tucson, Arizona, by Douglas Stotz through the resources of the Arid Lands Information Center. Analysis and writing were done by Peter Hazlewood and Douglas Stotz. The Arid Lands Information Center also provided editorial and secretarial services; particular thanks to Susan A. Parker, Director of the Center, who provided invaluable cooperation and assistance. The cooperation of personnel at AID and the National Park Service is gratefully acknowledged.

## 2.0 General Description

### 2.1 Geography and Climate

The United Republic of Cameroon lies between latitudes 2 and 13 degrees N and longitudes 8 and 16 degrees E. It has a 360 km coastline on the Gulf of Guinea and is bordered by six countries: Nigeria to the northwest, Chad to the northeast, the Central African Republic to the east, the People's Republic of the Congo to the southeast, and Gabon and Equatorial Guinea to the south. With an area of 475,400 sq km, Cameroon is slightly larger than California.

Often referred to as "Africa in miniature," Cameroon is a country of great natural diversity encompassing numerous kinds of transitions between humid and semiarid tropical features. Cameroon extends across four biogeographical provinces within the Africo-tropical Realm. Southern Cameroon forms part of the Congo Rain Forest biogeographical province, whose characteristic biome type is tropical rain forest. The Cameroon Mountains to the west comprise the Guinean Highlands province characterized by mixed mountain and highland systems with complex zonation. Central Cameroon falls within the West African woodland/savanna biogeographical province whose characteristic biome type is tropical dry or deciduous forests or woodlands. The northern reaches of Cameroon up to Lake Chad form part of the Western Sahel biogeographical province characterized by a semi-desert biome.

#### 2.1.1 Major Geographic Regions and Features

Four major geographic regions, loosely defined in terms of terrain and vegetational distribution, are commonly used to describe Cameroon: the western and coastal lowlands, the western highlands, the southern (forest) and central (savanna) plateaus, and the northern plains. This terminology will be used throughout this report, though the reader should bear in mind it does not adequately reflect the great ecological diversity of the country.

Western and Coastal Lowlands. The coastal zone is a narrow, predominantly flat area (below 600 meters) of sedimentary soils that front on the Gulf of Guinea for about 360 km. The region varies in width and can be divided into three physiographic areas. The first is a cliffy and rocky coast about 60 km long consisting of the volcanic slopes of Mt. Cameroon, which stands separately from the western highlands to the north. The second is the coastline of sedimentary rocks (Tertiary) and loose sediments (Quaternary) occurring on both sides of Mt. Cameroon. This area extends about 220 km and is further subdivided into two areas. One is very smooth

chevron-shaped coast occurring between the mouth of the Sanaga River and north of Kribi. The other is irregular mangrove coast occurring between the mouth of the Sanaga River and Douala, and in the western part of Mt. Cameroon. The marked differences between both areas may be determined by the size of the drainage areas. The third is a rocky coast consisting principally of basement complex rocks. This area stretches from Kribi southward to Campo for about 80 km (Kadamura 1977).

Along its seaward edges the central segment of the coastal zone is a series of many adjoining deltas. Numerous fast-flowing rivers continue to expand the deltas with erosional debris. Various estuaries are formed near the mouths of the major rivers where they divide into numerous sluggish channels.

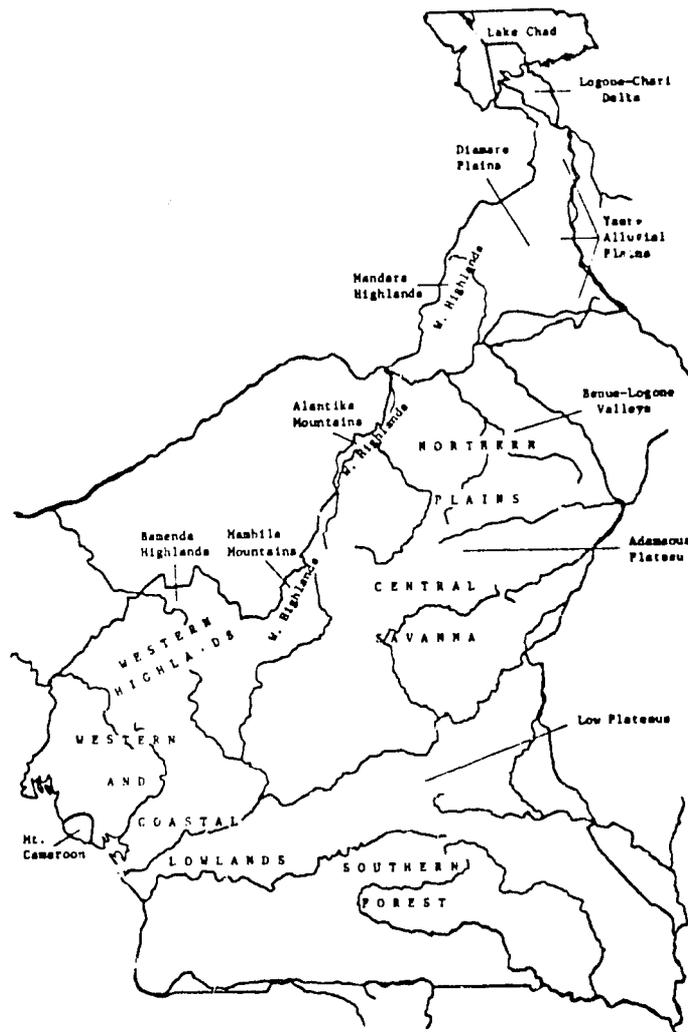


Figure 2. Major Geographic Regions and Features

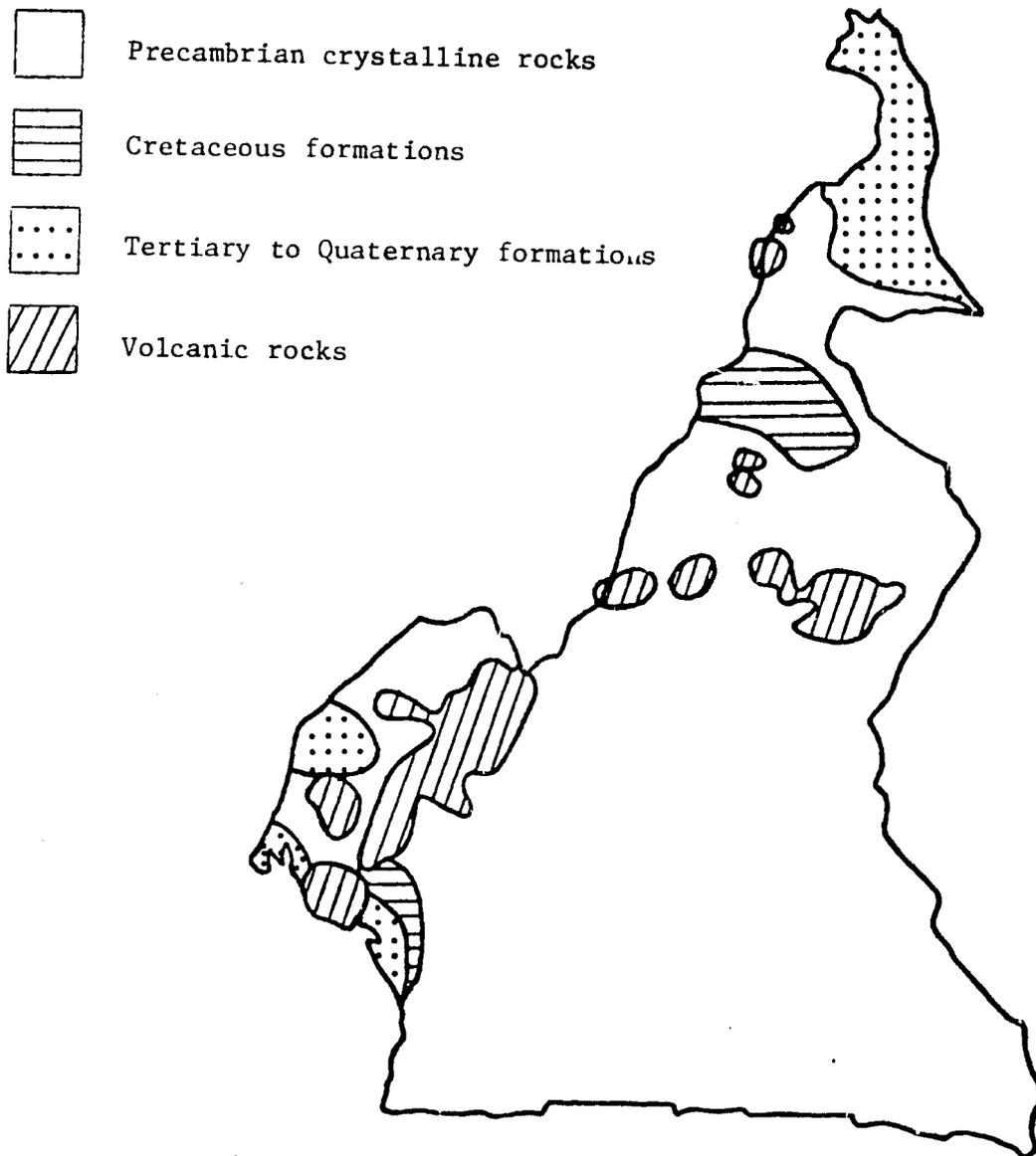


Figure 3. Geomorphological Regions

Table 1. Geomorphological Regions and Erosion Surfaces of Cameroon

<u>Geomorphological Regions</u>	<u>Erosion Surfaces</u>	
	<u>Surfaces</u>	<u>Ages Proposed</u>
Adamaoua Plateau	Gondwana Post-Gondwana	Pre-Cretaceous Cretaceous
High Plateau of West Comeroon	Gondwana Post-Gondwana	Pre-Cretaceous Cretaceous
Mandara Mountains	Post-Gondwana	Cretaceous
Southern Plateau	African I	Eocene
Benoue Basin	African II Late Tertiary- Quaternary	Late Tertiary  Late Tertiary- Quaternary
Coastal Lowland	Late Tertiary- Quaternary	Late Tertiary- Quaternary

Source: Kadamura. 1979.

Western Highlands. The western highlands are the result of a volcanic rift that trends northeastward from the island of Fernando Po along the western border of Cameroon. This tectonic line, known as the "Cameroon Direction," consists of several volcanic peaks, such as Mt. Cameroon (the highest elevation in West Africa at 4095 meters), Rumpi Hills (1,764 meters), Mt. Koupe (2,050 meters), Mt. Manengouba (2,396 meters), Mts. Bambouto (2,740 meters), Mandara (1,442 meters), and a number of others. The major mountain range and the upland areas on its eastern and western slopes were built up by volcanic activity associated with a series of faults in the granite substructures underlying the African continent.

Mount Cameroon is the only active volcano in Cameroon, having been active in 1909, 1922, 1954, and 1959. In 1922 and 1959 molten lava flowed several miles, destroying plantations on the lower slopes. The mountain is a complex of several connected fissures and cones.

Two other important ranges of lower elevation lie along the "Cameroon Direction"; these are the Atlantika Mountains and the Mandara Highlands. The Mandara Highlands are crystalline mountains with large granite boulders and rocks on the surface that form an isolated extension of the western highlands. Elevation ranges from 600-1200 meters.

Southern and Central Plateaus. The region east of the western highlands and the western and coastal lowlands and south of the Adamaoua Plateau consists of the southern plateau of Cameroon. The southern plateau extends to Gabon, Equatorial Guinea, and the Congo to the south and to the Central African Republic to the east. Elevation of the plateau ranges from 600-900 meters, rising to the north and lowering to the main rivers such as the Sanaga, the Ntem, and the upper reaches of the Congo. Between the plateau and the coastal lowland is a sharply descending scarp-zone. The principal geology of the plateau is the Precambrian granites, migmatites, gneisses, and schists. Massive migmatites and quartzites tend to form hills and inselbergs towering over the plateau level - Mbam Minkom (1295 meters) in the west of Yaounde, the Massif of Ntem in the Ebolowa region (1300-1400 meters), and the Ngorayang Range and hills of Lolodorf (1100 meters).

Though characterized as a "peneplain," the southern plateau is really an undulating terrain consisting essentially of innumerable small hills 40-100 meters high. These hills are generally separated by well-defined valleys and with a poorly drained flat floor which in many places is occupied by marshes and/or areas liable to flooding (Kadamura 1977).

The Adamaoua Plateau, which lies in the central part of Cameroon, is a gigantic horst-like massif composed mainly of granitic rocks of Precambrian age. The plateau ranges in elevation from 900-1500 meters, with a marked escarpment on its northern side. Along the western and, to a lesser degree, the eastern borders, lava from earlier eruptions has covered extensive areas of the underlying granite.

Northern Plains. The basin of the Benoue River, a tributary of the Niger, occupies the lowland between the escarpment of the Adamaoua Plateau and the Mandara Highlands to the north. This area is a vast plain sloping gently to the north from 600 meters at the foot of the escarpment to 200 meters and lower on the river bed of the Benoue near Garoua. Large-scale residual hills of granites, syenites, and gabbros tower over the plain level. More than 80 percent of this area is steep mountains. The rest consists of foot slopes and alluvial fans around the perimeter of the Poli Mountains. The upper Benoue-Logone Valleys, located within the upper reaches

of the Logone River and Vina River watersheds, consist primarily of broad uplands of low relief characterized by a series of crests between rivers and some shallow shales (a low-lying or depressed, and often wet stretch of land). Low hills and associated broad valleys are also extensive. The middle Benoue Valley consists of low hills, valleys, gently sloping and gently rolling uplands, and lowlands. Almost all the landforms are erosional surfaces, with elevations ranging from 300-600 meters. The lower Benoue Valley on either side of the lower reaches of the Benoue River is mainly lowlands and long gentle slopes extending to the surrounding more rolling uplands and rocky hills. Elevation here ranges from 160-300 meters.

Between the Mandara Highlands to the southwest and the flood plain of the Logone River to the east occur the Diamare Plains. This area is mostly plains, lowlands, and foot slopes adjacent to granitic hills and mountains. Landforms are mainly erosional surfaces of low relief, but dunes and interdune depressions occur in parts of the area. Elevation ranges from 320-600 meters.

To the east of the Diamare Plains and stretching northward are the Yaere Alluvial Plains, which include the flood plain of the Logone River between Kousseri and the Chad border south of Yagoua. From July to October the Yaere is flooded to a depth of 80-120 cm, except for high spots. Elevation ranges from 300-320 meters including nearly level lowlands, floodways of the Logone River, and wet depressions of the Danai-Fianga river system. Landforms are mainly alluvial deposits.

Extending northward to Lake Chad is the Logone-Chari Delta, an area of low relief consisting of the gentle slopes of the Lake Chad shore and the channeled delta of the Logone and Chad Rivers. Elevation ranges from 280-300 meters, and landforms consist mainly of shoreline or alluvial deposits. The Lake Chad shoreline can vary laterally as much as 20 km, depending on annual rainfall and the season of the year. The Chad basin is the largest inland drainage basin of the sub-Saharan region. The permanent drainage of the basin comes mainly from the Ubangi-Chari plateau via the Chari and Logone River systems.

- 2.1.2 Extending over 11 degrees of latitude, Cameroon has a marked south-north gradation of both climate and vegetation types. Generally, these include an equatorial climate in the south under which dense lowland rain forest grows, through the Guinea and Sudan type climates over woodland/savannas, to a drier climate of the Sahel type, the zone of wooded steppe in the far north.

The climatic pattern in Cameroon is governed by the interaction of continental and maritime air masses which, as they follow the annual migrations of the sun, bring about periodic differences in rainfall to distinguish the climatic seasons. The continental air mass to the north is stable with little moisture. Its prevailing northeast wind is the dry, dusty "harmattan" from the Sahara. The maritime air mass to the south, or "St. Helena anticyclone," is warm and moist with prevailing winds from the southwest. The equatorial low pressure belt, or "intertropical front," separates these two air masses. The front is a belt of instability, with variable winds and calms.

Coastal and Montane Rain Forest. In the southern coastal region a wet equatorial climate prevails. There is no dry season and diurnal and monthly fluctuations in temperatures and humidity are within narrow ranges, especially at the lower elevations and along the coast. Temperature ranges from an average of 22° to 29°C, and the average humidity is between 85-90 percent. Average rainfall ranges from 2540-4010 mm. Mountains in the western region force moisture laden on shore winds upward into cooler strata, creating local microclimates that are especially wet on their windward sides. The western slopes of Mount Cameroon are among the wettest places in the world, receiving from 6000-9000 mm of rainfall annually. Due to the high level of humidity and low rate of evaporation, most of this zone is covered with a rich vegetation of coastal mangrove forests and tropical lowland rain forest inland.

Humid South. The southern plateau region comes under the influence of equatorial air masses from the south and the maritime air mass from the southwest. The resultant climatic pattern includes two seasonal rainfall peaks annually and two less rainy seasons that are loosely referred to as the dry season and little dry season. Annual rainfall averages up to 2500 mm in southernmost reaches of the region. The heaviest rains occur in August and September with moderately heavy rainfall in April and May. The "dry season" is greatest during December-January and June-July when monthly rainfall drops to 76-152 mm. This climate supports lowland rain forest. Further north around 5 degrees north latitude, rainfall averages 1500 mm annually. Here the vegetation begins a transition to forest-savanna mosaic. Throughout the southern plateau region diurnal and seasonal fluctuations in temperature and humidity are within narrow ranges, especially at lower elevations and along the coast.

Central Savanna. In the transition zone of the Adamaoua plateau, elevation tends to moderate temperature. At Ngaoundere daily maximums range from 27.8°C in June during the



rainy season to 34°C in March at the end of the dry season. The daily average is around 15.6°C in the rainy season. Annual rainfall is about 1500 mm and the rainy season extends from April to October. This region supports relatively moist types of undifferentiated woodland.

Semiarid Northern Plains. The northern plains are tropical, hot, and dry with annual rainfall dropping to 600 mm toward Lake Chad. Most of the annual rainfall is concentrated in a five-month season from May to September in the Garoua region and in a shorter season northward near Lake Chad. For the rest of the year and intermittently during the rainy season, this northern region is under the influence of the dry harmattan winds. During the dry months the diurnal range in temperature often covers thirty degrees F and may reach fifty degrees F. The southern part of the region supports sudanian steppe grasslands. Much of this zone is heavily populated by man and livestock, and as a result the vegetation has been greatly modified.

Table 2. Climatic Data at Selected Stations

Climates	Stations	Rainfall mm	Temperature C	Evaporation mm	Dry Month	Wet Month
Equatorial	Ebolowa	1597	23.9	--	0	12
	Yaounde	1478	23.5	692	2	10
Tropical	Ngaoundere	1574	22.2	1822	5	7
Sudan	Garoua	982	28.1	2380	6	6

Source: Kadamura. 1977.

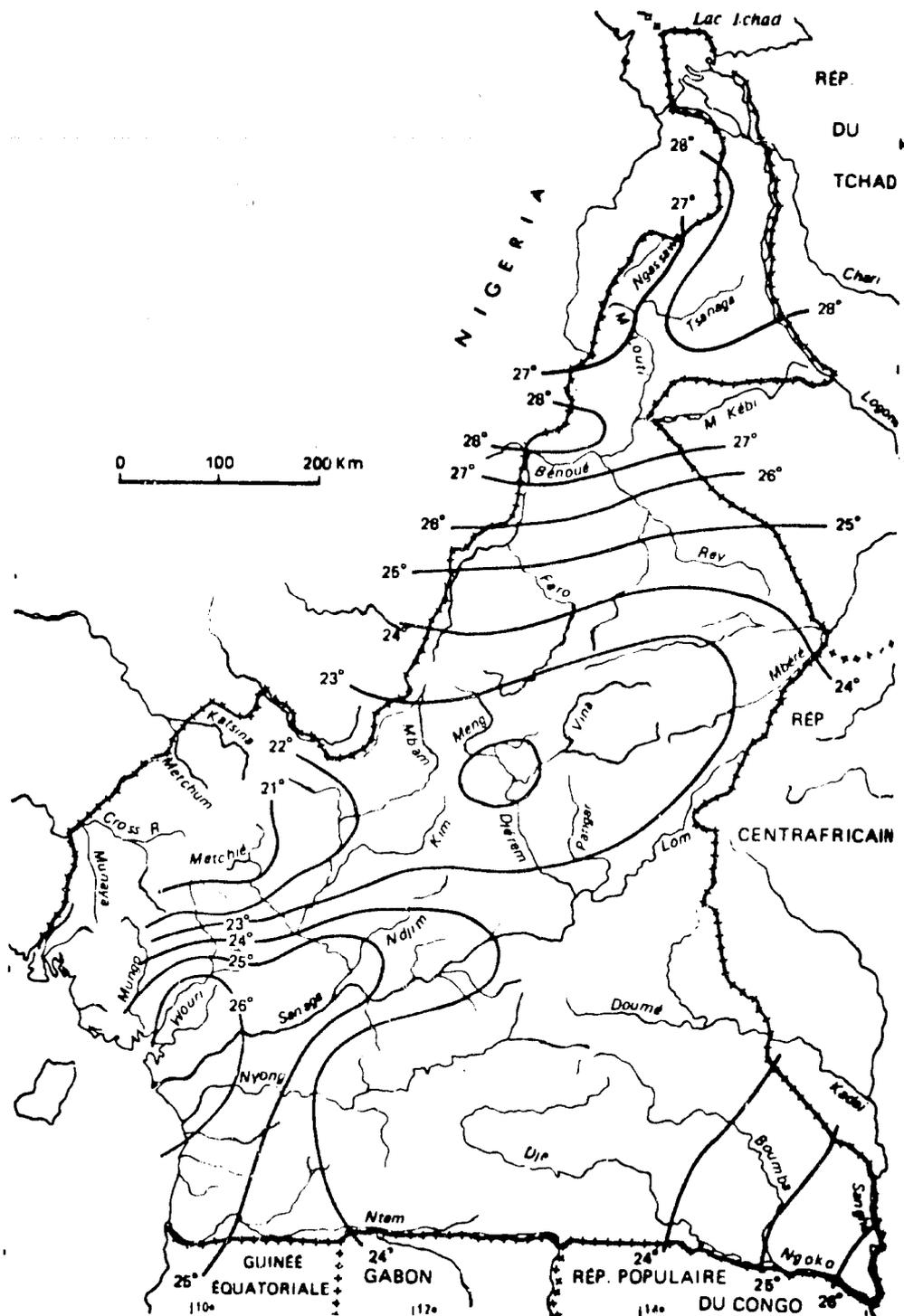


Figure 5. Average annual temperatures, °C.

## 2.2 Social Characteristics <sup>1/</sup>

The population of Cameroon was projected to reach 8,434,000 in 1980 with an annual growth rate of 2.56 percent, which if continued would lead to a doubling of the population in twenty-seven years. With an estimated 41.6 percent of the population under 15 years of age it is unlikely that the growth rate of the population will slow appreciably in the near future. Population density for the country is 17.7 persons per sq km, however this ranges from less than 5 per sq km in the forests of the southeast to over 100 per sq km in much of the western highlands. There are also high densities along the coast near Douala. The population in Cameroon is still largely rural with 28.5 percent of the population in urban centers. However, there is extensive migration into the urban centers, principally Douala and Yaoundi, and the urban population is estimated to be growing at five to ten times the rural rate.

Table 3. Population by Rural/Urban Distribution, Age, and Sex <sup>1/</sup>

	<u>Total</u>	<u>%</u>
<u>Rural and urban population</u>		
Rural population	5,479,004	71.5
Urban population	2,184,242	28.5
Yaounde	(313,706)	(4.1)
Douala	(458,426)	(6.0)
Other urban areas	(1,412,110)	(18.4)
Total	7,663,246	100.0%
<u>Population by age group</u>		
0-14	3,326,615	43.4
15-64	4,056,922	52.9
65 and over	279,709	3.7
Total	7,663,246	100.0%
<u>Population by sex</u>		
Male	3,754,991	49.0
Female	3,908,255	51.0
Total	7,663,246	100.0%

<sup>1/</sup>Based on April 1976 population census adjusted to take into account an omission rate of 6.9%

Source. Ministry of Economic Affairs and Planning.

<sup>1/</sup>Sources: Europa. 1980.  
Tsui. 1979.  
U.S. AID. 1978.  
U.S. AID. 1979b.  
U.S. AID. 1980.  
World Bank. 1980.

Table 4. Agricultural Population, 1972/73

Province and Department	Number of Agricultural Households	Agricultural Population	Agricultural Labor Force	Cultivated area (ha)
<u>Northern Province</u>	312,003	1,401,508	808,097	511,483
Adamaoua	36,696	171,689	93,077	44,011
Benoue	60,779	260,085	150,975	100,927
Diamare	81,750	366,445	219,239	177,569
Logone and Chari	22,020	88,486	50,854	34,838
Margui-Wandala	71,865	339,954	195,150	114,787
Mayo Danai	38,893	174,849	98,796	39,351
<u>Eastern Province</u>	56,269	279,319	155,366	102,149
Haut Nyong Lom and Djerem	23,079	114,702	64,841	49,797
Kadei	11,935	57,618	34,323	16,289
Loumba Ngoko	12,835	63,519	33,679	16,924
	8,420	43,280	22,523	19,138
<u>South Central Province</u>	189,108	983,400	513,722	381,446
Mefou	27,435	125,944	69,640	36,319
Mbam	25,366	139,888	64,977	47,433
Ntem	21,710	112,562	62,571	76,958
Dja and Lobo	16,195	82,543	44,147	47,540
Nyong and Soo	11,585	62,726	31,362	17,440
Nyong and Fomou	17,070	70,840	41,034	35,363
Haute Sanaga	10,360	53,033	33,573	19,658
Kribi	10,995	56,067	28,167	28,906
Lekie	33,895	201,037	97,718	49,986
Nyong and Kelle	14,497	78,760	40,533	21,841

Table 4, continued

Province and Department	Number of Agricultural Households	Agricultural Population	Agricultural Labor Force	Cultivated area (ha)
<u>Littoral Province</u>	50,260	299,111	125,691	74,735
Mungo	27,205	169,594	71,406	52,129
Sanga				
Maritime	13,108	82,349	32,317	15,514
Nkam	8,212	39,874	18,791	16,649
Wouri	1,735	7,294	3,177	443
<u>Western Province</u>	129,395	876,392	358,993	161,447
Menoua	26,430	185,083	75,651	28,986
Mifi	29,545	216,340	89,215	36,102
Bamboutos	20,800	153,676	63,146	29,223
Nde	11,550	67,723	27,598	11,975
Haut Nkam	15,500	99,321	39,403	16,672
Bamoun	25,570	154,249	63,980	38,484
<u>North-West Province</u>	110,242	709,144	314,636	134,418
Mezam	36,141	227,205	93,331	51,349
Momo	15,432	106,728	49,420	10,823
Denga Mentung	18,610	126,782	53,938	19,779
Mentohum	16,766	135,132	64,295	25,182
Bui	23,293	113,297	53,652	27,284
<u>South-West Province</u>	78,618	457,253	200,693	114,880
Fako	21,307	103,689	43,209	13,230
Meme	22,458	122,394	54,085	40,587
Ndiam	12,855	68,430	30,841	15,488
Mamzu	21,998	162,740	72,558	45,574

Source: Agricultural Census 1972/73.

The life expectancy for a Cameroonian at birth is 41 years. The adult literacy rate is 44 percent. This rate varies widely regionally and is highest in the relatively urban areas and lowest among the pastoralists of the north. The enrollment statistics of children aged 5-14 are good for Africa with about 65 percent receiving primary education. The same regional pattern of school attendance exists as that for literacy.

The ethnic composition of Cameroon is very diverse. There are about 200 different ethnic groups in all. In the south Bantu stock predominates, while in the northern pastoral zones Hamitic Fulani, Arab Choa and Sudanese Negroes are the main groups. A Bantu group, the Bamileke have historically dominated the cultural and economic life of the country. French and English are the official languages of Cameroon with French the dominant one, but a large variety of local languages are used in day-to-day activities. Islam, Christianity, and animism are about equally observed in Cameroon with Christianity predominating in the south and Islam in the north.

There is approximately one physician for every 26,000 people in Cameroon making Cameroon 110th among nations in that statistic. The infant mortality rate is 142 per 1000 children. Health care is generally better in urban areas than in rural areas. Malaria is considered the most critical health problem in the country. No area of the country is entirely free from it, although its incidence varies greatly regionally. Tuberculosis is the second most serious health problem. Other serious health problems include schistosomiasis, onchocerciasis and typanosomiasis. Nutritional deficiencies and insufficient medical care have contributed to health problems in Cameroon.

Malnutrition of children is a severe problem in Cameroon with nearly a quarter of all children affected. Incidence is highest in rural areas, particularly the western and northern provinces. Nearly forty percent of Cameroon's children are anemic. However, there is no evidence of a significant amount of acute malnutrition in Cameroon.

### 2.3 Economic Characteristics <sup>2/</sup>

The gross domestic product (GDP) of Cameroon in 1977 was 2.65 billion and has been growing at an annual rate of 2.9 percent.

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<sup>2</sup>Sources: Europa. 1980.  
U.S. AID. 1975a.  
U.S. Bureau of Mines. 1975.  
World Bank. 1980.

With its relatively large population and diversified production pattern, it appears to have a significant potential for expansion.

Table 5. GDP by Industrial Origin, 1970-78  
(at 1974/75-1976/77 market prices)

Sector	Percentages				
	1970	1972	1974	1976	1978
Agriculture .....	36.45	36.91	34.32	34.12	31.99
Mining.....	0.31	0.22	0.36	0.30	0.44
Manufacturing.....	9.32	10.08	8.77	10.23	9.59
Electricity, gas and water.....	1.27	1.23	1.07	1.06	1.01
Construction.....	3.85	3.69	3.92	4.34	5.01
Trade .....	18.45	17.60	15.51	16.09	15.98
Transport and communications...	8.36	8.50	7.91	8.17	7.84
Public administration .....	6.76	6.98	6.83	7.35	7.27
Other services.....	11.00	10.55	17.25	13.26	14.64
Import Duties.....	4.22	4.24	4.07	5.07	6.20
Total GDP.....	100.00	100.00	100.00	100.00	100.00

Source: World Bank, 1980.

Table 6. GDP by Industrial Origin, 1970-78  
(at 1974/75-1976/77 market prices)

Sector	Growth Rates (percent)				
	1970	1972	1974	1976	1978
Agriculture .....	4.9	5.8	4.8	1.3	8.5
Mining.....	128.6	-64.7	35.3	-20.0	17.2
Manufacturing.....	3.0	1.3	1.8	12.3	5.1
Electricity, gas and water.....	6.6	-1.5	1.5	2.9	-6.0
Construction.....	-2.6	5.8	11.1	21.7	-0.5
Trade .....	2.2	-2.0	5.5	2.6	9.0
Transport and communications..	2.1	3.8	5.0	4.9	6.5
Public administration .....	10.5	4.7	7.4	8.8	7.7
Other services.....	0.5	5.1	46.4	-2.3	11.1
Import Duties.....	18.0	-4.1	18.2	36.9	21.6
Total GDP.....	3.0	2.6	11.1	5.0	8.5

Source: World Bank, 1980.

Agriculture is the dominant activity in Cameroon. 32 percent of the GDP is from agricultural production, a figure which has remained nearly constant over the past two decades. Nearly three-quarters of the population are engaged in agricultural activity. Agriculture also provides about 75 percent of Cameroon's exports. Agricultural production is almost entirely on small family-owned farms. The average holding is about 2.5 hectares. Traditional farming methods are largely still in use. In these small holdings, there is virtually no mechanization. About 5 percent of the cropland under cultivation is in large plantations producing such crops as tea, rubber, bananas, cocoa and sugar.

The major crop grown by small farmers for export is coffee. About two-thirds of the coffee is *robusta* and one-third *arabica*. Cotton is the second major crop grown for export by small farmers. Bananas and cocoa are grown in smaller quantities, but the export market is controlled by the large plantations and has been declining for both crops.

Cameroon is judged to be essentially self-sufficient in food. The primary staple foods are root and tuber crops and cereals such as millet and maize. About 80 percent of the daily per capita caloric intake is from these sources.

Table 7. Principal Crops

	AREA HARVESTED ('000 ha)			PRODUCTION ('000 metric tons)		
	1970*	1977*	1978*	1976*	1977*	1978*
Rice (paddy)	20	20	20	19†	20	20
Maize	340	300	350	355	300	350
Millet and sorghum	430	430	435	360	300	370
Potatoes	15	15	15	40	41	41
Sweet potatoes	49	49	49	160	160	160
Cassava (Mamoc)	100	101	100	300	300	331
Other roots and tubers	303	320	330	1,000	1,030	1,098
Dry beans	125	130	130	70	70	81
Groundnuts (in shell)	203	205	210	170	170	164
Sesame seed	10	10	11	0	0	0
Seedcotton	} 60†	} 53†	} 61†	45†	41	60
Cotton seed				25†	24	35
Cotton lint				15†	15	23
Peanut kernels	n.a.	n.a.	n.a.	45	47	45.5
Sugar cane	30	40	41	300	407	500
Coffee (green)	200	304	300	80†	0	0
Cocoa beans	330	330	330	52†	105	100
Tobacco (leaves)	6	6	6	3	3	3
Natural rubber	n.a.	n.a.	n.a.	18	15	19

Source: Europa. 1980.

The major governmental instruments for agricultural development are the Secteurs de Modernisation, agencies divided by crop and region that provide assistance to farmers. Zones Agricoles de Priority Integrees have been set up to facilitate activities to increase

crop production. Various regional agricultural development centers have also been initiated.

The livestock sector contributes about a third of the total agricultural production. Cattle, sheep and goats are the major stock raised. Most production is in Northern Cameroon. Cattle are primarily raised by the Fulani in the far north. Farther south, the tsetse fly has made cattle production very difficult and sheep and goats predominate.

Table 8. Livestock ('000 head)

	1976	1978
Cattle	2,750	2,972
Sheep	2,100	2,155
Goats	1,550	1,636
Pigs	650	789
Horses	59	60
Asses	64	73
Chickens	9,000	9,620

Source: Europa. 1980.

Fishing is generally an unimportant part of the Cameroonian economy, despite the coastline. It is largely a part-time subsistence occupation. Most of the fish caught are sold in the coastal towns of the Douala area. A small amount of commercial fishing is done. Recently, commercial shrimp catches have been increasing, and shrimp has become a major export product.

Table 9. Fishing ('000 metric tons, live weight)

	1970	1971	1972
Inland waters	50.0	50.0	50.0
Atlantic Ocean	20.8	24.5	21.6
TOTAL CATCH	70.8	74.5	71.6

Source: Europa. 1980.

Industrial activities employ about 15 percent of the labor force and contribute about 10 percent of the GDP. This sector has two divisions, a traditional, labor-intensive, mainly small-scale section of artisan workshops and a modern section processing raw materials and assembling imported components. There has been considerable recent expansion in this sector under the Third Five-Year Plan (1971-1976).

Table 10. Industry, Selected Products

		1973	1974	1975	1976	1977
Palm oil	'000 metric tons	69.3	72.2	79.9	89*	77
Raw sugar	" " "	12*	14*	25	32*	35
Cocoa butter	" " "	0.6	0.6	7.9	6.6	n.a.
Beer	'000 hectolitres	11*	1,242	1,065	1,147	1,526
Soft drinks	" " "	159*	173*	569*	439	n.a.
Cigarettes	million	1,159*	1,515	1,935	1,535	1,755
Soap	'000 metric tons	n.a.	n.a.	7.6	14	n.a.
Cement	" " "	17*	125	192	210	278
Aluminium (unwrought)	" " "	11.1	47.5	51.9	51.3	56.0
Radio receivers	'000	85*	85*	69	51	80
Leather footwear	'000 pairs	0	4,434	2,973	4,215	n.a.
Electric energy	million kWh.	1,122	1,142	1,319	1,339	1,340

Source: Europa. 1980.

The mineral industry in Cameroon is small and at present constitutes less than one percent of the GDP. The only minerals with sufficient reserves to be economically extractable are tin and aluminum. Bauxite with reserves estimated at 1 billion tons at Minim-Martap has the potential of becoming more important. In addition, in 1976, the first commercial oilfield was located near the Nigerian border. Further finds have followed. By 1979, oil output reached 1.7 million tons. Annual output is expected to reach 5 million tons within a few years. Cameroon should become self-sufficient in petroleum and able to export small quantities. When the bauxite and petroleum resources are under full production, the mining sector may contribute as much as 5 percent of the GDP.

### 3.0 Environmental Resources

#### 3.1 Soils <sup>3/</sup>

Crystalline metamorphic and volcanic rock underlies much of Cameroon. There is very little sedimentary rock in Cameroon. Soils derived from existing rock tend to be dominated by clay in the south and central areas and by sandy soils in the north. In the north, the soils have not been thoroughly leached and laterized due to the limited rainfall. However, there is considerable variation in the amount of laterization. Along the watercourses, such as along the Logone river, the soils are more fertile and contain more humus. Most crops grown in the north are grown in such areas. In central Cameroon, where the soils are younger and generally of volcanic origin, the soil is relatively fertile and supports much of the coffee crop, numerous subsistence crops and rich grasslands. In southern Cameroon, the soils are mostly derived from ancient granites. The heavy rainfall and intense heat in this area have formed extensive areas of weak lateritic soils. Along the coast, the soils are mainly sedimentary and are generally good. Most commercial plantations are here, particularly banana and rubber.

Degradation of the soil in Cameroon is widespread. In the north, erosion and exhaustion of the relative infertile soil are common. In the fertile central regions, particularly in the Western Highlands, erosion is a major problem. Finally, in the south, where the forest cover has been removed, the already poor lateritic soils have become virtually useless.

An FAO soil map of the entire country is found in Appendix III. For western Cameroon there is only a general soil map based on the FAO report *The Soils and Ecology of West Cameroon*. In eastern Cameroon ORSTOM has published many local maps at the scale of 1:100,000.

Maps that provide coverage of Cameroon include:

Hawkins, P. and Brunt, M. 1965. *The Soils and Ecology of West Cameroon*. Report to the Government of Cameroon. 2 vols. with maps. Rome: FAO. FAO/EPTA Report No. 2083.

Martin, D. 1963. *Carte Pedologique du Nord Cameroon au 1:100,000*. (Kaele) Yaounde: ORSTOM.

Martin, D. and Seagalen, P. 1966. *Notice Explicative de la Carte Pedologique du Cameroon Oriental au 1:1,000,000*. Yaounde: ORSTOM.

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<sup>3</sup> Source: U.S. AID. 1975a.

Seagalen, P. and Vallerie, M. 1963. Carte Pedologique du Nord Cameroun au 1:100,000 (Mokolo). Yaounde: ORSTOM.

Sieffermann, G. 1963. Carte Pedologique du Nord Cameroun au 1:100,000 (Kalfou). Yaounde: ORSTOM.

Sieffermann, G. and Vallerie, M. 1963. Carte Pedologique du Nord Cameroun au 1:100,000 (Yagoua). Yaounde: ORSTOM.

## 3.2 Vegetation

### 3.2.1 Vegetational Associations <sup>4/</sup>

Cameroon stretches from Lake Chad in the north, a semi-desert region, to the rainforests of the Congo basin. Figure 6 shows the location of the major vegetational associations, which are described in the following text.

#### Tropical Rain Forest

The tropical lowland rain forest of southern Cameroon forms part of the Guineo-Congolian floristic region, a belt of tropical rain forest stretching from Sierra Leone to the Rift Valley and occurring on drained sites throughout most of the region. The annual rainfall is between 200 mm for the drier types up to more than 3000 mm for the wetter types. The tropical rain forest belt consists of a continuous stand of trees of several strata, including an upper stratum of large trees which may be 50-60 meters high. Although it shows differences in its floristic composition and certain variations in structure, its most remarkable feature is its floristic and physiognomic uniformity.

Tropical rain forests are most generally mixed forests. Single dominant forests cover a small area, but they are widely scattered; nearly all are dominated by members of the Caesalpinioideae, which is also very well represented in mixed forest. Wetter types of rain forest are evergreen throughout the year but deciduous species appear in disturbed wetter types and gradually increase in numbers with decreasing rainfall. However, tropical rain forest always shows an evergreen nature rather than a deciduous one.

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<sup>4</sup>Sources: FAO. 1977.  
IUCN. 1979.  
U.S. Department of Agriculture. 1978.



Figure 6. Phytogeographic Regions

1a. Guineo-Congolian wet evergreen lowland rain forest

This forest type covers a narrow band along the Atlantic coast where mean annual rainfall is 200 mm and higher. Most individuals are evergreen and shed their leaves intermittently throughout the year. This wet coastal strip has a very rich and distinct endemic flora. The Congo-Cameroon

coastal strip is probably one of the richest because it has been one of the few refuges where evergreen rain forests were able to persist during the climatic vicissitudes of the late Pleistocene. Very few endemics occur throughout, but *Sacoglottis gabonensis* is one of them. This is an area of great scientific value as it is a living fossil holding clues to the theory of the continental drift, to the patterns of climatic change, and to the evolution, diversification, and radiation of primates.

#### 1b. Guineo-Congolian moist evergreen lowland rain forest

This forest type is scattered in small islands throughout the moist semi-evergreen lowland rain forest in a broad aureole surrounding the Zaire River basin. It is usually dominated by the Leguminosae (Cesalpiniodeae). *Gilbertiodendron dewevrei* forests are common in southeastern Cameroon. This species is able to regenerate in its own shade and can also invade moist semi-evergreen lowland rain forest which is usually deficient in regeneration of its own dominant species.

#### 2. Guineo-Congolian semi-evergreen lowland rain forest

This consists of both moist and dry semi-evergreen lowland rain forest. The moist type occurs in areas with annual rainfall between 1600 and 2000 mm, well distributed or with a dry season tempered with moist air from the sea. This is a rich flora with tropical large tree species of: Meliaceae (*Entandrophragma angolense*, *E. candollei*, *E. utile*, *Guarea cedrata*, *G. thompsonii*, and *Lova trichiliodes*); Myristicaceae (*Coelocaryon preussii*), and Chrysobalanaceae (*Maranthes glabra*). It is possible that all the semi-evergreen rain forest is secondary.

Dry semi-evergreen lowland rain forest occurs in areas with annual rainfall between 1600 and 2000 mm with high humidity in the dry season. Most individuals of larger trees are deciduous, but often only 1 to 2 weeks in the dry season. Individuals of the same species shed their leaves at different times so that the forest continues to show an evergreen nature. This type of forest occurs north of the moister type. Frequent species include *Azalia africana*, *Aningeria altissima*, *A. robusta*, *Chrysophyllum perpulchrum*, *Cola gigantea*, and *Khaya grandifoliola*. *Terminalia superba*, a fast growing and valuable timber species, has deeply penetrated into moist semi-evergreen and wet evergreen rain forests after the clearing of forest for agriculture.

#### 3. Mosaic of types 1 and 2

#### 4. Swamp forest

Occurs on low-lying sites on land permanently water-logged with the watertable permanently or seasonally above ground-level. Permanent swamp forest is rich in species. In Cameroon there are two major areas of swamp forest, upper Nyong (4a) and Sangha (4b). Its canopy is rather open with the tallest trees as high as 40 meters. Characteristic species include *Entandrophragma palustre*, *Coelocaryon botryoides*, *Uapaca guineensis*, and *Symphonia globulifera*.

#### Mosaics of Forests and Transitions

#### 5. Guineo-Congolian lowland rain forest - secondary grassland mosaic

This mosaic forms part of a belt of rain forest to the north and south of the Zaire basin that is replaced with an abrupt transition to tall grassland. It is generally assumed that this grassland has been derived from the clearing of rain forest for the planting of crops. Grass may invade land that is left to revert to bush fallow, especially where the soil is poor (low water-holding capacity) and the fallow period short. It occurs more readily on sandy than on heavier soils and in drier than in wetter regions.

In this mosaic, patches of rain forest species intermixed with deciduous species (not confined to streamsides) are surrounded by savanna of tall grasses. The semi-deciduous rain forest grows especially along rivers and in groves on hills and plateaus. In contrast to the relatively rich flora of the forest patches, the savanna is usually poor floristically: *Pennisetum purpureum*, *Panicum maximum*, *Loudetia arundinacea*, *Impreata cylindrica*, or some other grass may assume almost complete dominance in the herb layer. This savanna is normally burnt each year and, since it burns fiercely, only fire-tolerant trees and shrubs can survive; among the latter *Hymenocardia acida* is especially characteristic. As the climate in this region differs little from that of rain forest, the savanna may be invaded by rain forest species if fires are excluded for several years.

On the Adamaoua Plateau in the north of this region (Sudanian-Guinean ecological zone) the vegetation shifts to relatively moist types of undifferentiated woodland which forms part of a wide belt between the forest-savanna mosaic to the south and the woodland with abundant *Isobertinia* to the north. This is a more varied belt of woodland than that to the north. Characteristic tree species include *Daniella oliveri*, *Lophira lanceolata*, *Bauhinia*, and *Terminalia* (most notably the first two) in association with *Andropogon* and other grasses.

## 6. Montane forest - secondary grassland mosaic

This rather heterogeneous formation is composed almost entirely of species that also occur in lowland rain forest (though they may be of restricted occurrence there), as well as *Podocarpus* and *Olea* spp., woodland associations of trees and shrubs, the tree fern *Cothlea drogei*, and thickets of the bamboo *Arundinaria alpina*.

Also found in this formation are grasslands. Among the grasslands common at lower altitudes are *Themada triandra*, *Pennisetum clandestinum*, *P. schimperii*, *Loudetia simplex*, and *Andropogon distachyus*. At higher altitudes occur *Festuca abyssinica*, *Agrostis isopholis*, and *Pentaschistis manni*.

Montane evergreen forest (6a) occurs on Mt. Cameroon above about 1300 meters altitude. This differs from its lowland counterpart in floristic composition, in the abundance of epiphytic bryophytes, and in the smaller height of the trees. *Olea*, *Ocotea*, *Juniperus*, *Podocarpus*, *Schefflera*, and *Pittosporum* are among the many genera characteristic of this type. Above about 300 meters on Mt. Cameroon occur afro-alpine communities (6b). Arborescent species of *Senecio* and *Lobelia*, and shrubby species of *Alchemilla* and *Helichrysum* are typical of the afro-alpine communities.

### Woodland

Trees occur in open stands with the canopy from 8-20 meters over at least 40 percent of the surface. Most species are deciduous or semi-deciduous. The dominance of trees combined with a light open canopy and the presence of heliophilous grasses distinguish woodland from the other vegetation types. The ground cover includes mostly herbaceous geophytes, hemicryptophytes, and chamaephytes. This woodland is the most extensive vegetation type in Africa and is very variable in height, density, deciduousness, and thorniness. Due to extensive degradation, this woodland is often referred to as savanna.

## 7. Sudanian woodland with abundant *Isoberlinia* (relatively moist type)

This vegetation type marks the transition from the Guinean to the Sudanian ecological zone. Stages range from woodland to grassy savanna. Tree cover density varies greatly with edaphic conditions and the nature and extent of human activity. This woodland is physiognomically similar to the miombo woodland (though floristically poorer) and is dominated by *Isoberlinia*. *Brachystegia* and *Julbernardia* genera, other characteristic features of the woodlands of tropical Africa, are absent. *Isoberlinia* is represented by two

species - *I. doka* and *I. dalzielii* - in association with *Andropogon* and other grasses. *I. doka*, after cultivation and burning, is often replaced by more fire tolerant species which persist in wooded grasslands.

#### 8. Undifferentiated Sudanian woodland (relatively dry type)

This formation is often found in association with #7. Climatically, it falls between the moister type of woodland described above and the dry wooded steppe with abundant *Acacia* that occurs to the north in the Sahelian zone. Stages range from woodland to grassy savanna. Practically all the vegetation has been deeply modified by cultivation, cutting, grass fires, and intensive grazing. Woodland remains only on rocky hills and ironstone plateaux. Many broad-leaved semi-deciduous trees occur. Larger trees are 8-12 meters high and characteristic species include *Anogeissus leiocarpus*, *Balanites aegyptiaca*, *Lannea microcarpa*, *Prosopis africana*, and *Sclerocarya birrea*. The lower tree stratum is about 6 meters high, with short boles, and includes *Combretum glutinosum*, *Strychnos spinosa*, and *Terminalia avicennoides*. The grasses are mainly of the *Hyperrhenia* genus. Other significant grasses include *Pennisetum* spp. and *Andropogon gavanus*.

#### Woodland and Transition Mosaic

#### 9. Mandara plateau mosaic

On the steep, rocky slopes cultivation and continuous excessive grazing have destroyed most of the climax vegetation. Very few of the climax species remain and the present plant community is mostly annual grasses. The potential plant community is grassland characterized by *Hyperrhenia rufa*, *Heteropogon contortus*, *Andropogon gayanus*, *Aristida*, and scattered *Ficus*, *Balanitis aegyptica*, and *Acacias*.

On the upland plateau, the vegetation has been altered by grazing but still remains in fair to good condition. The potential plant community is grassland characterized by *Hyperrhenia rufa*, *Pennisetum pedicellatum*, and *Andropogon gayanus*.

On the colluvial foot slopes and outwash plains, the present plant community consists of many annual grasses and a few perennial grasses. The potential plant community of the natural savanna is characterized by *Hyperrhenia rufa*, *Pennisetum* spp., *Ctenium* spp., and tree species of the genera *Ficus*, *Balanitis*, and *Acacia*.

#### 10. Wooded steppe with abundant *Acacia*

This vegetation belt, part of the Sahelian ecological zone, is a transition zone between the desert and subdesert types to the north and the savanna/woodlands to the south. The abundance of the trees and shrubs. In some places the trees, mostly species of *Acacia*, form open or closed woodland or thickets; in other places the trees are widely scattered. Most of the trees are deciduous, fine-leaved and thorny.

The stoney loamy slopes of the hills and mountains rising out of the plains form a natural savanna on which the potential plant community is characterized by *Hyperrhenia rufa*, *Andropogon gayanus*, *Pennisetum* species *Acacia senegal*, and *Balanites aegyptica*. The present plant community has been significantly modified by intense grazing and annual burning.

On the alluvial flood plain, the potential plant community of the natural savanna is characterized by *Andropogon gayanus*, *Hyperrhenia rufa*, *Setaria pallidifusca*, *Setaria communis*, and scattered *Acacia* and other trees. The present plant community is primarily annual grasses. Trees and shrubs have increased in density.

On the deep sands and sandy loams on windformed terraces and sloping uplands, the potential plant community is *Hyperrhenia rufa*, *Pennisetum pedicellatum*, *Andropogon gayanus*, *Ctenium canesiens*, *Acacia* species, *Ficus* species, *Commiphora africana*, and *Scleracarya bicoene*. The present plant community is mainly annual grasses and *Acacia* trees.

#### Edaphic Grassland Mosaics

Vegetation classified under this heading covers large tracts across Africa between the desert and subdesert types on the one side and moister woodland types on the other. These grasslands occur on seasonally or permanently waterlogged soils (anaerobic grasslands).

#### 11. Mosaics of edaphic grassland and communities of *Acacia* and broad-leaved trees

This vegetation zone occurs in the flood plains of the Logone River. An unusual feature of this area is the Yaere flood plain, which is flooded to a depth of 80-120 cm, except for high spots. There are three major potential plant communities in this area. An open savanna on the sandy ridges adjacent to the Logone River is characterized by *Andropogon gayanus*, *Pennisetum* spp., and *Ctenium* spp. *Acacia* predom-

inates in this woody savanna, but many broad-leaved trees (*Combretum* and *Terminalia*) occur in association with *Adansonia digitata*, *Sclerocarya*, *Celtis*, *Ziziphus*, and *Gymnosporia*. This plant community has been greatly altered by excessive grazing and now consists mainly of annual grasses and *Acacia* trees.

In the grassland on the Yaere flood plain, the potential plant community is characterized by *Oryza barthii*, *Hyperrhenia rufa*, *Enchinochloa* spp., and *Sporobolus pyramidalis*. The present plant community consists of high-yielding annual sorghums and some of the perennial grasses of the potential plant community.

The third potential plant community is on a natural savanna, primarily on broad alluvial flood plains. It is characterized by *Andropogon gayanus*, *Hyperrhenia rufa*, *Setaria pallidifusca*, *S. communis*, and scattered *Acacia* trees. The original plant community has been altered by excessive grazing and now consists mainly of annual *Aristida* spp., *Setaria* spp., and *Hyperrhenia rufa*.

#### 12. *Acacia*-wooded grassland - edaphic grassland mosaic

These grasslands develop on the Pleistocene clay of the Lake Chad shore and the channeled delta of the Logone and Chari Rivers. These clays are periodically flooded (with large ponds, some of which are more or less permanent) or waterlogged during the wet season (June to September), and dry out on the surface during the dry season. Grasslands occur where the annual flooding is deep (1-2 meters) and prolonged. Woody communities dominated by *Acacia* are only shallowly flooded. The floristic composition is very variable but generally includes the hygrophilous grasses *Echinochloa pyramidalis*, *Vetiveria nigritana*, *Oryza barthii*, and *Hyperrhenia rufa*. During the dry season, the vegetation dries up completely even if it has escaped destruction by grazing or fire. Scrubs have increased in density in the alluvial flood plain.

#### Azonal Vegetation

#### 13. Semi-aquatic vegetation (reed swamps)

These swamps are periodically or permanently inundated. The vegetation in them or their surroundings varies greatly with the depth of the water, the peat content, and period of submersion. The commonest species, which often form pure stands, are *Cyperus papyrus*, *Typha*, *Juncus*, and *Scirpus*. In temporary swamps the vegetation consists of *Hyperrhenia rufa*,

*Chloris gayana*, *Ischaemum afrum*, and *Setaria palustris*.

#### 14. Mangrove

This forest vegetation is confined to marine and fluvial intertidal areas along Cameroon's coast that are regularly flooded with salt or brackish water. Dominating species of trees include *Rhizophora racemosa*, *R. harrisonii*, and *R. mangle*, with *Avicennia nitida* sometimes occurring behind areas of *Rhizophora*.

#### 3.2.2 Status of Native Flora

Cameroon includes areas representative of nearly every major habitat type in Africa, except for arid habitats. As a result there is a rich and varied flora. This flora has not been completely catalogued, but some families and regions of Cameroon have been effectively surveyed. In addition, *Flora of West Tropical Africa* includes Cameroon. There are a considerable number of endemic taxa in Cameroon, particularly in the montane forests of the western highlands and on Mt. Cameroon. These montane areas are unique in West Africa. Most of the plants considered in need of protection in Cameroon are found in the montane areas (see Table 11).

Table 11. Plant Species Recommended for Protection

Species	Location on Biogeographical Map
<i>Podocarpus milanjanus</i>	Montane formations (6)
<i>Glossocalyx brevipes</i>	Forest on Mt. Koupe (2)
<i>Pararistolochia goldieana</i>	Mts. Roumpi
<i>Phyllobotrym soyauxianum</i>	Biafran forest (1a)
<i>Cylicomorpha solmsii</i>	Western Highlands (6)
<i>Crateranthus talbotii</i>	Southern Coastal Formation (1a)
<i>Tetraphyllaster rosaceum</i>	Mt. Cameroon (6)
<i>Poga oleosa</i>	Biafran forest (1a)
<i>Endodesmia calophylloides</i>	Biafran forest (1a)
<i>Oldfieldia africana</i>	Southern Coastal Formation (1a)
<i>Pentabrachion reticulatum</i>	Forest on Mt. Koupe (2)
<i>Cultia kamerunica</i>	Mts. Bamboutos (11)
<i>Hamilcoa zenkeri</i>	Forest on Mt. Koupe (2)
<i>Tapura africana</i>	Southern Coastal Formation (1a)
<i>Zenkerella citrina</i>	Biafran forest (1a)
<i>Eurypetalum unijugum</i>	Forest on Mt. Koupe (2)
<i>Microberlinia bisulcata</i>	Yabassi-Edea (1a)
<i>Paraberlinia bifoliolata</i>	Yabassi-Edea (1a)
<i>Myrica arborea</i>	Mt. Cameroon (6)
<i>Scyphosyce manniana</i>	Biafran forest (2)

Table 11, continued

Species	Location on Biogeographical Map
<i>Medusandra richardsiana</i>	Forest on Mt. Koupe (2)
<i>Okoubaka aubrevillei</i>	Deng Deng forest ( )
<i>Melanodiscus africanus</i>	Biafran forest (2)
<i>Alangium chinense</i>	Mt. Cameroon (6)
<i>Lefebvrea nigeriae</i>	Mts. Mandara (9)
<i>Hoplestigma pierreanum</i>	Mt. Cameroon (6)
<i>Afrostyrax kamerunensis</i>	Mt. Cameroon (6)
<i>Rhychostigma racemosum</i>	Mt. Cameroon (6)
<i>Neeschumannia kamerunensis</i>	Southern coastal formation (1a)
<i>Corynanthe dolichocarpa</i>	Mt. Cameroon (6)
<i>Calochone acuminata</i>	Forest on Mt. Koupe (2)
<i>Didymosalpinx parviflora</i>	Mt. Cameroon (6)
<i>Atractogyne gabonii</i>	Forest on Mt. Koupe (2)
<i>Anthospermum cameroonense</i>	Mt. Cameroon (6)
<i>Anthospermum asperuloides</i>	Mt. Cameroon (6)
<i>Succisa trichotocephala</i>	Mt. Cameroon (6)
<i>Bafutia tenuicaulis</i>	Mts. Bamboutos (11)
<i>Crassocephalum mannii</i>	Mt. Cameroon (6)
<i>Helichrysum mannii</i>	Mt. Cameroon (6)
<i>Helichrysum cameroonense</i>	Mt. Cameroon (6)
<i>Helichrysum biafranum</i>	Mt. Cameroon (6)
<i>Vernonia calvoana</i>	Mt. Cameroon (6)
<i>Vernonia insignis</i>	Mt. Cameroon (6)
<i>Vernonia myriantha</i>	Mt. Cameroon (6)
<i>Vernonia chapmanii</i>	Mts. Bamboutos (11)
<i>Vernonia bamendae</i>	Mts. Bamboutos (11)
<i>Wahlenbergia arguta</i>	Mt. Cameroon (6)
<i>Wahlenbergia mannii</i>	Mt. Cameroon (6)
<i>Lightfootia ramosissima</i>	Mt. Cameroon (6)
<i>Lobelia columnaris</i>	Mt. Cameroon (6)
<i>Dielsantha galeopsoides</i>	Forest on Mt. Koupe (2)
<i>Celsia densifolia</i>	Mt. Cameroon (6)
<i>Celsia ledermannii</i>	Mts. Bamboutos (11)
<i>Veronica mannii</i>	Mt. Cameroon (6)
<i>Bartsia mannii</i>	Mt. Cameroon (6)
<i>Didymocarpus kamerunensis</i>	Forest on Mt. Koupe (2)
<i>Streptocarpus elongatus</i>	Mt. Cameroon (6)
<i>Acanthonema strigosum</i>	Mt. Cameroon (6)
<i>Whitfieldia preussii</i>	Forest on Mt. Koupe (2)
<i>Mimulopsis solmsii</i>	Mt. Cameroon (6)
<i>Filetia africana</i>	Forest on Mt. Koupe (2)
<i>Afrofittonia silvestris</i>	Forest on Mt. Koupe (2)
<i>Staurogyne kamerunensis</i>	Biafran forest (1a)
<i>Schaueria populifolia</i>	Southern coastal formation (1a)
<i>Isoglossa nervosa</i>	Mt. Cameroon (6)
<i>Brachystephanus longiflorus</i>	Mt. Cameroon (6)

Table 11, continued

Species	Location on Biogeographical Map
<i>Oreacanthus manni</i>	Mt. Cameroon (6)
<i>Pycnostachys pallidicaerulea</i>	Mts. Bamboutos (11)
<i>Sciaphila ledermannii</i>	Southern coastal formation (1a)
<i>Forrestia preussii</i>	Mt. Cameroon (6)
<i>Notosceptrum reflexum</i>	Mts. Bamboutos (11)
<i>Wurmbea tenuis</i>	Mt. Cameroon (6)
<i>Cynastrum cordifolium</i>	Southern coastal formation (1a)
<i>Aristea maitlandii</i>	Mt. Cameroon (6)
<i>Romulea camerooniana</i>	Mt. Cameroon (6)
<i>Acidanthera divina</i>	Mts. Bamboutos (11)
<i>Hesperantha alpina</i>	Mt. Cameroon (6)
<i>Podococcus barteri</i>	Biafran forest (1a)
<i>Raphia regalis</i>	Congolian forest (1b)
<i>Sclerosperma manni</i>	Biafran forest ( <u><i>Gilbertiodendron deweyrei</i></u> ) (1a)
<i>Hypoxis recurva</i>	Mt. Cameroon (6)
<i>Hypoxis camerooniana</i>	Mt. Cameroon (6)
<i>Gymnosiphon usambaricus</i>	Congolian forest (1b)
<i>Afrothismia winkleri</i>	Mt. Cameroon (6)
<i>Afrothismia polyantha</i>	Mt. Cameroon (6)
<i>Oxygyne triandra</i>	Mt. Cameroon (6)
<i>Holothrix tridentata</i>	Mt. Cameroon (6)
<i>Deroemera ledermannii</i>	Mts. Bamboutos (11)
<i>Cynorchis debilis</i>	Mt. Cameroon (6)
<i>Brownleea alpina</i>	Mt. Cameroon (6)
<i>Sarcorrhynchus polyanthus</i>	Mts. Bamboutos (11)
<i>Barombia gracillima</i>	Forest on Mt. Koupe (2)
<i>Cephalangraecum braunii</i>	Mt. Cameroon (6)
<i>Angraecopsis tridens</i>	Mt. Cameroon (6)
<i>Angraecopsis ischnopus</i>	Mt. Cameroon (6)
<i>Microdracoides squamosus</i>	Yaounde (2)
<i>Guaduella macrostachys</i>	Biafran forest (1a)
<i>Guaduella ledermannii</i>	Forest on Mt. Koupe (2)
<i>Puelia acuminata</i>	Forest on Mt. Koupe (2)
<i>Isoetes biafrana</i>	Mts. Bamboutos (11)
<i>Oleandra annetii</i>	Southern coastal formation (1a)
<i>Antrophyum annetii</i>	Southern coastal formation (1a)
<i>Vittaria schaeferi</i>	Southern coastal formation (1a)
<i>Athyrium ammfolium</i>	Mt. Cameroon (6)
<i>Hypodematum crenatum</i>	Mts. Mandara (9)
<i>Polystichum fuscopalceum</i>	Mt. Cameroon (6)
<i>Elaphoglossum isabelense</i>	Southern coastal formation (1a)
<i>Elaphoglossum preussii</i>	Mt. Cameroon (6)
<i>Elaphoglossum cinnamomeum</i>	Mt. Cameroon (6)
<i>Ctenopteris zenkeri</i>	Yaounde (2)
<i>Stenochlaena mildbraedii</i>	Congolian forest (1b)

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Source: Hedberg. 1968.

### 3.2.3 Range Resources <sup>5/</sup>

#### Northern Cameroon

Warm, dry conditions combined with open woodlands, savannas and grassland in northern Cameroon provide generally good natural rangelands. Annual temperature in the north ranges from 23°C to 28°C. It is somewhat cooler in the dry winter season, but seasonal temperature change is very slight. Rainfall varies from less than 600 mm in the north near Lake Chad to 1500 mm on the northern edge of the Adamaoua Plateau. Rainfall seasonality is very pronounced, with less than 5 percent of the rain falling between November and April.

In northern Cameroon there are some seven million ha of rangeland. Much of the area has been very heavily grazed and burned for many years, so that the native vegetation of perennial grasslands and savanna has in large part been replaced with annual grasses, annual forbs and unpalatable shrubs. This is particularly true in the northern quarter of the country. Southwards rangelands tend to be in better shape, in large part due to the limitations of its use for livestock by the tsetse fly.

North Cameroon has been divided into nine resource areas, which have further been divided into twenty-nine soil resource units (see Figure 7). The present condition of these units, their potential annual yield and potential for livestock development have been analyzed (see Table 12). The degradation of the resource in the north is shown by the presence of only one resource unit in areas A, B, C, or D with a potential that is considered highly while seven units are rated low or very low. In the southern sector all units are rated medium potential or higher.

Recent drought in northern Cameroon has left the range in an almost denuded state. This has resulted in increased wind and water erosion. The drought has caused the tsetse fly to retreat to riverine vegetation during the dry season. This has opened up more dry season grazing territory. In response to the drought, there has been an increase in this sector in the relative numbers of sheep and goats. This shift has been particularly noticeable in sedentary livestock owners.

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<sup>5</sup>Sources: U.S. AID. 1975a.  
U.S. AID. 1975b.  
U.S. Dept. of Agriculture. 1978.

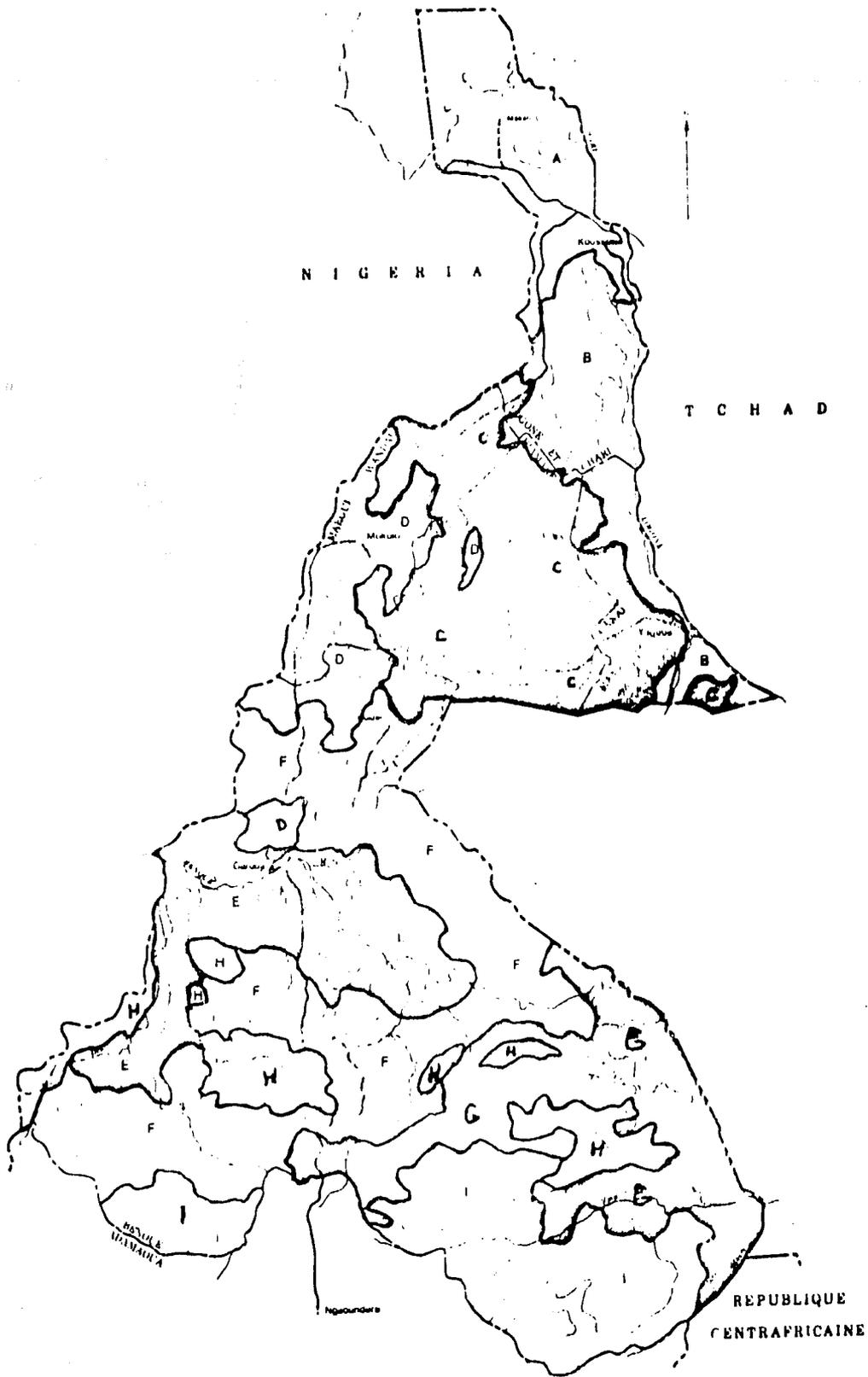


Figure 7. Range Resource Areas of Northern Cameroon.  
 Source: U.S. Dept. of Agriculture. 1978.

Table 12. Potential for Livestock Development, by Soil Resource Unit and Range Site

Soil resource unit	Resource area	Natural plant community group <sup>1/</sup>	Range site	Potential annual yields Kg/ha	Potential for livestock development
1	A	1	Sodic-----	500-1,000	Very low.
2	A	1, 12	Sodic-----	500-1,000	Very low
3	B	2	Flood Plain-----	8,000-10,000	Very high.
4	B	1	Sandy Open Savannah-----	1,000-2,000	Low.
5	B	12	Clayey Savannah-----	1,800-3,000	Medium.
6	B, C	12	Clayey Savannah-----	1,800-3,000	Medium.
7	C	1	Sodic-----	500-1,000	Very low.
8	C	1	Sandy Open Savannah-----	1,000-2,000	Low.
9	C	3	Stony Loamy Savannah-----	2,500-4,000	Medium.
10	C	10	Sandy Dense Savannah-----	3,500-5,000	Medium.
11	C	10	Sandy Dense Savannah-----	3,500-5,000	Medium.
12	C, F	12	Clayey Savannah-----	1,800-3,000	Medium.
13	C	12	Clayey Savannah-----	1,800-3,000	Medium.
14	D	7	Alluvial Granitic Savannah---	1,000-2,000	Low.
15	D	8	Upland Plateau-----	2,500-4,000	High.
16	D	8	Shallow Rocky Slopes-----	1,000-2,000	Low.
17	E	4	Deep Loamy Savannah-----	3,500-6,000	High.
18	E	4	Stony Loamy Savannah-----	2,500-4,000	Medium.
19	E	5	Meadow-----	6,000-8,000	Very high.
20	E	6	River Bottom-----	6,000-8,000	Very high.
21	F	13	Clay Hardpan Savannah-----	1,500-3,000	Medium.
22	F	3	Stony Loamy Savannah-----	2,500-4,000	Medium.
23	F, G	3	Red Ferruginous Savannah-----	2,500-4,000	Medium.
24	F, G	4	Deep Loamy Savannah-----	3,500-6,000	High.
25	F	10	Sandy Dense Savannah-----	3,500-5,000	Medium.
26	H	9	Steep Mountain Savannah-----	3,000-5,000	Medium.
27	H, I	9	Steep Mountain Savannah-----	3,000-5,000	Medium.
28	I	11	High Plateau-----	4,000-6,000	High.
29	I	11	High Plateau-----	4,000-6,000	High.

Source: U.S. Department of Agriculture. 1978.

### Southern Cameroon

The livestock raising areas in central and southern Cameroon are separated from northern Cameroon by a narrow *cordon sanitaire* which is maintained free of cattle to prevent the spread of contagious bovine pleuropneumonia from the north, where it is endemic, to the south which is free of the disease. The Adamaoua plateau is the major sector for cattle in the south, with lesser numbers in the western highlands and in the lower elevations of eastern Cameroon near the border with the Central African Republic. The quality of the range of these areas is generally better than in northern Cameroon. In large part, this is due to more rainfall and the tsetse fly. The danger of typanosomiasis has helped keep cattle numbers low in proportion to the resource. Livestock numbers are increasing at the rate of one or two percent annually. It is believed that the increase will not cause a degradation in the resource, except in scattered areas near human population centers, for some time to come.

#### 3.2.4 Forests <sup>6/</sup>

In Cameroon, much of the southern area is still covered with moist forests. The southern forest is largely evergreen. In central Cameroon the forests are largely semi-evergreen. It appears that more of this forest type has been cut to accommodate agriculture than of the rainforest.

#### Status of Information on Forest Resources

There is very little information on forests in Cameroon. In 1967 a limited forest inventory was conducted, but none since. The estimates of remaining forest range from 175,000 sq. km to 65,000 sq. km. This would suggest that from half to a quarter of the original forest resource remains. In addition to the dearth of survey information, there is also little information available on plans for conservation and exploitation of forests.

#### Description of the Resource

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- <sup>6</sup>Sources: Europa. 1980.  
FAO and World Bank. 1979.  
Meggers et al. 1973.  
Myers. 1980.  
Schmithüsen. 1979.  
Unesco. 1978.

The tropical rainforest of the south and the mountain forests of the west are rich areas of endemism. In general it appears that the tropical rainforest in Cameroon may be the most diverse in Africa. In the Korup Reserve near the Nigerian border 500 tree species have been identified. The area along the Gabon border very likely has an even richer flora. It is part of a presumed Pleistocene refugium and may be valuable for biogeographical studies. The montane forests in western Cameroon have previously been mentioned for their high endemism and unique nature in western Africa (see Section 3.2.1).

#### Forest Exploitation

Table 13. Roundwood Removals ('000 cubic meters all non-coniferous)

	1973	1974	1975	1976	1977
Sawlogs, veneer logs and logs for sleepers	885	780	700	700	700
Other industrial wood	490	502	512	512	512

Source: Europa. 1980.

The use of the forest resource is expected to increase in the near future with plans to double commercial utilization. Commercial logging is considered to be the most significant cause of rainforest destruction, although shifting agriculture has caused local destruction. As much as 85,000 sq. km have been logged to date with the area expected to expand rapidly. At present most logging has been along the coast extending inland as far as Yaounde, but the recent extension of the Trans-Cameroon Railway is expected to open more inland areas to logging in the near future. Large areas in eastern Cameroon are considered beyond reach for at least a decade.

#### Institutional and Legal Framework

Control of the forestry sector is under the Ministry of Agriculture. The resources are managed by the Direction des Eaux et Forêts. The Fond National Forestier et Piscicole is responsible for reforestation and applied forestry research. It is financed through forestry taxation. Management of exploited forests has not been highly developed to this point. It is planned to reorganize the agencies controlling forest exploitation in order to rationalize and regulate exploitation. Also needed is an increase in staff to facilitate control of forestry concession-holders.

A unified forest law was adopted in 1973. It contains provisions for orderly management of forest resources. It does not, however, provide any clear definition of the main objectives of this management, so it has had little impact on management thus far.

### 3.3 Water Resources <sup>7/</sup>

There are four major drainage basins in Cameroon. The Sanaga basin occupies the central portion of the country. The two major cities of Cameroon, Douala and Yaounde, are within this basin. It is generally heavily populated. The Benoue basin is in the north central part of the country between the Adamaoua Plateau on the south and the Mandara Mountains in the north. The Congo basin drains the southeastern part of the country through the Dja and Kadei Rivers. North of the Mandara Mountains is the Chad basin in which such rivers as the Logone and Chari take water to Lake Chad.

Although Lake Chad has no outlet, it is not saline. As a result, fish are plentiful and the land around the lake is fertile. The surface area of Lake Chad is about 16,000 sq. km. It has been increasing in size slowly in the recent past. Its volume is about 75 billion cubic meters. Its depth varies from 3 to 7 meters with a mean of about 4 meters.

There are three major reservoirs in Cameroon: Bamendjin on the Noun river with a reservoir capacity on 1.8 million cubic meters; Edea on the Sanaga River; and Mbakou on the Djerm River with a capacity of 2.2 million cubic meters. Several hydroelectric projects are under construction or study with a total capacity of 670 megawatts. The only project in operation is the Eda Complex producing 192 megawatts.

Community water supplies serve 32 percent of the population, however only 26 percent of the population is considered to have access to a safe water supply. Sewage systems are practically non-existent. The supply system is very fragmented. The Ministry of Agriculture is responsible for the rural water supply, while the Ministry of Mines and Energy, the Société National des Eaus du Cameroon and local municipalities operate the water systems in the various urban areas.

Groundwater resources are very poorly known in Cameroon and have not been heavily exploited. There are approximately 2000 wells and yields are generally small. Use of groundwater and surface water for irrigation is virtually non-existent and is apparently

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<sup>7/</sup>Sources: Balek. 1977.  
Beadle. 1974.  
Ekobo et al. 1978.  
Franklin. 1979.  
U.S. AID. 1975a.  
U.S. AID. 1979a.  
World Health Organization and World Bank. 1975.

practiced almost exclusively along the major rivers in the arid north. Away from the rivers in the northern part of the country, access to water of any sort can be a problem. Most of the wells in Cameroon are in this region and many are dry due to drought. During the dry season, people and stock are forced to congregate near water sources, which contributes to the problem of local degradation of the range and the spread of trypanosomiasis, since the tsetse flies are also limited to this habitat.

### 3.3.1 Mandara Mountains Water Resources Project

A project to develop a consistent water supply in the Mandara Mountains has been proposed by U.S. Aid. The following description is from U.S. AID (1979a).

#### A. Physical and Human Geography of the Project Area.

The Mandara Mountains are crystalline mountains of approximately 1,700 meters in altitude. They are located in the Marqui-Wandala and Diamaré departments, near the Nigerian border. They are bound by the large alluvial plain of the Logone River.

The dry season, from November to April, is followed by a rainy season from April-May to October. The rainfall is generally under 900 mm a year. The average temperatures vary from 20°C in January to 32°C in April; however, a maximum of 46°C and a minimum of 12°C have been recorded. The relative humidity varies between 10 percent in March to 95 percent during the rainy season.

Apart from the Logone River, there are no permanent rivers in North Cameroon. The hydrographic network is constituted by "mayos" (dry rivers) which presents flash floods during rain storms. They die away in the "yaérés" which are vast swamps. In the dry season, surface waters are limited to residual ponds and a few streams. There are a few small lakes created by dams previously constructed in the region.

The vegetation of the region is characteristic of the sudano-sahelian dry savannas. Millet is commonly grown in terraced fields. In the plains the crops are more diversified, with industrial crops (cotton) and food crops (sorghum, peanuts). Rice is beginning to be cultivated in the river beds.

The Fulbe people, who are Muslim, have lived in the Diamaré plain since XIXth century. They are herders and farmers and are settled for the most part in towns of the region. The mountain inhabitants are animists

and Christians, but some have become Muslims and "Fulbéisés" once settled in the plains. The "saré" constitutes the family unit and the social cell. It is composed by a number of houses surrounded by a wall. Housing is scattered in the mountains, but grouped in the plains.

#### B. The Project

A total of fifty-seven small dams with 47 to be financed by AID and the remaining 10 by the World Bank, will be constructed in the Mandara Mountains of North Cameroon. These dams are designed to provide potable water for human and animal consumption and water to be used for increasing the production of small gardens during the 7-month season.

The proposed dams will be constructed in narrow mountain valleys of reinforced concrete, varying from 4.5 to 10 meters in height, and they would have a water retention volume ranging from 10,000 to 60,000 cubic meters.

### 3.4 Fauna <sup>8/</sup>

Because Cameroon stretches from humid tropical rainforest to semidesert, it has an impressive array of animals. As is usual in tropical regions, information on groups other than birds and mammals is fragmentary, often no more than the original description of a species. This is unfortunate as these groups are often very susceptible to disturbance and extinctions of the more specialized species are undoubtedly widespread in tropical regions. Out of necessity, this discussion will be largely limited to birds and mammals, particularly the large mammals, but the status of these groups is probably indicative of the status of the fauna as a whole.

Nearly all of the genera of mammals in West and Central Africa are represented in Cameroon, primarily because it contains virtually every habitat present in West and Central Africa. The major habitat types are savanna and tropical rainforest.

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<sup>8</sup> Sources: Balinga. 1978.  
FAO. 1979.  
Hall and Moreau. 1970.  
IUCN. 1976.  
Moreau. 1944.  
de Vos. 1978.  
Walker. 1968.

In the savannas of the north large numbers of antelopes of the open country are the major feature of the animal life. Elephants, giraffes, warthogs and buffaloes are also present. The scene resembles East Africa, but both numbers of individuals and species are lower. This area contains several national parks which serve primarily to protect this resource. Numbers of wild ungulates are higher in areas with limited numbers of cattle. In particular, areas with tsetse fly infestations tend to have good numbers of game animals.

In the tropical rainforest, Cameroon has a very high faunal diversity. There are, for example, twenty-two species of primates known in the coastal forests near the Gabon border. Forest antelopes such as duikers and bongos are well represented also. The tropical forest contains a number of genera of small mammals endemic to the region. Although the mammalian fauna of the tropical forest is not as impressive as that of the savannas in numbers of large mammals, the importance of Cameroon's forests to the continued survival of unique fauna is much greater than that of the savanna.

The pattern of diversity in the bird fauna is quite similar to that for mammals. Once again, the tropical forest of Cameroon is more important than the savanna to the survival of their respective avifaunas. In this regard, the western highlands and Mt. Cameroon stand out for birds. These montane regions contain a large number of endemic bird species and subspecies. These species and subspecies are generally the sole West African representatives of widespread montane forms from East Africa. Protection of some areas in these highland regions appears vital to their continued survival.

Despite degradation of the range in the savanna region and destruction of much of the tropical forest, Cameroon is not known to have lost any species of terrestrial vertebrates.

The "Red Data Book" compiled by the Survival Service Commission of the International Union for Conservation of Nature and Natural Resources lists the following threatened species occurring in Cameroon.

#### Mammals

Common Name: Chimpanzee.

Scientific name: *Pan troglodytes*

Status: Vulnerable.

No further information given.

Common name: Gorilla (western).

Scientific name: *Gorilla gorilla*

Gorilla (western), continued.

Status: Vulnerable; due to constantly shrinking range and harassment from an increasing human population.

Habitat: The gorilla inhabits several major types of forests; the lowland rain forests, montane rain forests, and bamboo forests. It frequents floristically diverse types of forests which range in altitude from near sea level to more than 3000 m. The habitats utilized are similar in being lush and damp with an abundance of forage near ground level throughout the year.

Common name: Cameroon clawless otter.

Scientific name: *Aonyx microdon*

Status: Endangered; occurs in Cameroon (and Nigeria) where its range and populations have declined seriously as a result of uncontrolled hunting for the fur trade. An ecological survey is urgently required to determine its range and status, and to formulate effective measures for its conservation, including reservation of representative samples of its habitat.

Habitat: Inhabits rivers, but is probably more terrestrial in its habits than related species. It feeds mainly on relatively soft matter, such as small land vertebrates, eggs, and frogs rather than on fish. Deterioration of its habitat is not believed to have been instrumental in its decline.

Common name: African wild dog.

Scientific name: *Lycaon pictus*

Status: Depleted throughout its range; vulnerable to continued persecution; shrinkage of range and reduction in numbers of natural prey.

Habitat: Open or wooded savanna. They are primarily diurnal and commonly regarded as harmful to game and domestic stock, but they play an important role in the balance of their environment.

Common name: Leopard.

Scientific name: *Panthera pardus*

Status: Vulnerable; exterminated from large parts of its former range and depleted elsewhere.

Habitat: A wide variety of biomes. One important factor is cover, both for hunting and for lying-up to feed and rest. Human modification of savanna ecotypes tends to the removal of trees and bush, although the leopard has proved to be exceptionally resilient and tolerant of changes to its habitat.

Common name: West African manatee.

Scientific name: *Trichechus senegalensis*

Status: Vulnerable; seriously depleted throughout most of its range in rivers and coastal areas of western Africa. New attempts are required to define its present status and distribution as a basis for the establishment of effective sanctuaries.

Habitat: Occurs in both coastal and riverine areas, where it feeds on aquatic plants and terrestrial plant material. There is no conclusive evidence of regular or extensive migration. The possible effects of modification of habitat on populations through pollution, water impoundment or increased human disturbance, have not been ascertained.

Mammals (continued)

Common name: Black rhinoceros.  
Scientific name: *Diceros bicornis*  
Status: Vulnerable.  
No further information given.

Birds

Common name: Gray-necked rock-fowl.  
Scientific name: *Picathartes oreas*  
Status: Very rare and declining in numbers due to overexploitation for the bird trade. Estimated numbers are not known and the rough, tangled habitat would make any precise survey extremely difficult.  
Habitat: Confined to the forested areas of central and southern Cameroon. The species is not known to have ever occurred anywhere outside of the present known range.

Common name: Mt. Kupe bush shrike.  
Scientific name: *Malaconotus kupeensis*  
Status: Rare and local. It is not considered to have declined and appears to be no more than a rare and retiring bird with a limited distribution in a little known area.  
Habitat: Known only from the primary forest of Kupe Mountain in Cameroon, and from the four specimens taken at an altitude of about 1350 meters.

Reptiles

Common name: African slender-snouted crocodile.  
Scientific name: *Crocodylus cataphractus*  
No further information given.

Common name: Nilotic or Nile crocodile.  
Scientific name: *Crocodylus niloticus*  
Status: Endangered. Destruction by poachers is undoubtedly the most important factor.  
Habitat: Rivers and lakes. The breeding season coincides with changes in the water level. The eggs are laid during the dry season and some part of the incubation period coincides with the phase of lowest water and hatching occurs after the onset of rain, when the lakes and rivers are again rising into flood. Observations have clearly shown the vital part played by maternal care in the successful rearing of offspring. If guardian female crocodiles are unable, through human disturbance, to carry out their proper functions, eggs and hatchlings perish.

## Amphibians

Common name: Cameroon toad.

Scientific name: *Bufo superciliaris*

No further information given.

In general, Cameroon has been interested in conserving its wildlife resources. This interest is based on a recognition of the value of game as a traditional food source and wildlife as an agent to get more income through tourism and sport hunting. The demand for game meat is generally high in Cameroon and as a result poaching can be a severe problem. The staff to control poaching is generally not sufficient, but efforts are being made to improve and expand the game guards. The Ecole de Faune in Garoua stands out in this regard. The school began operation in 1970 and trains wildlife management personnel for all of Francophone Africa.

### 3.5 National Parks and Reserves <sup>9/</sup>

The thirteen national parks and equivalent reserves of Cameroon cover approximately 2.5 million ha, about 5 percent of the country. In West and Central Africa, only Chad and Zaire have more land under comparable protection. Nearly forty percent of the protected area is in dense tropical rain-forest. Most of the rest is in savanna and transition between savannah and Guinean forest. The montane forest of the Western Highlands has no parks or equivalent reserves and is the only major ecological zone with no protection. Presently, the protected areas in the rainforest have little access and are not managed for tourism. However, the savanna tourism is an important activity. The national parks are administered by the General Delegation for Tourism which is under the Ministry of Economy and Plan. The reserves are administered by the Forestry Department of the Ministry of Agriculture.

#### 3.5.1 Review of Parks and Reserves

- 1) Kala-Maloué National Park. 4,500 ha. Grassland with thorny scrub, grassland and swampy grasslands. Large mammals include Kob (*Kobus defassa*), topi (*Damaliscus*

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<sup>9</sup>Sources: Allo. 1979.  
IUCN. 1976.  
IUCN. 1977.  
IUCN. 1979.  
Ngog Nje. 1975.

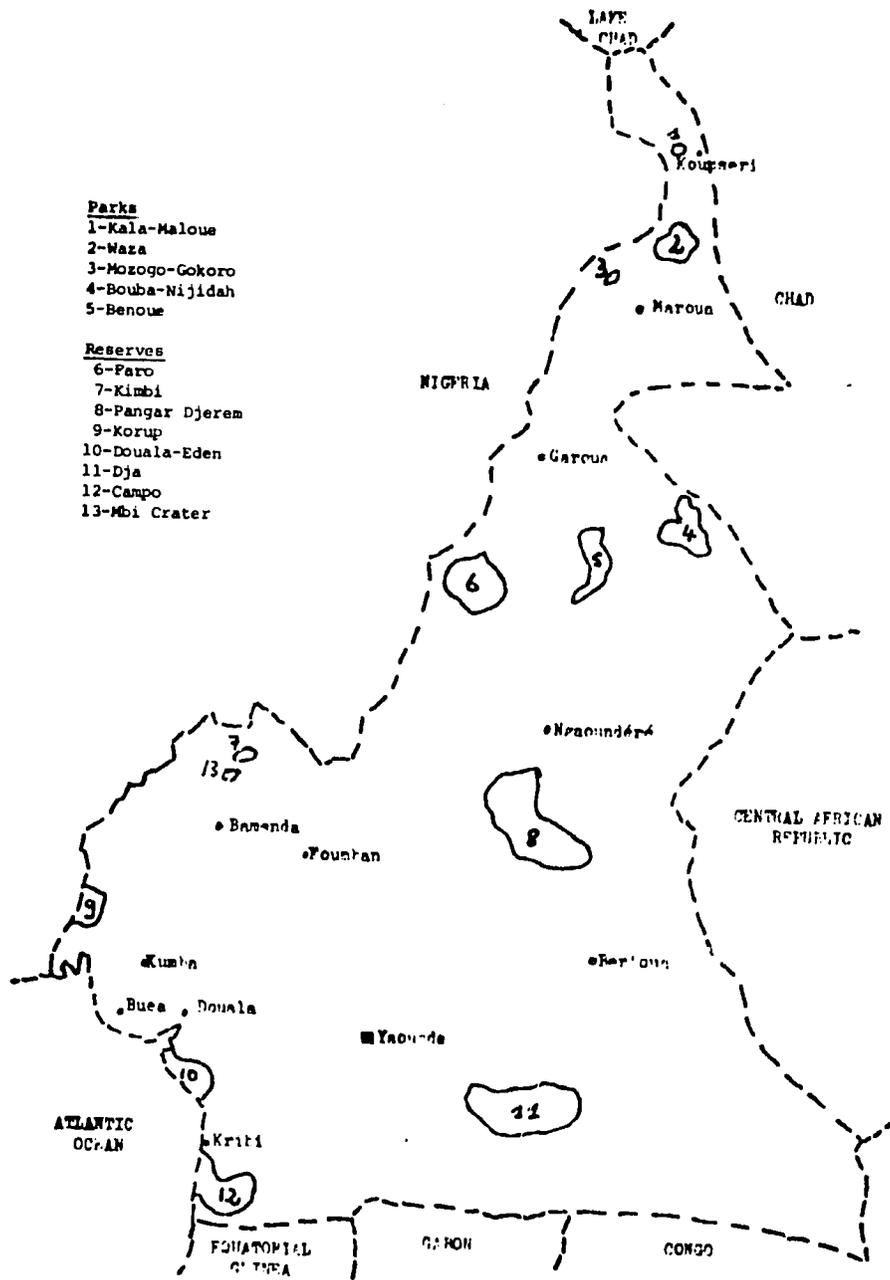


Figure 8. Parks and Reserves in Cameroon  
 Source: Ngoy Nje. 1975.

*korrigum*) bushbuck (*Tragelaphus scriptus*), and red-fronted gazelle (*Gazella rufifrons*). A few leopards (*Panthera pardus*), listed as vulnerable in the Red Data Book, are present. Monitor lizards, pythons and crocodiles are also present, although it is uncertain whether they are *Crocodylus cataphractus* or *C. niloticus* or both. Both species are listed in the Red Data Book. Birds are typical of grassland-savanna regions.

- 2) Waza National Park. 170,000 ha. Savanna dominated by *Acacia seyal* and grassland that is periodically flooded. Waza is a MAB Biosphere Reserve. However, the reserve may be too small to be viable. A number of important dry season watering places and grazing lands are outside the park and are controlled by pastoral tribes. The park is managed for tourism with a hotel just outside the park, about 400 kilometers of roads, and a system of tours. The park is open to tourists only during the dry season from November to April. There are large numbers of large mammals in the park including striped hyena (*Hyaena hyaena*) lion (*Panthera leo*), elephant (*Loxodonta africana*), warthog (*Phacochoerus aethiopicus*), giraffe (*Giraffa camelopardalis*) and a variety of antelopes. Two species, leopard and cheetah (*Acinonyx jubatus*), listed in the Red Data Book were historically present, but may have been extirpated in this region. The avifauna is impressive both in numbers of species and individuals, but no particularly rare species are present.
- 3) Mozogo-Gokore National Park. 1,400 ha. This area was protected for its flora. The general habitat is similar to the savanna elsewhere in the north.
- 4) Boubandjidah National Park. 220,000 ha. *Isoberlina* woodland. Large mammals similar to those in Waza National Park, but without the high densities. The avifauna contains a higher proportion of woodland species and fewer waterbirds and savanna zone birds.
- 5) Benoue National Park. 180,000 ha. *Isoberlina* woodland. Very similar to Boubandjidah National Park.
- 6) Faro Fauna Reserve. 330,000 ha. *Isoberlina* woodland. Large mammals include giraffe, buffalo (*Syncerus caffer*), black rhinoceros (*Diceros bicornis*) in addition to a number of primates and antelopes. A bad poaching problem exists.
- 7) Kimbi Reserve. 47,500 ha. Transition between rain forest and woodland; mainly gallery forest. Large mammals include kob, striped hyena, warthog, pangolins (*Manis* spp.), and hyrax (*Procavia* spp.).

- 8) Pangar Djerem Reserve. 500,000 ha. Semi-evergreen rain forest dominated by Sterculiaceae and Ulmaceae grading into savanna. Large mammals include buffalo, hippopotamus (*Hippopotamus amphibius*), a variety of antelopes including kob, Defassa waterbuck, hartebeest (*Alcelaphus buselaphus*) and bongo (*Boocercus euryceros*), gorilla (*Gorilla gorilla*) and chimpanzee (*Pan troglodytes*).
- 9) Korup Forest Reserve. 125,000 ha. Coastal forest.
- 10) Douala-Eden Reserve. 160,000 ha. Coastal forest, mangroves and lagoons. The Red Data Book listed West Africa manatee (*Trichechus senegalensis*) is in the lagoons. Other mammals include elephant, hippopotamus, and a large number of forest primates.
- 11) Dja Reserve. 526,000 ha. Primary rain forest. Areas of *Gilbertiodendron dewevrei* forest are included. Large mammals include elephant, bongo, buffalo, a number of primates including gorilla and chimpanzee and various duikers (*Cephalophus* spp.). Near the borders, there are some poaching problems.
- 12) Campo Reserve. 330,000 ha. Coastal forest with scrubland. A twenty year logging concession has been granted and considerable degradation is resulting. In addition, there is heavy poaching. The integrity of this reserve is in danger.
- 13) Mbi Crater Reserve. 370 ha.

### 3.5.2 Conservation Issues

Cameroon is among the most advanced countries in Africa in its conservation activities. Lack of manpower, particularly in the southern reserves (only 10 guards in reserves 7-13 in 1979), has made poaching a major problem. The size and remoteness of several of the reserves has kept this problem down to this point, but with further development, it is likely to become critical. The montane region of western Cameroon has been identified by the IUCN and the World Wildlife Fund as being in critical need of some protection. The montane region is significant due to its wealth of endemic species, particularly birds and plants. Cameroon is the only area of West Africa with extensive montane habitat, so protection should be encouraged here.

## 4.0 Environmental Problems

### 4.1 Forest Destruction

Destruction of the forest resource in Cameroon continues at an impressive rate. Most of the forest may already be gone. There are several issues associated with this destruction. The lowland forests are a very important habitat for wildlife in Cameroon and its loss has affected the forest wildlife already. Cameroon needs to develop a survey of the forests so that the extent of the destruction can be accurately assessed. Presently, estimates vary as to the amount of remaining forest by 200 percent. An effective survey of the forests will help Cameroon to formulate a coherent policy for effective conservation and exploitation of its forest resource. Although many policies have been instituted in Cameroon, their effectiveness has been negligible because of the lack of well-defined goals. The formulation and implementation of an integrated forest policy should be considered an environmental priority.

There are a number of forestry reserves that have been set aside. However, several have logging concessions within their boundaries and have lost their integrity. More areas need to be protected. Logging and poaching within the reserves is a continuing problem. It appears to be most severe in the reserves in the coastal forests.

### 4.2 Range Degradation <sup>10/</sup>

The range in the semi-arid region of Northern Cameroon has been severely degraded. There are two major causes of this degradation. First, both drought and a large number of stock animals have placed severe pressure on the range. It is considered unlikely that without protection that this range can recover. Second, much of the resource is underutilized. This has forced larger numbers of stock to be crowded into a smaller area. The underutilized areas are generally those infested by the tsetse fly (*Glossina* spp.). In order to develop these regions some form of control of trypanosomiasis in cattle must be developed.

Projects have been formulated to try to deal with both parts of the problem. A management plan which would protect severely degraded lands in grazing reserves has been developed. It is suggested that areas in the Chari Delta near Lake Chad and on the Diamaré Plain be used as pilots to develop the system since these

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<sup>10</sup> Source: U.S. Department of Agriculture. 1978.

areas are badly denuded and of little present value for grazing. 320 potential areas for grazing reserves have been identified. A livestock development program has been proposed for the area south of Benoue River. It is hoped that it can serve as a model for development in tsetse fly areas in Cameroon. In addition, range seeding projects and livestock water supply projects have been developed. It is thought that far northern Cameroon will profit from range seeding and that a policy of rotating livestock around a number of water sources will help to reduce the destruction of range in the general vicinity of the present limited number of dry season waterholes.

#### 4.3 Water-borne Diseases

Malaria, schistosomiasis, trypanosomiasis and various intestinal parasites are the most important water related diseases in Cameroon. Malaria is easily the most important, with about 90 percent of the adult population infected. It is a significant contributing factor to poor general health which makes the population susceptible to other infections. At present control of malaria depends on control of the *Anopheles* mosquitoes that carry the disease. No effective and environmentally safe method of controlling the mosquito population exists. Local techniques, including introduction of larvae-eating fish (*Gambusia* spp.) and drainage of standing water may help reduce the problem. Such actions might be most useful in urban areas. Here, the area to which the treatment is applied would be small compared to the population protected.

Schistosomiasis is carried by snails. The snails are particularly likely to be in pools, small creeks and irrigation ditches. Water supply development projects such as the one in the Mandara Mountains can be expected to increase the potential for the infection of the population. Improved sanitation and measures to keep people out of the snail's habitat should help alleviate the problem.

Trypanosomiasis carried by tsetse flies is a problem in all but the most northerly part of Cameroon. It has been discussed in Sections 3.2.3 and 4.2. Alleviation of the problem will require control of the fly. This does not appear to be forthcoming in the near future, although various biological control schemes are being tested in tropical Africa.

Intestinal parasites are a problem associated with poor sanitation. As more of the population has access to safe water, the problem will decrease in severity. In rural areas, significant improvement in the water supply is not considered likely for some time to come.

#### 4.4 Protection of Montane Forests <sup>11/</sup>

The western highlands of Cameroon contain the only large area of montane habitats in West Africa. A unique flora and fauna exists in these forests with numerous endemics, particularly among the vascular plants and birds. In Cameroon, this area is also the most heavily populated part of the country. It has been heavily cultivated for a long period and much of the native vegetation is already gone. Protection of areas of forest in the highlands is considered the most critical preservation need in Cameroon today.

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<sup>11/</sup>Source: IUCN. 1979.

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## Appendix I

### Organizations and Institutions with Environmental Interests or Responsibilities<sup>12/</sup>

- A. Governmental
- B. Educational Institutions
- C. Non-governmental
- D. International
- E. Inter-governmental

<sup>12</sup>Sources: Economic Commission for Africa. 1972.  
Europa. 1980.  
Sierra Club. 1976.  
Unesco. 1966.

Appendix I. Organizations and Institutions with Environmental Interests  
or Responsibilities

A. Governmental

1. Bureau Des Sols  
B.P. 193, Yaounde
2. Institut Geographique National  
Yaounde, avenue Mgr.-Vogt  
B.P. 157
3. Laboratoire De Recherches Agricoles De N'Kongsamba  
N'Kongsamba.  
Does research in chemistry, plant pathology, entomology, pedology  
and genetics.
4. Ministry for Animal Breeding and Livestock  
Industries, Yaounde
5. Ministry of Agriculture  
B.P. 194, Yaounde
  - A. Directorate of Water and Forests and Wildlife
    - 1). Section de Peches et Pisciculture
    - 2). Section de Recherches
6. Ministry of the Economy and Plan
  - A. General Delegation for Tourism
7. Ministry of Energy and Mines  
B.P. 70, Yaounde
  - A. Directorate of Mines and Geology of Cameroon
8. Ministry of Equipment, Environment and Land  
Yaounde, Cameroon
9. Ministry of Health and Public Assistance  
Yaounde, Cameroon
10. Ministry of Plans and Territorial Development  
Yaounde, Cameroon
11. Ministry of Transport  
Yaounde
  - A. Meteorological Service  
B. P. 186, Douala
12. Service du Genie Rural  
B.P. 236, Yaounde
13. Societe Nationale d'Investissement du Cameroun  
B.P. 423, Yaounde

## B. Educational Institutions

1. College of Arts, Science and Technology  
Buea, Western Cameroon  
Private institution.
2. Ecole Federale Superieure D'Agriculture  
B.P. 138, Yaounde
3. Ecole pour la Formation des Specialistes de la Faune  
(School for the Training of Wildlife Specialists)  
B.P. 271, Garoua, Cameroon  
Affiliated with FAO and the College of African Wildlife Management, Mweka, Tanzania. Studies in general ecology, animal biology, veterinary science, and park and reserve management.
4. Forestry School M'Balmayo  
M'Balmayo, Cameroon
5. Universite Federale Du Cameroun (UFC)  
B.P. 337, Yaounde
  - a. Faculty of Science
  - b. Faculty of Law and Economics
  - c. Faculty of Arts and Social Science
  - d. Affiliated Institutes
    - 1) Centre Universitaire des Sciences de la Sante  
B.P. 1364, Yaounde
    - 2) Ecole Nationale Superieure Polytechnique  
B.P. 337, Yaounde
    - 3) Ecole Normale Superieure  
B.P. 47, Yaounde
    - 4) Institut d'Administration des Entreprises  
B.P. 337, Yaounde
    - 5) Institut des Relations Internationales du Cameroun  
B.P. 1365, Yaounde

### C. Non-Governmental

(Note: Many of these organizations are partly owned by the state.)

1. Banque Camerounaide de Developpement  
rue du Miounjd  
B.P. 55, Yaounde  
Gives financial and tehcnical assistance to development projects.
2. Cameroon Development Corporation  
B.P. 28, Bota, Victoria
3. Compagne Forestiere du Golfe de Guinee (CFGG)  
B.P. 703, Douala
4. Crn/04  
Centre De Recherches Agronomiques De N'Kolbisson (CRAC)  
B.P. 235, Yaounde
5. Fisheries Industries Society  
B.P. 581, Douala
6. Fonds National de Developpement Rural (FONADER)  
B.P. 1548, Yaounde
7. Fond National Forestier et Pisciculture  
Yaounde  
Charged with regeneration of exploited forests, afforestation,  
and promotion of fish culture.
8. Forestry Society of Cameroon  
c/o Department of Forestry Services, Buea  
Members are primarily employees of the government and timber  
companies.
9. Institut des Cultures Vivrieres Tropicales  
B.P. 2123, Yaounde-Messa  
Stations at Dschang, Maroua, Ngaoundere.
10. Institut de Recherches Agronomiques et Forestieres (IRAF)  
B.P. 2123, Yaounde-Messa  
Centres at Douala, Ekena, Maroua, Nyombe; Dir. Nya Ngatchou.
11. Institut de Recherches sur les Fruits et Agrumes (I.R.F.A.)  
B.P. 13, Nyombe  
Stations at Ekona, Penja.
12. Meteorologie National du Cameroun  
B.P. 186, Douala  
Departments of climatology, hydro-meteorology, agrometeorology,  
synoptic, aeronautical and marine meteorology, research and  
training; 34 surface observation stations; 400 rainfall posts;  
small library.

13. Mission de Developpement d'Ombessa  
B.P. 152, Bafia  
Extension and marketing service for local produce.
14. Organisation de Coordination Et De Cooperation Pour La Lutte  
Contre Les Grandes Endemies En Afrique Centrale (OCCGAC)  
Yaounde
15. Societe Camerounaise d'Exploitation Forestiere (SCEF)  
B.P. 671, Douala  
Exploitation of forests and production of wood.
16. Societe Camerounaise de Promotion (Promocam)  
Yaounde  
Cultural, commercial and industrial promotion.
17. Societe de Developpement de la Riziculture dans la plaine des Mbo  
(SODERIM)  
B.P. 160, Dschang  
Expansion of rice-growing and processing.
18. Societe de Developpement du Cacao (SODECAO)  
B.P. 4083, Yaounde  
Development of cocoa production in the Centre-Sud province.
19. Societe de Developpement du Coton (SODECOTON)  
B.P. 302, Garoua  
Development of cotton and other agricultural production in the  
north; marketing and processing of cotton.
20. Societe de Developpement du Perimetre de Mise en Valeur Agricole  
Yambassi-Bafang (SODENKAM)  
B.P. 02, Nkondjock, Yambassi-Bafang  
Development of northern area by improving infrastructure and in-  
creasing production.
21. Societe de Developpement pour la Culture et la Transformation du  
Ble (SODEBLE)  
B.P. 41, Ngaoundere  
Development of wheat-growing and flour-milling in the Adamaoua  
region.
22. Societe de Developpement et d'Exploitation des Produits Animaux  
(SODEPA)  
B.P. 1410, Yaounde  
Development of livestock raising and livestock products.
23. Societe d'Etudes des Bauxites du Cameroun (SEBECAM)  
B.P. 1090, Douala  
Feasibility studies for the exploitation of bauxite reserves at  
Minim-Martap.

- C. Non-Governmental (continued)
24. Societe d'Expansion et de Modernisation de la Riziculture de Yagoua-SEMRY  
B.P. 46, Yagoua  
Expansion of rice-growing in areas where irrigation is possible and commercialization of products.
  25. Societe ELF de Recherches et d'Exploitation des Petroles du Cameroun  
B.P. 2214, Douala-Bassa  
Off-shore prospecting and mining of petroleum.
  26. Societe Financiere pour le Developpement du Cameroun  
B.P. 5493, Douala
  27. Societe Forestiere et Industrielle de la Doune (SFID)  
B.P. 1343, Douala  
Exploitation of forests, processing of timber; logging factory at Dimako.
  28. Societe Forestiere Industrielle de Belabo (SOFIBEL)  
B.P. 1762, Yaounde; f. 1975.  
Exploitation of forests; 40 percent state-owned.
  29. Societe Industrielle des Bois Africains (SIBAF)  
B.P. 376, Douala  
Exploitation of forests.
  30. Total Cameroun  
B.P. 4048, Douala  
Exploration for and exploitation of petroleum reserves.

#### D. International

1. Bureau de Recherches Geologiques et Minieres (BRGM)  
B.P. 343, Yaounde
2. Centre Technique Forestier Tropical (CTFT)  
B.P. 832, Douala  
Forestry research.
3. Compagnie Francaise pour le Developpement des Fibres Textiles (CFDT)  
B.P. 302, Garoua  
Textile research.
4. Development of Forests and Forest Industries Project  
B.P. 309, Yaounde, Cameroon  
Joint project of the Cameroon Government and the Food and Agriculture Organization of the UN for research and training for rational exploitation of forests and development of forest industries.
5. Institut de Formation et de Recherches Demographiques  
Yaounde  
Basic research on demographic trends and their links with economic and social factors.
6. Institut de Recherches du Coton et des Textiles Exotiques-IRCT  
Section Experimentation Cotonniere du Cameroun  
B.P. 22, Maroua  
Genetics, agronomy and phyto-sanitary defence  
a) Station de Maroua
7. Institut de Recherches pour les Huiles et Oleagineux (IRHO)  
B.P. 243, Douala
8. Institut Francais de Recherches Fruitieres Outre-Mer  
Paris, France  
a. Station des Cultures Fruitieres de la Republique de Cameroun
9. Institut Pasteur du Cameroun  
B.P. 888, Yaounde
10. Office de la Recherche Scientifique et Technique Outre-Mer  
B.P. 1857, Yaounde  
Pedology, hydrology, nutrition, psycho-sociology, demography, economics, geography, archaeology, botany and vegetal biology, and medical entomology.  
a. Institut de Recherches du Cameroun  
B.P. 193, Yaounde

#### E. Inter-Governmental

International organizations of which Cameroon is a member state.

1. African Development BANK (ADB)  
P.O. Box 1387, Abidjan, Ivory Coast
2. African Training and Research Centre in Administration and Development (CAFRAD)  
P.O. Box 310, Tangiers, Morocco
3. Institute for Economic Development and Planning (IDEP)  
P.O. Box 3186, Dakar, Senegal
4. Inter-African Committee for Hydraulic Studies (CIEH)  
P.O. Box 369, Ougadougou, Upper Volta
5. Lake Chad Basin Commission  
P.O. Box 727, Fort Lamy, Chad
6. Organisation Commune de lutte antiacridienne et de lutte antiaviaire (OCLALAV)  
P.O. Box 1066, Dakar, Senegal
7. Organisation Internationale contre le Criquet Migrateur Africain (OICMA)  
P.O. Box 136, Bamako, Mali
8. Organisation pour le developpement du tourisme en Afrique (ODTA)  
Yaounde, Cameroon  
Technical services and management; 6, Rue Mesnil, Paris 16e, France
9. River Niger Commission  
P.O. Box 729, Niamey, Niger
10. Trans-African Highway Co-ordinating Committee  
Trans African Highway Bureau  
ECA, P.O. Box 3001  
Addis Ababa, Ethiopia

Appendix II

National Committee for the Man and the Biosphere Program

Appendix II. National Committee for the Man and the Biosphere Program

Chairman

Youssoufa Daouda  
Ministre de l'Economie et du Plan (Economy and Plan)

Secretariat

Directeur des Affaires Scientifiques et Techniques (Scientific and Technical Affairs)

Members

A representative from each of the following organizations:

Ministere de l'Agriculture (Agriculture)  
  
Ministere de l'Elevage et des Industries Animales (Livestock and Animal Industry)  
Ministere de l'Education Nationale (National Education)  
Ministere de l'Economie et du Plan (Economy and Plan)  
Ministere des Mines et de l'Energie (Mines and Energy)  
Ministere des Affaires Sociales (Social Affairs)  
Ministere de l'Information et de la Culture (Information and Culture)  
Ministere de l'Equipement et de l'Habitat (Equipment and Housing)  
Ministere de l'Administration Territoriale (Territorial Administration)  
Ministere de la Jeunesse et des Sports (Youth and Sports)  
Ministere de la Sante Publique (Public Health)  
Ministere des Finances (Finance)  
Office National de la Recherche Scientifique et Technique et des ses Instituts  
Universite de Yaounde  
Office Pharmaceutique Veterinaire  
Commission National pour l'UNESCO  
Mission d'Amenagement et de Gestion des Zones Industrielles  
Missions de Developpement  
Societe d'Etudes pour le Developpement de l'Agriculture

Appendix III

FAO Soil Map and Key

Appendix III: FAO Soil Map and Key

The following soil map and key are both from the FAO Soil Map of Africa (FAO 1977).

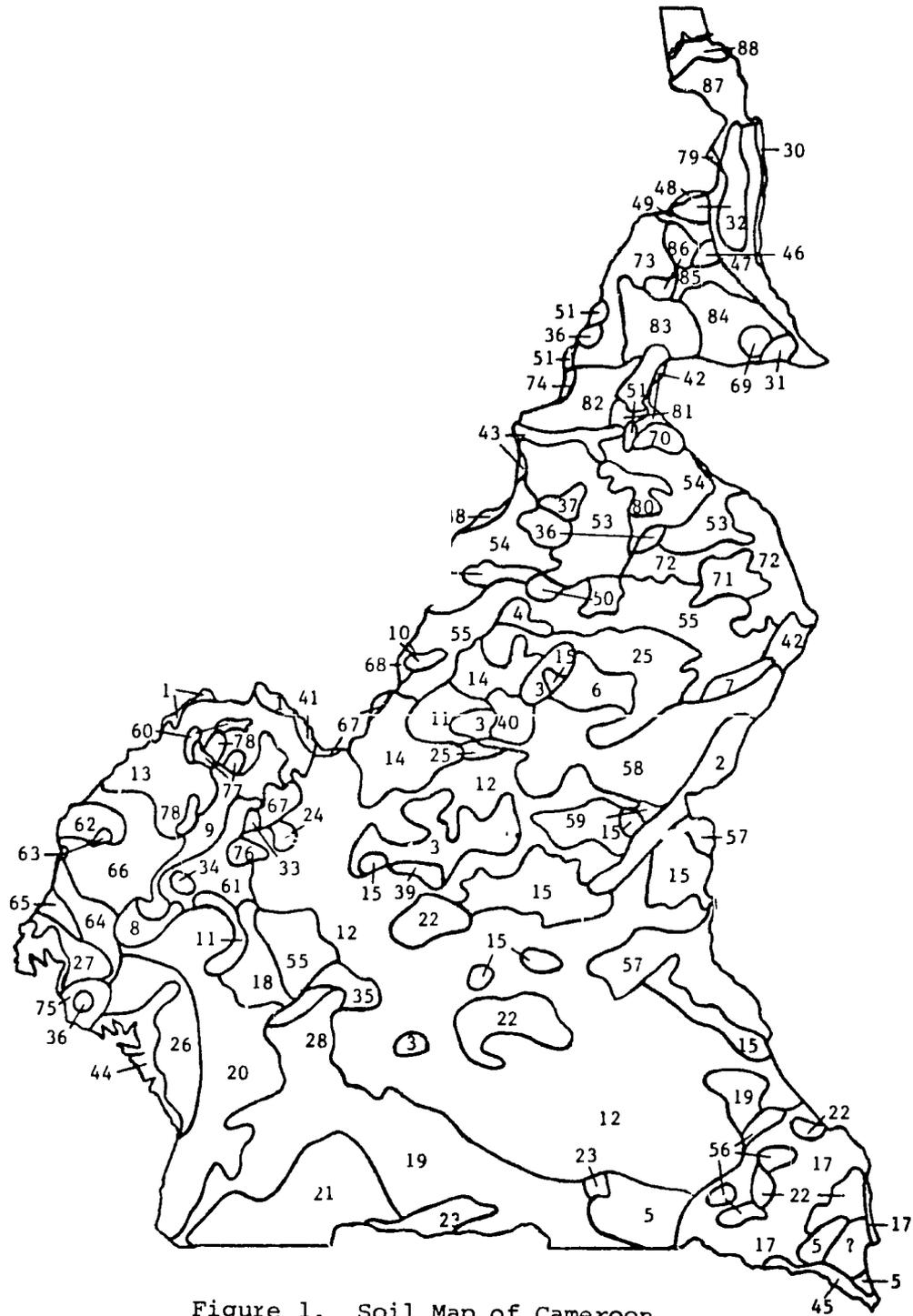
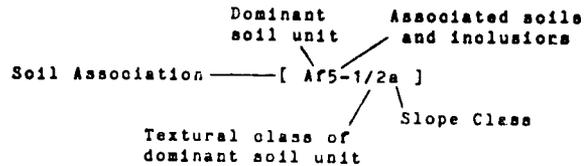


Figure 1. Soil Map of Cameroon.

## Key to Soil Map

Example: Af5-1/2a



For each soil association symbol, the dominant soil unit is given first, followed by the textural class of the dominant soil unit, any associated soils and inclusions, and the slope class.

**Associated soils:** Subdominant soils with an extension of more than 20% of the mapping unit.

**Inclusions:** Inclusions of important soils occupying less than 20% of the mapping unit.

**Slope class:** Topography in which a soil association occurs:  
a: slope of 0-6% (level to undulating);  
b: slope of 8-30% (rolling to hilly);  
c: slope of more than 30% (steeply dissected to mountainous).

**Phases:** A subdivision of the soil association having characteristics that affect the use and management of the soil but which do not vary sufficiently to differentiate it as a separate species.

**petric and petroferric:** shows the presence of indurated layers (concretionary horizons and petroferric horizons respectively) within 100 cm. of the surface.

**saline:** shows that certain soils of the association (not necessarily the dominant) are affected by salt to the extent that they have a conductivity greater than 4mmhos/cm in some parts of the soil within 125 cm. of the surface for some part of the year. The phase is intended to mark present or potential salinization.

**sodic:** soils which have more than 6% saturation with sodium in some part of the soil within 125 cm. of the surface.

**stony:** areas where the presence of gravels, stones, boulders or rock outcrops makes the use of mechanized agricultural equipment impracticable.

### Acrisols (2,524,000 ha.)

1. Af1 (petric phase): Ferric Acrisols.  
Extension: 75,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
2. A01-2b (petric phase): Orthic Acrisols, medium textured; rolling to hilly.  
Extension: 438,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
3. A07: Orthic Acrisols; Orthic Ferralsols.  
Extension: 1,062,000 ha.  
Vegetation: Tropical lowland rain forest, tropical semi-deciduous rain forest, large-leaved semi-deciduous tree savanna, moist savanna.
4. A07-a: Orthic Acrisols; Orthic Ferralsols; level to undulating.  
Extension: 89,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
5. A07-2a: Orthic Acrisols, medium textured; Orthic Ferralsols; level to undulating.  
Extension: 572,000 ha.  
Vegetation: Tropical lowland rain forest.
6. A030-a: Orthic Acrisols; Ferralic Cambisols; level to undulating.  
Extension: 288,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.

**Cambisols (274,000 ha.)**

7. Be30: Eutric Cambisols; Rhodic Ferralsols.  
Extension: 110,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
8. Bh8-bc: Humic Cambisols; Humic Ferralsols and Humic Andosols; rolling to hilly and steeply dissected to mountainous.  
Extension: 164,000 ha.  
Vegetation: Tropical lowland rain forest.

**Ferralsols (26,117,000 ha.)**

9. Fh1-ab: Humic Ferralsols; level to undulating and rolling to hilly.  
Extension: 493,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.
10. Fh1-3b: Humic Ferralsols, fine textured; rolling to hilly.  
Extension: 62,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.
11. Fo1: Orthic Ferralsols.  
Extension: 462,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.
12. Fo1-ab: Orthic Ferralsols.  
Extension: 10,088,000 ha.  
Vegetation: Tropical lowland rain forest, tropical semi-deciduous rain forest, large-leaved semi-deciduous tree savanna, moist savanna.
13. Fo9-bc (stony phase): Orthic Ferralsols; Rhodic Ferralsols; rolling to hilly and steeply dissected to mountainous.  
Extension: 1,130,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.
14. Fo14: Orthic Ferralsols; Orthic Acrisols.  
Extension: 791,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.
15. Fo14-2a (petric phase): Orthic Ferralsols, medium textured; Orthic Acrisols; level to undulating.  
Extension: 1,531,000 ha.  
Vegetation: Tropical lowland rain forest, tropical semi-deciduous rain forest, large-leaved semi-deciduous tree savanna, moist savanna.
16. Fo14-2/3a: Orthic Ferralsols, medium-fine textured; Orthic Acrisols; level to undulating.  
Extension: 164,000 ha.  
Vegetation: Tropical lowland rain forest.
17. Fo14-2/3a (petric phase): Orthic Ferralsols, medium-fine textured; Orthic Acrisols; level to undulating.  
Extension: 1,205,000 ha.  
Vegetation: Tropical lowland rain forest.
18. Fo26: Orthic Ferralsols; Dystric Nitosols, with Lithosols.  
Extension: 329,000 ha.  
Vegetation: Tropical lowland rain forest.
19. Fo26-ab: Orthic Ferralsols; Dystric Nitosols, with Lithosols; level to undulating and rolling to hilly.  
Extension: 3,493,000 ha.  
Vegetation: Tropical lowland rain forest.
20. Fo33-ab: Orthic Ferralsols; Humic Gleysols; level to undulating and rolling to hilly.  
Extension: 1,859,000 ha.  
Vegetation: Tropical lowland rain forest.
21. Fo35-ab: Orthic Ferralsols, medium textured; Humic Gleysols; level to undulating and rolling to hilly.  
Extension: 1,151,000 ha.  
Vegetation: Tropical lowland rain forest.
22. Fo35: Orthic Ferralsols; Dystric Histosols.  
Extension: 1,113,000 ha.  
Vegetation: Tropical lowland rain forest, tropical semi-deciduous rain forest.

23. Po35-3ab: Orthic Ferralsols, fine textured; Dystric Histosols; level to undulating and rolling to hilly.  
Extension: 240,000 ha.  
Vegetation: Tropical lowland rain forest.
24. Pp2-a: Plinthic Ferralsols; Lithosols; level to undulating.  
Extension: 58,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.
25. Fr6-2/3a: Rhodic Ferralsols, medium-fine textured; orthic Ferralsols and Dystric Nitisols, with Humic Ferralsols; level to undulating.  
Extension: 1,038,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
26. Fx1-1a: Xanthic Ferralsols, coarse textured; level to undulating.  
Extension: 705,000 ha.  
Vegetation: Tropical lowland rain forest.
27. Fx8-1a: Xanthic Ferralsols, coarse textured; Orthic Acrisols and Dystric Nitisols, with Gleysols and Humic Podzols; level to undulating.  
Extension: 205,000 ha.  
Vegetation: Tropical lowland rain forest.

Gleysols (1,401,000 ha.)

28. G2-a: Gleysols; Fluvisols; level to undulating.  
Extension: 99,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.
29. Gd16-2/3a (sodic/saline phase): Dystric Gleysols, medium-fine textured; Dystric Fluvisols, Thionic Fluvisols and Gleyic Solonchaks; level to undulating.  
Extension: 192,000 ha.  
Vegetation: Mangroves.
30. Ge1-2/3a: Eutric Gleysols, medium-fine textured; level to undulating.  
Extension: 69,000 ha.  
Vegetation: Reed Swamps.
31. Ge16: Eutric Gleysols; Cambic Arenosols and Pellic Vertisols.  
Extension: 41,000 ha.  
Vegetation: Dry savanna.
32. Gh1-3a: Humic Gleysols, fine textured; level to undulating.  
Extension: 325,000 ha.  
Vegetation: Reed swamps.
33. Gh4: Humic Gleysols; Dystric Gleysols and Dystric Nitisols, with Dystric Fluvisols.  
Extension: 65,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.
34. Gh4-a: Humic Gleysols; Dystric Gleysols and Dystric Histosols, with Dystric Fluvisols.  
Extension: 432,000 ha.  
Vegetation: Reed swamps.
35. Gh8-b: Humic Gleysols; Dystric Nitisols; rolling to hilly.  
Extension: 178,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.

Lithosols (839,000 ha.)

36. I: Lithosols.  
Extension: 243,000 ha.  
Vegetation: Tropical semi-deciduous rain forest, moist savanna, dry savanna.
37. I-Lf (petric phase): Lithosols; Ferric Luvisols.  
Extension: 82,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
38. I-Lf-bc (stony phase): Lithosols; Ferric Luvisols; rolling to hilly and steeply dissected to mountainous.  
Extension: 120,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.

39. I-Md: Lithosols; Dystric Nitosols.  
Extension: 72,000 ha.  
Vegetation: Tropical semi-deciduous tree savanna.
40. I-Rd-bc: Lithosols; Dystric Regosols; rolling to hilly and steeply dissected to mountainous.  
Extension: 182,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
41. I-Rd-c (stony phase): Lithosols; Dystric Regosols; steeply dissected to mountainous.  
Extension: 27,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
42. I-Re: Lithosols; Eutric Regosols.  
Extension: 113,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.

Fluvisols (1,218,000 ha.)

43. J2-1/2a: Fluvisols, coarse-medium textured; Gleysols; level to undulating.  
Extension: 205,000 ha.  
Vegetation: Dry Savanna.
44. J4-a (sodic/saline phase): Fluvisols; Gleysols and Xanthic Ferralsols; level to undulating.  
Extension: 308,000 ha.  
Vegetation: Mangroves.
45. Jd3-za: Dystric Fluvisols, medium textured; Plinthic Gleysols and Dystric Nitosols; level to undulating.  
Extension: 79,000 ha.  
Vegetation: Regularly inundated tropical forest, tropical swamp forest.
46. Je28 (sodic phase): Eutric Fluvisols, Solodic Planosols  
Extension: 62,000 ha.  
Vegetation: Thornbush savanna.
47. Je30-2/3a: Eutric Fluvisols, medium-fine textured; Ferric Luvisols and Pellic Vertisols, with Gleysols and Gleyic Luvisols; level to undulating.  
Extension: 455,000 ha.  
Vegetation: Dry savanna, thornbush savanna.
48. Je32-1a (sodic phase): Eutric Fluvisols, coarse textured; Luvic Arenosols and Pellic Vertisols; level to undulating.  
Extension: 27,000 ha.  
Vegetation: Thornbush savanna.
49. Jq35-2a (sodic phase): Eutric Fluvisols, medium textured; Eutric Regosols and Gleyic Solonetz, with Solodic Planosols; level to undulating.  
Extension: 82,000 ha.  
Vegetation: Thornbush savanna.

Luvisols (3,165,000 ha.)

50. L2: Luvisols; Dystric Cambisols.  
Extension: 195,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
51. Lc5-2ab: Chromic Luvisols, medium textured; Chromic Vertisols; level to undulating and rolling to hilly.  
Extension: 288,000 ha.  
Vegetation: Dry savanna.
52. Lf1-1: Ferric Luvisols, coarse textured; level to undulating.  
Extension: 120,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
53. Lf12-1a: Ferric Luvisols, coarse textured; Lithosols and Eutric Regosols; level to undulating.  
Extension: 1,233,000 ha.  
Vegetation: Tropical semi-deciduous tree savanna, moist savanna, dry savanna.
54. Lg15-1/2a: Gleyic Luvisols, coarse-medium textured; Eutric Planosols; level to undulating.  
Extension: 1,329,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.

**Nitisols (7,354,000 ha.)**

55. Nd1: Dystric Nitisols.  
Extension: 2,109,000 ha.  
Vegetation: Tropical semi-deciduous rain forest, large-leaved semi-deciduous tree savanna, moist savanna.
56. Nd1-2a: Dystric Nitisols, medium textured; level to undulating.  
Extension: 339,000 ha.  
Vegetation: Tropical lowland rain forest.
57. Nd6-3a (petric phase): Dystric Nitisols, fine textured; Rhodic Ferralsols, with Plinthic Ferralsols and Lithosols; level to undulating.  
Extension: 818,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.
58. Nd6-3ab (petric phase): Dystric Nitisols, fine textured; Rhodic Ferralsols, with Plinthic Ferralsols and Lithosols; level to undulating and rolling to hilly.  
Extension: 1,603,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
59. Nd8: Dystric Nitisols; Orthic Acrisols with Lithosols.  
Extension: 366,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.
60. Nd10-b: Dystric Nitisols; Orthic Ferralsols and Rhodic Ferralsols; rolling to hilly.  
Extension: 69,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.
61. Nd10-3b: Dystric Nitisols, fine textured; Orthic Ferralsols and Rhodic Ferralsols; rolling to hilly.  
Extension: 438,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.
62. Nd16-2/3a: Dystric Nitisols, medium-fine textured; gleyic Acrisols and Orthic Acrisols; level to undulating.  
Extension: 212,000 ha.  
Vegetation: Tropical lowland rain forest.
63. Ne1: Eutric Nitisols.  
Extension: 27,000 ha.  
Vegetation: Tropical lowland rain forest.
64. Ne3-b: Eutric Nitisols; Orthic Ferralsols and Lithosols; rolling to hilly.  
Extension: 301,000 ha.  
Vegetation: Tropical lowland rain forest.
65. Ne16-a: Eutric Nitisols; Orthic Ferralsols and Dystric Nitisols; level to undulating  
Extension: 103,000 ha.  
Vegetation: Tropical lowland rain forest.
66. Ne17: Eutric Nitisols; Dystric Nitisols, with Lithosols.  
Extension: 757,000 ha.  
Vegetation: Tropical lowland rain forest.
67. Nh3: Humic Nitisols; Humic Ferralsols and Lithosols.  
Extension: 171,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.
68. Nh3-ac: Humic Nitisols; Humic Ferralsols and Lithosols; level to undulating and steeply dissected to mountainous.  
Extension: 41,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna.

**Arenosols (189,000 ha.)**

69. Qc1: Cambic Arenosols.  
Extension: 79,000 ha.  
Vegetation: Dry savanna.
70. Qc10-1a: Cambic Arenosols, coarse textured; Lithosols; level to undulating.  
Extension: 110,000 ha.  
Vegetation: Dry savanna.

Regosols (1,607,000 ha.)

71. Re33: Eutric Regosols; Lithosols and Ferric Luvisols.  
Extension: 253,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
72. Re33-1a (petroferric): Eutric Regosols, coarse textured; Lithosols and Ferric Luvisols; level to undulating.  
Extension: 747,000 ha.  
Vegetation: Large-leaved semi-deciduous tree savanna, moist savanna.
73. Re40-bc: Eutric Regosols; Gleyic Luvisols and Eutric Planosols; rolling to hilly and steeply dissected to mountainous.  
Extension: 562,000 ha.  
Vegetation: Dry savanna.
74. Re40-1b: Eutric Regosols, coarse textured; Gleyic Luvisols and Eutric Planosols; rolling to hilly.  
Extension: 45,000 ha.  
Vegetation: Dry savanna.

Andosols (374,000 ha.)

75. Th2-o: Humic Andosols; Lithosols and Vitric Andosols; steeply dissected to mountainous.  
Extension: 158,000 ha.  
Vegetation: Tropical lowland rain forest.
76. Tm3: Mollic Andosols; Humic Gleysols.  
Extension: 72,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.
77. Tv11-ab: Vitric Andosols; Humic Andosols; level to undulating and rolling to hilly.  
Extension: 58,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.
78. Tv12-b: Vitric Andosols; Orthic Ferralsols; rolling to hilly.  
Extension: 86,000 ha.  
Vegetation: Tropical semi-deciduous rain forest.

Vertisols (1,648,000 ha.)

79. Vc9-3a: Chromic Vertisols, fine textured; Solodic Planosols; level to undulating.  
Extension: 24,000 ha.  
Vegetation: Thornbush savanna.
80. Vp9-a: Pellic Vertisols; Eutric Fluvisols; level to undulating.  
Extension: 171,000 ha.  
Vegetation: Dry savanna.
81. Vp10-3a: Pellic Vertisols, fine textured; Vertic Cambisols; level to undulating.  
Extension: 55,000 ha.  
Vegetation: Dry savanna.
82. Vp11: Pellic Vertisols; Ferric Luvisols and Eutric Regosols, with Lithosols and Chromic Luvisols.  
Extension: 435,000 ha.  
Vegetation: Dry savanna.
83. Vp12-3a: Pellic Vertisols, fine textured; Gleyic Luvisols, Chromic Vertisols, and Solodic Planosols, level to undulating.  
Extension: 418,000 ha.  
Vegetation: Thornbush savanna.
84. Vp13-a: Pellic Vertisols; Eutric Gleysols and Cambic Arenosols; level to undulating.  
Extension: 394,000 ha.  
Vegetation: Dry savanna.
85. Vp17-3a: Pellic Vertisols, fine textured; Cambic Arenosols, with Chromic Luvisols and Planosols; level to undulating.  
Extension: 151,000 ha.  
Vegetation: Thornbush savanna.

Planosols (579,000 ha.)

86. Ws2: Solodic Planosols; Gleyic Luvisols.  
Extension 127,000 ha.  
Vegetation: Thornbush savanna.
87. Ws10-a: Solodic Planosols; Pellic Vertisols; level to undulating.  
Extension: 322,000 ha.  
Vegetation: Thornbush savanna.
88. Ws11-a: Solodic Planosols; Eutric Fluvisols; level to undulating.  
Extension: 130,000 ha.  
Vegetation: Thornbush savanna.

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## Appendix IV

### Bibliography

- A. Soil Resources
- B. Forest Resources
- C. Water Resources and Climate

## Appendix IV. Bibliography

### A. Soil Resources

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