

DRAFT
ENVIRONMENTAL PROFILE
of
MALAWI

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THE UNITED STATES NATIONAL COMMITTEE FOR MAN AND THE BIOSPHERE



Department of State, IO/UCS

WASHINGTON, D. C. 20520

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 (AID), Bureau of Science and Technology (ST/FNR) 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.

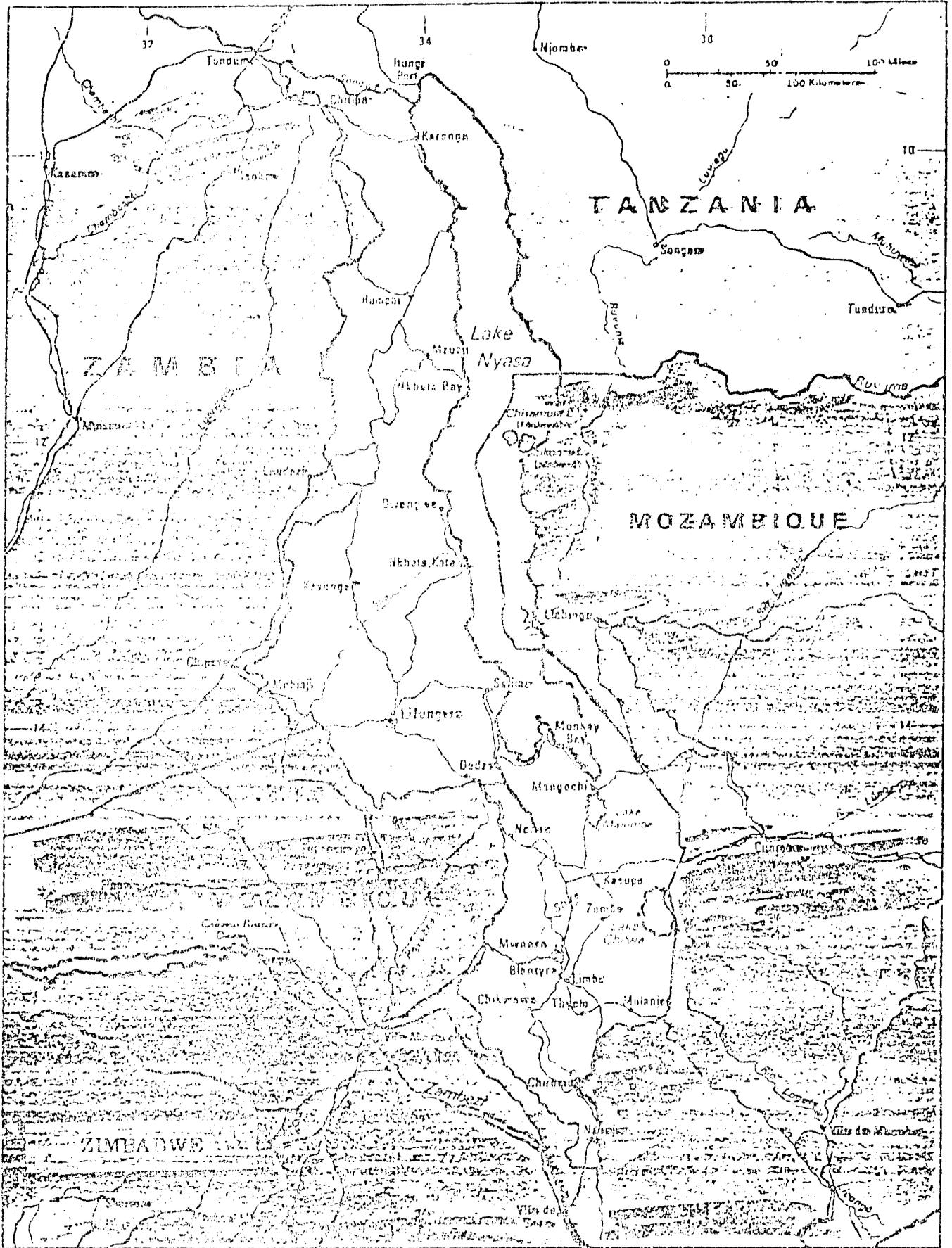
Comments on the attached draft report would be welcomed by US MAB and ST/FNR and should be addressed to

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Malawi



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SUMMARY

Malawi, a southeast African nation the size of Pennsylvania, is one of the continent's smallest countries. Although it is landlocked, Malawi is characterized by its water resources. Lake Malawi (formerly Lake Nyasa), Africa's third largest lake, covers more than a fifth of the nation's territory; other lakes and rivers add to Malawi's large inland water area. Within the remaining 94,000 sq km of terrain, the country supports a rapidly growing population that was estimated at 6.2 million in 1980. Although the total is small by African standards, Malawi is the fifth most densely populated country on the continent. An exceptionally high fertility rate of 7.0 births per woman continues to increase the population rapidly.

The pressures caused by this growing population, which already saturates available land, are responsible for inducing most of the country's environmental difficulties. Compounding the problems caused by overpopulation is Malawi's lack of exploitable natural resources. Only water, and consequently fish, can be considered in plentiful supply. And while the region's climate and physiography are exceptionally favorable for human habitation, these features are not complemented by sufficient supplies of mineral, timber, and energy resources. Continuing population growth, moreover, threatens to deplete further those resources that remain.

In decreasing order of importance, Malawi's principal environmental concerns include:

Environmental Disease. In spite of its mild climate, its elevated situation, and the general absence of drought, public health in Malawi is among Africa's worst. High fertility, insufficient nutrition, poor water supply and sanitation, and exceptionally few physicians per population all contribute to high infant mortality and low life expectancy. Although improvements in some of these phenomena have occurred over the past two decades, excessive population growth has masked some of the advances. As a result, mean life expectancy is just 47 years, the average caloric intake remains ten percent below the recommended minimum, and infectious diseases affect much of the population.

Trypanosomiasis, an African sleeping sickness, is not as serious in Malawi as in neighboring countries. Other parasitic disorders -- most of them waterborne -- such as malaria, schistosomiasis, helminthiasis, elephantiasis, and trachoma are prevalent. Additionally, leprosy, pneumonia, tuberculosis, dysentery, venereal disease, meningitis, influenza, eye diseases, childhood diseases, and malignancies all affect large numbers of residents, occasionally reaching

epidemic proportions. Insufficient medical facilities and too few physicians permit these ailments to exact higher tolls than they might otherwise.

Misuse of Land. Already by the end of the colonial period (1964) Malawi's population was beginning to exert substantial pressure on available farmland. Since that time, population has continued to increase, but little new land has been brought under cultivation. Indeed, probably almost no land remains to be converted. Forested land already has been seriously depleted (although official statistics fail to note this decline), and unproductive land is likely to remain so until improvements in agriculture can be implemented.

Reduction in the cycle of "slash and burn;" cutting of trees for firewood; land fragmentation resulting from traditional modes of inheritance; erosion occasioned by improper farming, deforestation, and overgrazing; unpredictability of seasonal rainfall; and lack of non-rainfed irrigation have disrupted a previously stable environmental equilibrium. Perhaps worst of all, reliable figures indicating the extent of these problems do not appear to have been collected. Proper corrective measures must of course await meaningful analysis of the nature and magnitude of Malawi's land use problems.

Wildlife Extinction. As in most African nations, Malawi's fauna were extremely varied and numerous until the turn of the century. Since then, commercial exploitation, encroachment by human population, and loss of habitat due to expanding cropland and deforestation have diminished both members and varieties of wildlife. Despite a fairly protective official policy supported by adequate (though antiquated) legislation, Malawi's wildlife population faces continuing threats. Unlike the problems encountered in some countries, Malawian fauna have not been endangered by intense traumatic events such as wars or by benign government policies and enforcement. The continuing pressure from the nation's increasing population can be seen as a long-term menace which will require increasing public attention.

Natural Disasters. Malawi is fortunate in that few natural calamities strike its environment. Although atop an active tectonic zone, and subject to more than 100 earthquakes each year, the country has not experienced a serious trauma this century. Similarly, drought, which plagues most of the continent, has been notably absent in Malawi. Indeed, safety from drought has enabled Malawi to absorb neighboring populations from affected areas.

It is rainfall which presents Malawi's only serious environmentally detrimental activity. Although plentiful and sufficient for agriculture, the timing of seasonal rains is

occasionally problematic. Early or late rains have been responsible for ruining harvests periodically this century. In addition, Malawi is situated within a region which is affected by cyclones born in the Indian Ocean, off the coast of neighboring Mozambique. These storms are frequently severe and have caused heavy damage from flooding and high winds. Despite their near regularity, the government possesses no integrated plan to warn and evacuate the population, or to alleviate the damage to persons, livestock, crops, and property.

1.0 Introduction

This draft environmental profile summarizes information available in the United States on the natural resources and environment of the Republic of Malawi. The report reviews the major environmental problems of Malawi and the impact of the development process upon resources and the environment. This draft report represents the first step in developing an environmental profile for use by the U.S. Agency for International Development (USAID) and Malawi government officials. The next step in this process should be a field study to evaluate the information presented here, obtain additional information, and define the issues, problems, and priorities in greater detail. This entire process should help provide direction in future efforts to deal with the management, conservation, and rehabilitation of the environment and natural resources.

The information and interpretations in this report are preliminary and are not intended to attain the detail and accuracy required for development planning. The report represents a cooperative effort by the Man and the Biosphere (MAB) project staff of the Arid Lands Information Center (ALIC). The primary research, writing and analysis of the Malawi profile were done by Robert G. Varady through the resources of ALIC and the University of Arizona Library. The sections on faunal resources, conservation, and problems relating to wildlife were written by Steven L. Hilty. The text was edited by Mercy A. Valencia. The cooperation of James Corson, AID/MAB Project Coordinator, and other AID personnel is gratefully acknowledged. Additionally, the author wishes to take particular note of Malawi in Maps, edited by S. Agnew and M. Stubbs, from which an appreciable amount of information was derived.

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2.0 General Description

2.1 Geography and Climate

2.1.1. Boundaries and Administrative Divisions 1/

Formerly known as the British Protectorate of Nyasaland, the Republic of Malawi is a landlocked southeast-central African nation of some six million inhabitants. Narrow and elongated, the country stretches 900 km from north to south (between 9°27'S and 17°10'S), and averages just 140 km in width (between 32°20'E and 36°00'E). Its land area of 94,080 square kilometers (FAO 1980) lies just west of Lake Malawi (previously, Lake Nyasa) at the southern extreme of the East African rift system. The lake itself, Africa's third largest in area (30,790 sq km; Van der Leeden 1975), constitutes half of the eastern border and the Malawian portion (24,400 sq km, or four-fifths of the lake) accounts for 20.5 percent of the nation's territory.

Malawi borders on just three countries. In the extreme north the Songwe River separates it from Tanzania, which also adjoins Malawi along the northeastern shore of Lake Malawi. The remainder of the eastern frontier is with Mozambique, which possesses the rest of Lake Malawi and surrounds the southern portion of Malawi. Zambia is the nation's only other neighbor, lying to the northwest, beyond an 800 km-long border. Although Malawi's boundaries generally conform to natural geographic features, they are the result of European colonial activity. Of the three borders, only the one with Tanzania remains to be completely undisputed; both countries, however, appear to be abiding by the present delineation.

Administratively, Malawi is divided into three regions of approximately equal size: the Northern, Central, and Southern Regions (Fig. 1). These are subdivided into 24 districts and further broken down into 60 constituencies, or subdistricts (Fig. 1). Table 1 lists the regions and districts, and their headquarters.

¹ Sources: Agnew and Stubbs. 1972
Nelson et al. 1975.
Pike. 1968a.
Pike and Rimmington. 1965.

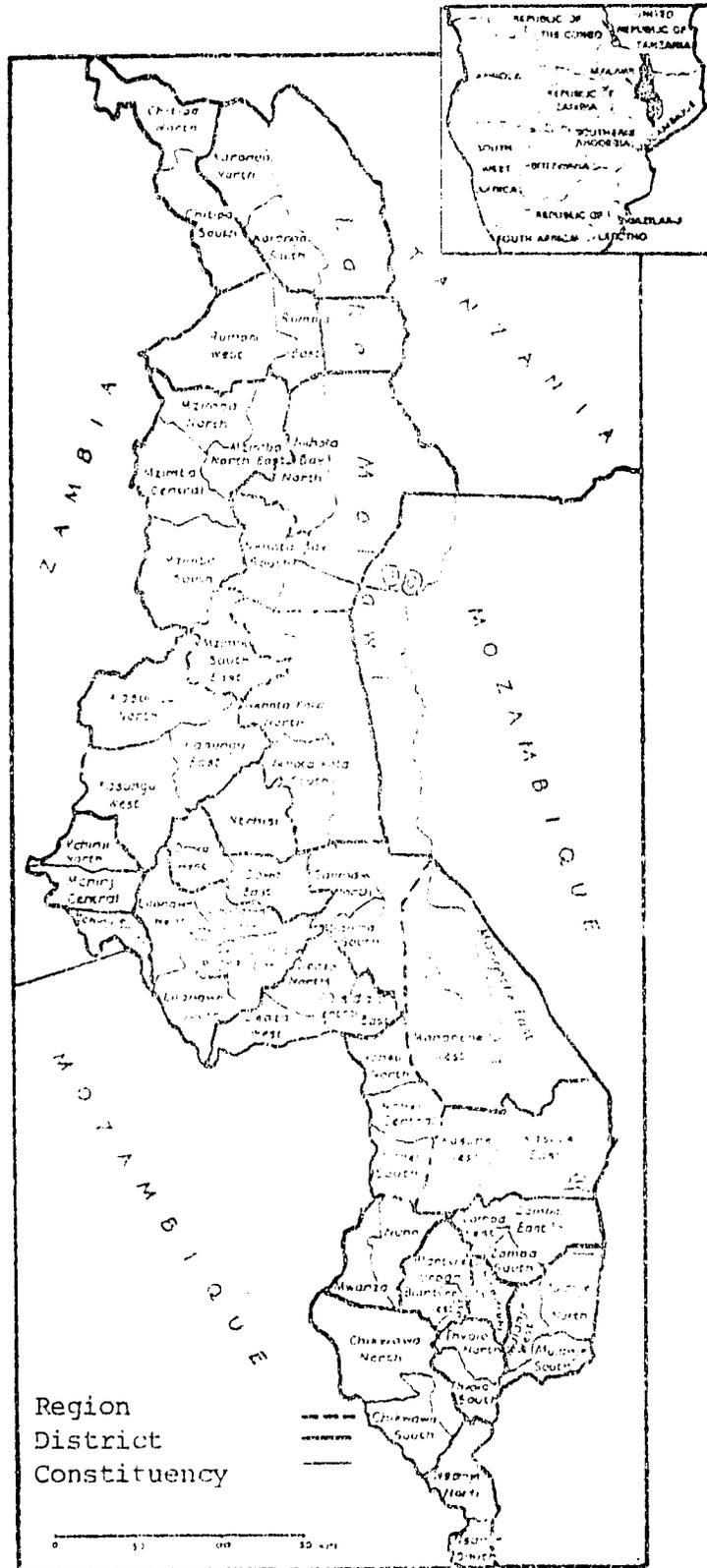


Figure 1. Administrative Units

Source: Adapted from Agnew and Stubbs (1972);
 Nelson et.al. (1975); and Pachai (1978).

Table 1. Administrative Units

Unit (Region/District)	No. of constituencies or subdistricts	Headquarters
Northern Region	13	Mzuzu
Chitipa	2	Chitipa
Karonga	2	Karonga
Mzimba	5	Mzimba
Nkhata Bay	2	Nkhata Bay
Rumphi	2	Rumphi
Central Region	25	Lilongwe
Dedza	4	Dedza
Dowa	2	Dowa
Kasungu	3	Kasungu
Lilongwe	5	Lilongwe
Mchinji	3	Mchinji
Ncheu	3	Ncheu
Nkhota Kota	2	Nkhota Kota
Ntchisi	1	Ntchisi
Salima	2	Salima
Southern Region	22	Blantyre
Blantyre	3	Blantyre
Chikwawa	2	Chikwawa
Chiradzulu	1	Chiradzulu
Kasupe	2	Kasupe
Mangoche	2	Mangoche
Mulanje	3	Mulanje
Mwanza	2	Mwanza
Nsanje	2	Nsanje
Thyolo	2	Thyolo
Zomba	3	Zomba
Malawi	60	Lilongwe

Sources: Agnew and Stubbs. 1972.
Nelson et al. 1975.

2.1.2 Geographic Features ^{2/}

For a nation the size of Pennsylvania, Malawi exhibits a very diverse physiography. Its landscape includes lakes, lowland floodplains, marshes, plateaus, and highlands. Elevations vary from a minimum of about 100 m above sea level in the southern Shire River Valley to more than 2,500 m at several locations (Fig. 2).

Although Malawi's complex physiography can be subdivided into as many as 54 distinct zones (Stubbs and Young 1972), it is sufficient to consider four broad relief regions. In order of rising elevation, these are: (1) the Shire Valley; (2) the lake littoral; (3) the plateaux; and (4) the highlands (Fig. 3). Each of these may in turn be subdivided into localized regions.

Shire Valley. The valley of the Shire River extends some 400 km directly southward from the southern tip of Lake Malawi (Fig. 3). The Upper Shire Valley, which covers terrain from south of the lake to Murchison Falls west of Zomba, is a broad, flat continuation of the lake basin. It is bounded on the west by the Chiripa Plateau scarp, and on the east by the scarp of the Mangoche highlands. The northern reaches of the valley are composed of fertile alluvial soils which degenerate into stony terrain further south.

Below this region, the Middle Shire Valley is an extension of the valley landform. Within this 80 km zone the Shire River drops about 380 m in elevation through a series of cataracts. This portion of the valley is hilly, rocky, and generally infertile. Still further to the south, the Lower Shire Valley continues beyond its last cataract at Hamilton Falls to where it exits from Malawi toward its eventual merger with the Zambezi River. At the southern border the elevation in the valley is just 37 m above sea level. Much of the region consists of low rolling hills, though east of the Shire River the land is marshy.

² Sources: Agnew. 1972a.
Agnew and Stubbs. 1972.
Nelson et al. 1975.
Pike. 1968a.
Pike and Rimmington. 1965.

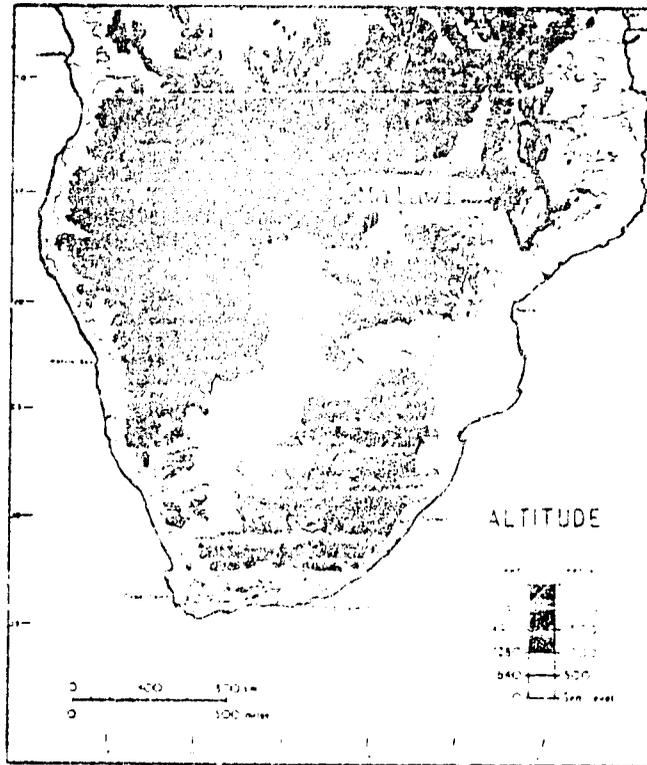


Figure 2. Elevation

Source: Werger. 1978.

Lake Littoral. The littoral strip of land surrounding Lake Malawi is generally 8 to 24 km wide. Most of this coastal area is part of the Rift Valley floor, a continuation of the lake bottom. At some points this transitional zone disappears, and steep fault scarps fall directly to the shore. In all, the littoral covers approximately 7,770 sq km, or eight percent of Malawi's land. The soil cover consists of alluvial and colluvial deposits, and occasional swamps. To the west the littoral slopes upward to meet the cliffs of the Rift Valley scarp.

Plateaux. About 75 percent of Malawi's land area consists of plateaux lying between 750 m and 1,350 m above sea level. Pike and Rimmington (1965) identify nine distinct plateau regions. These are distributed throughout the length of the country and are the areas of greatest population concentration. The largest of these is the Central Province Plateau (or Lilongwe Plain) which covers some 23,300 sq km and rises to 1,500 m at its summit. Most of the plateau is gently sloping woodland country drained by mature rivers flowing toward Lake Malawi.

The other plateaux identified by Pike and Rimmington are: the Shire Plateau (or Shire Highlands), Lake Chilwa-Palombe Plain, Mangoche Highlands and Chiripa Plateau in Malawi's Southern Region; and the Mzimba Plain, Henga and Kasitu Valley, Nchenachena-Livingstonia Hills, and Fort Hill-Lairia Plateau in the Northern Region.

Highlands. Rising above Malawi's extensive plateaux are remnants of late Jurassic and late Cretaceous erosion surfaces. These mountainous forests and grasslands are scattered through the Northern, Central, and Southern Regions of the country. They vary in elevation between 1,350 m to 2,500 m. While some of the highland subregions consist merely of the immediate vicinities of individual mountains (for example, the Malanje Mountains, Zomba Mountain, Mafingi Mountains, and Misuku Highlands), others are considerably more extensive. The longest of these areas are the Dedza-Kirk Range Highlands of west central Malawi, the Vipya Highlands west of Nkhata Bay, the Nyika Plateau--the nation's most elevated--north of Rumphu, and the Dowa Highlands north of Lilongwe. The highest peaks in Malawi are in the north, within the Nyika Plateau region, and in the far

south, east of Blantyre. Individual peaks reach 2,590 m, and the nation's highest elevation is 3,000 m in the Mulanje Massif.

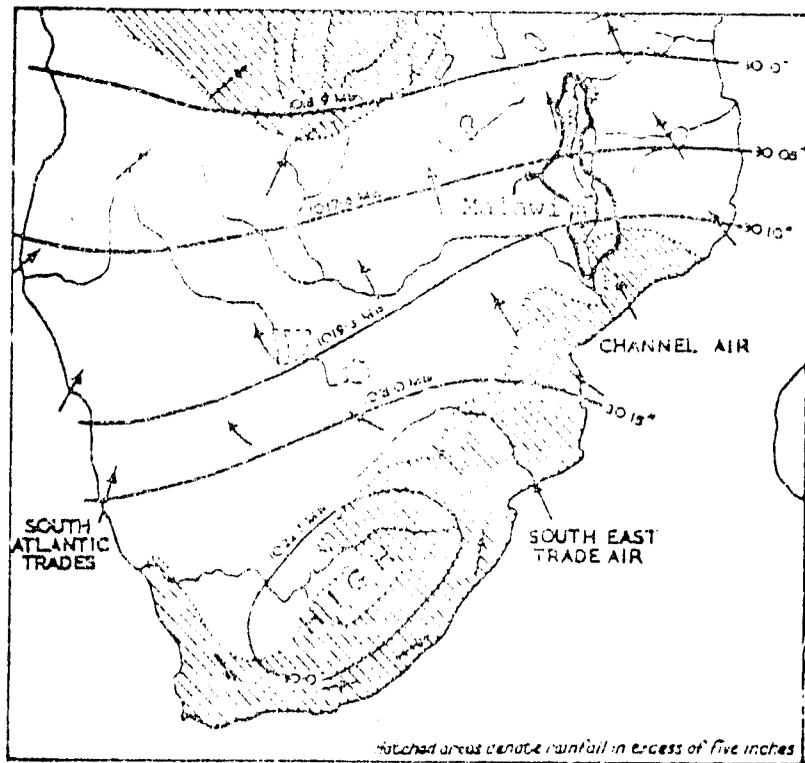
2.1.3 Climate ^{3/}

Malawi lies within the African region whose climate is influenced by the Intertropical Convergence Zone (ITCZ), an air pressure system created by the interaction of continental tradewinds (Fig. 4). It is the action of the ITCZ that determines Malawi's seasons.

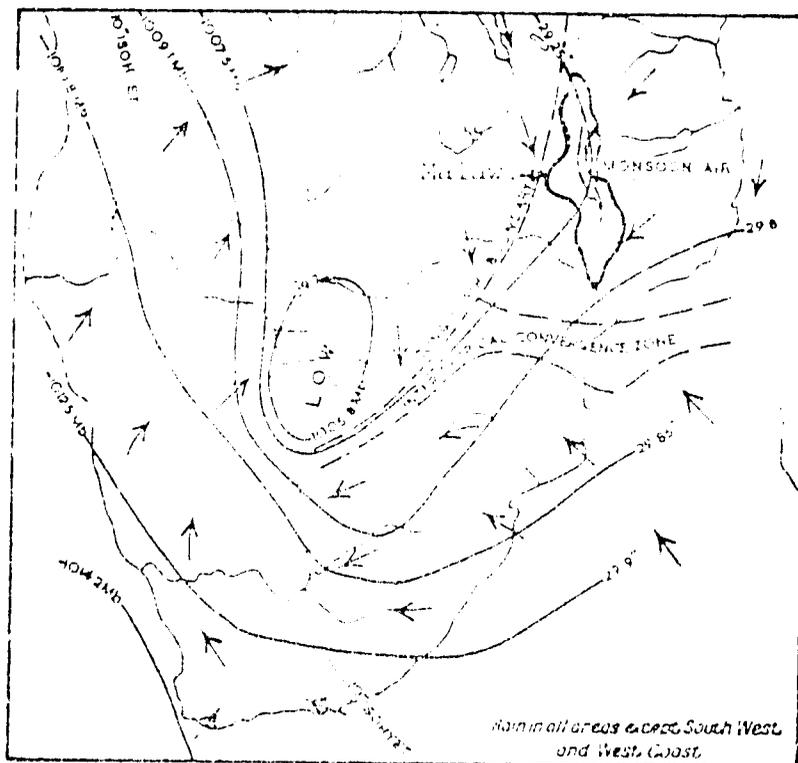
The rainy season begins soon after the arrival of the ITCZ, usually in November. Within a month the entire country is covered with humid air from the Mozambique Channel of the Indian Ocean. As the Convergence Zone drifts southward by late December, rains intensify over most of the terrain. By late February or early March the ITCZ is pushed to the north by strengthening southeast tradewinds and the rainy season ends in southern Malawi. In the vicinity of Lake Malawi and in the north, however, rainfall persists through April. May through October mark the dry season.

While the ITCZ is the dominant climatic determinant, Malawi's weather patterns are influenced locally by: topography; exposure to monsoons and cyclones originating in the Indian Ocean; and proximity to Lake Malawi. Pike (1981a) divides the country into four climatic regions: (1) hot and dry (the Shire Valley, and coastal areas around Salima and Karonga); (2) hot and wet (much of the remaining lakeshore); (3) warm with moderate rainfall (areas of medium elevation, generally the nation's plateaux); and (4) warm and wet (the highlands).

³ Sources: Agnew. 1972a.
Lineham. 1972a, 1972b.
Nelson et al. 1975.
Pike. 1968a.
Pike and Rimmington. 1965.
Robertson and Sellick. 1933.
Schultze and McGee. 1976, 1978.
Torrance. 1972a, 1972b.
Wernstedt. 195?



a. June



b. December

Figure 4. Air Currents and the Intertropical Convergence Zone (ITCZ)

Source: Adapted from Pike and Rimmington (1965).

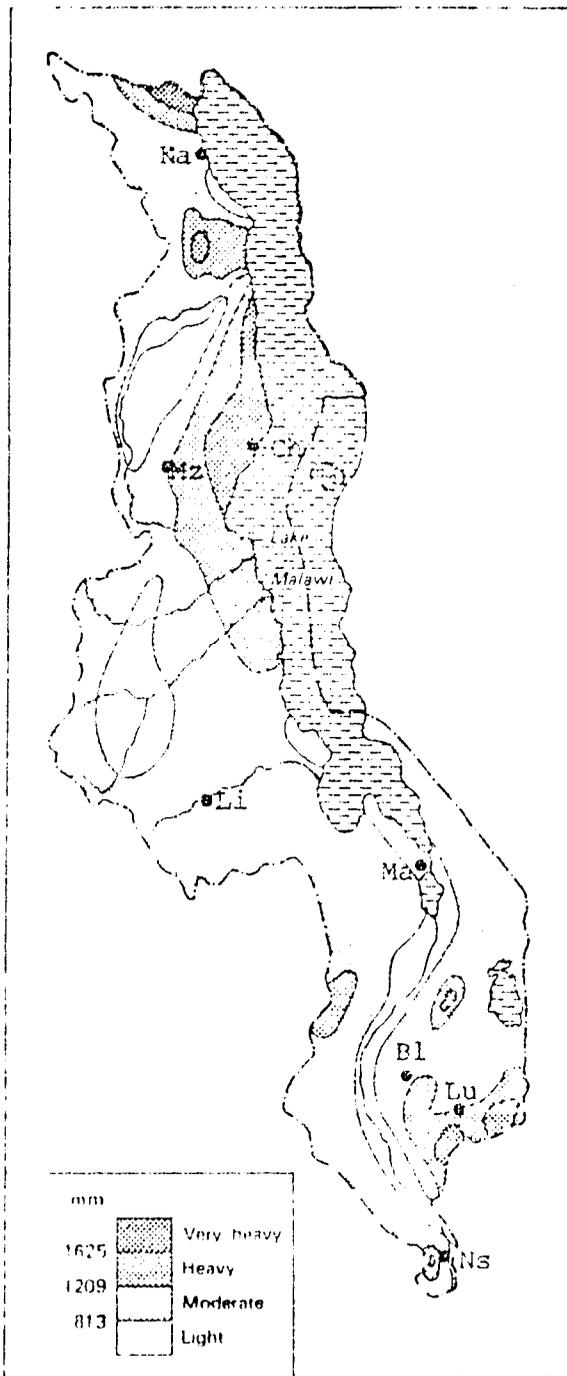
2.1.3.1 Rainfall

Figure 5a shows the geographical distribution of rainfall in Malawi. Precipitation is heaviest along the northern coast of Lake Malawi and in isolated highlands near Lake Chilwa. These areas receive more than 1,625 mm of rainfall per year. The driest regions are along the Shire River Basin, in parts of the Central Plateau, and across the Mzimba Plains. Rainfall in these areas is generally below 800 mm per annum. Mean annual precipitation of the entire country is about 1,140 mm (Pike 1968a). Rainfall varies considerably, however, several years of abundant precipitation alternate with relatively dry years. Over a majority of the country, the annual rainfall coefficient of variability is between 20 and 25 percent (Lineham 1972b). Table 2 shows the distribution of rainfall in Malawi.

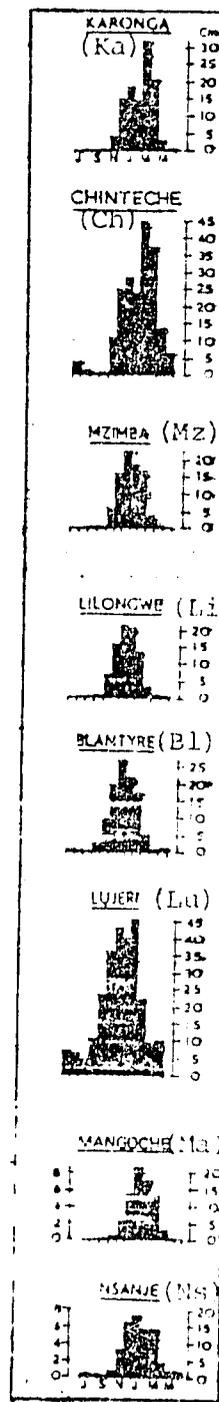
Table 2. Rainfall Distribution

Mean annual rainfall (mm per annum)	Percent of total area
Under 500	3
500 - 700	2
750 - 1,000	71
1,000 - 1,250	14
1,250 - 1,500	7
1,500 - 1,750	2
Over 1,750	1

Source: Adapted from Pike and Rimmington (1965).



a. Geographic Distribution



b. Monthly Distribution at Selected Sites

Figure 5. Rainfall

Sources: Adapted from Agnew (1972a) and Lineham (1972b)

Within each year rainfall patterns reflect the arrival and departure of the ITCZ. November through March is the rainy season for most of Malawi. As Figure 5b shows, some regions experience longer rainy seasons. In Lujeri, south of Lake Chilwa, for example, at least 50 mm of precipitation falls each month and the wet season extends from October to June. By contrast in Mzimba, on the elevated Mzimba Plain, the wet season is short and far less intense (Fig. 5b). Table 3 provides data for monthly and annual precipitation of selected sites.

2.1.3.2 Temperature, Humidity, and Radiation

Elevation and proximity to Lake Malawi are the strongest determinants of temperature in Malawi. Each 109 m of elevation accounts for one degree (Celsius) of temperature change in midday, while a rise of 182 m is required to lower the temperature one degree at night. Since altitudes vary by as much as 2,500 m within the country, temperatures vary accordingly. In addition, Lake Malawi exerts a cooling effect on average temperatures. Maximum temperatures are generally five degrees lower by the lake than at comparable elevations elsewhere in Malawi.

The hottest temperatures typically occur in October and November, just before the onset of the rainy season. Minimum temperatures are in June and July at most locations. The average range of temperatures is between 12° and 15°C. The nation's hottest spots are within the Lower Shire Valley, while the coolest areas are atop the high plateaux and mountains. The region adjacent to Lake Malawi experiences the least variation.

Figure 6 illustrates the geographical distribution of temperatures and Figure 7 shows their variations in January and July. Table 4 lists temperature characteristics for nine selected sites in Malawi. Table 5 provides relative humidity readings for seven locations, and Table 6 lists the number of hours of sunshine at those places. Finally, Figure 8 maps incoming solar radiation in winter and summer. During winter Malawi receives levels of solar radiation that are among southern Africa's highest; in summer, however, incoming radiation is relatively low compared to the rest of the region.

Table 3. Precipitation of Selected Locales

Locale	Elevation (m)	Precipitation (mm)												Annual
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Chileka	771	208	206	169	42	7	3	4	2	4	21	87	133	893
Cholo	902	271	210	225	64	50	39	35	32	23	50	152	209	1,358
Port Johnston	484	232	184	149	40	4	4	2	1	1	20	40	161	839
Karonge	487	158	180	285	189	35	5	1	4	0	11	46	138	1,052
Lilongwe	1,041	203	198	153	42	6	1	0	1	8	10	87	125	633
Livingstonia	1,371	439	407	483	363	164	35	11	15	12	67	132	264	2,391
Mlanje	628	355	281	342	158	79	56	37	42	19	85	138	272	1,865
Mzimba	1,355	203	205	168	38	6	0	1	1	2	7	75	142	845
Port Herald	58	187	182	131	49	22	20	9	10	8	12	102	132	864

Source: Adapted from Wernstedt (1959?).

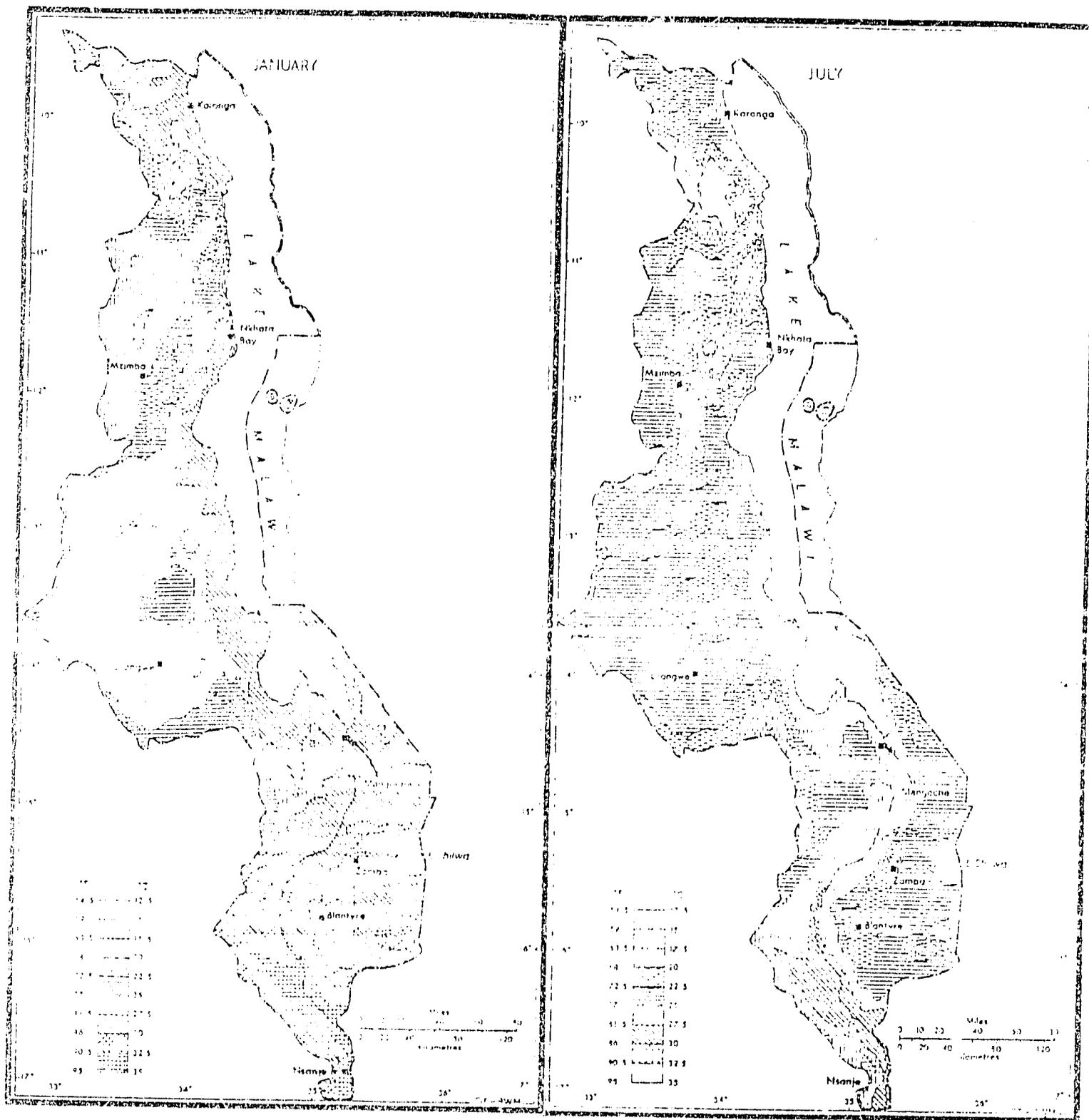


Figure 6. Mean Maximum Temperatures in January and July

Source: Adapted from Torrance (1972a, 1972b).

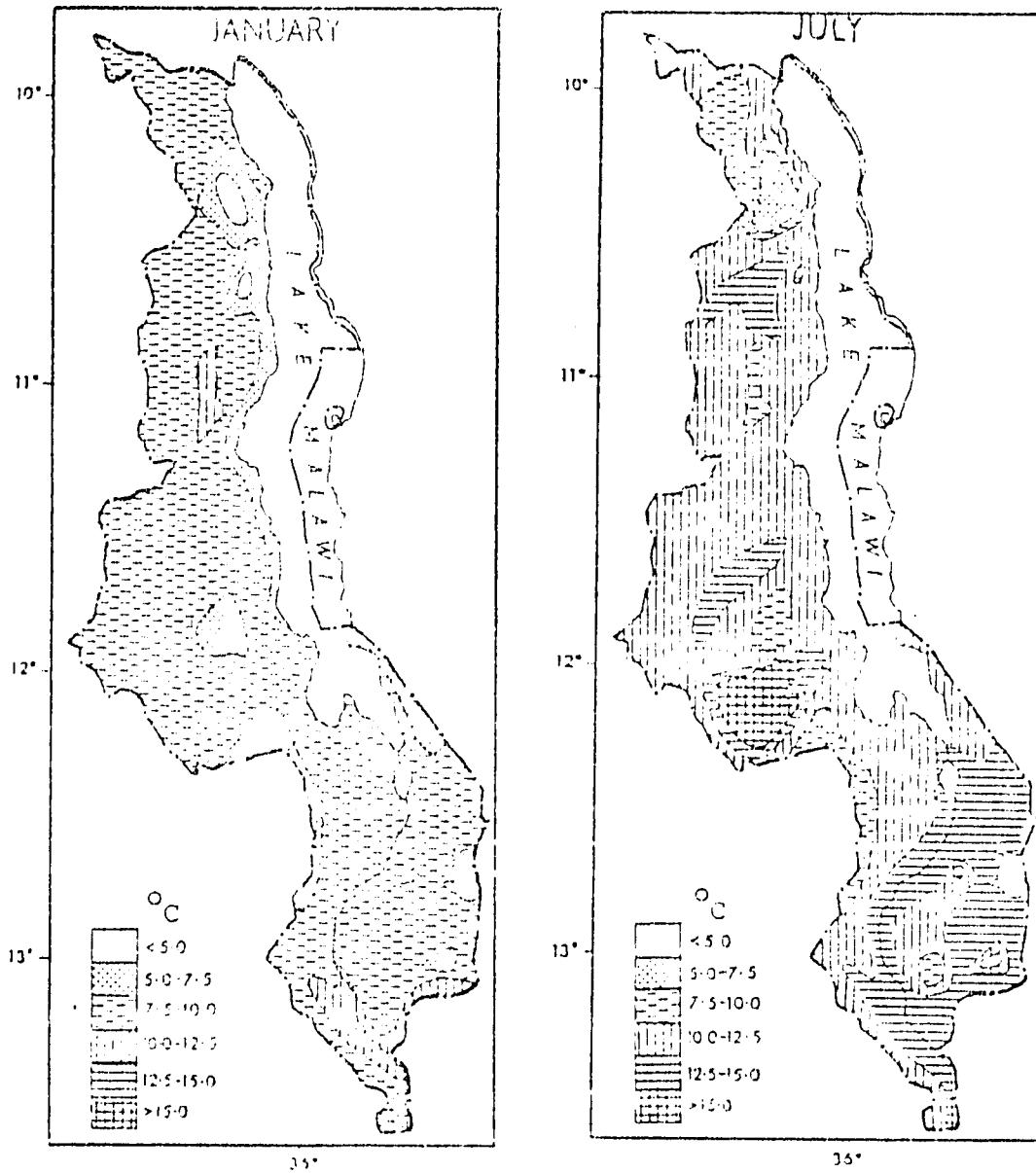


Figure 7. Temperature Variation in January and July

Source: Adapted from Torrance (1972a, 1972b).

Table 4. Temperatures at Selected Locales

Location	Temperature (°C)												Annual
	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	
Chileka	24.1	23.7	23.3	22.4	20.1	18.3	18.4	19.7	22.6	25.4	25.4	24.6	22.3
Cholo	22.9	22.1	22.2	21.7	18.8	16.9	17.1	17.6	20.7	23.1	23.4	24.5	20.8
Port Johnston	25.7	25.3	25.4	24.4	22.1	20.1	20.2	21.2	24.2	26.8	27.4	16.4	24.0
Karonga	25.7	25.4	25.2	24.9	23.6	21.5	20.8	21.6	23.2	25.7	26.7	26.2	24.2
Lilongwe	22.2	22.0	22.3	20.3	17.6	15.2	14.9	16.3	19.4	22.1	23.2	22.8	19.8
Livingstonia	20.2	19.9	20.2	19.6	17.7	15.8	15.7	16.6	19.0	20.8	21.6	21.0	19.0
Mlanje	24.1	23.4	23.6	22.1	19.0	16.9	16.9	17.7	21.0	23.8	24.9	23.9	21.4
Mzimba	20.7	20.4	20.8	20.4	18.3	16.2	15.9	16.8	19.6	22.4	22.7	21.5	19.7
Port Herald	28.2	27.8	27.2	26.1	23.1	20.9	21.3	22.6	25.8	28.6	29.2	28.6	25.8

Source: Adapted from Wernstedt (1959?).

Table 5. Relative Humidity at Selected Locales

Station	Relative Humidity (%)												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
Makanga	77	81	78	79	78	76	76	65	61	60	76	77	72
Byumbwe	83	88	84	85	80	80	70	69	65	62	69	84	77
Chileka	79	80	80	75	70	69	63	57	52	50	60	74	67
Zomba	82	82	86	80	77	76	70	60	61	52	64	82	73
Lilongwe	83	86	82	77	72	67	61	58	54	50	62	77	69
Mzimba	82	83	82	80	74	72	68	65	60	52	64	75	71
Chitipa	80	83	82	80	74	70	64	61	52	47	54	74	68

Source: Torrance. 1972b.

Table 6. Duration of Sunshine at Selected Locales

Station	Hours of Sunshine												
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Mean
Makanga	6.4	6.6	8.2	8.6	8.4	6.9	7.7	7.3	7.9	8.8	8.3	7.0	7.7
Byumbwe	5.5	5.7	6.7	7.4	7.9	6.3	7.4	7.6	7.8	8.4	7.5	4.9	7.0
Chileka	6.0	6.2	6.1	7.7	8.2	7.1	7.3	7.9	8.2	8.6	7.3	6.2	7.2
Monkey Bay	5.4	5.2	7.5	8.9	9.3	8.7	8.2	9.2	9.3	9.8	9.5	7.9	8.3
Lilongwe	4.6	4.9	6.1	8.0	8.4	7.7	8.3	8.3	8.5	9.9	7.9	5.4	7.3
Mzimba	4.1	4.0	5.3	7.4	8.5	8.6	9.0	9.4	9.7	10.3	8.5	5.4	7.5
Fort Hill	5.0	3.9	4.7	7.4	9.5	9.2	9.3	8.7	9.9	9.1	7.5	4.6	7.4

Source: Torrance. 1972b.

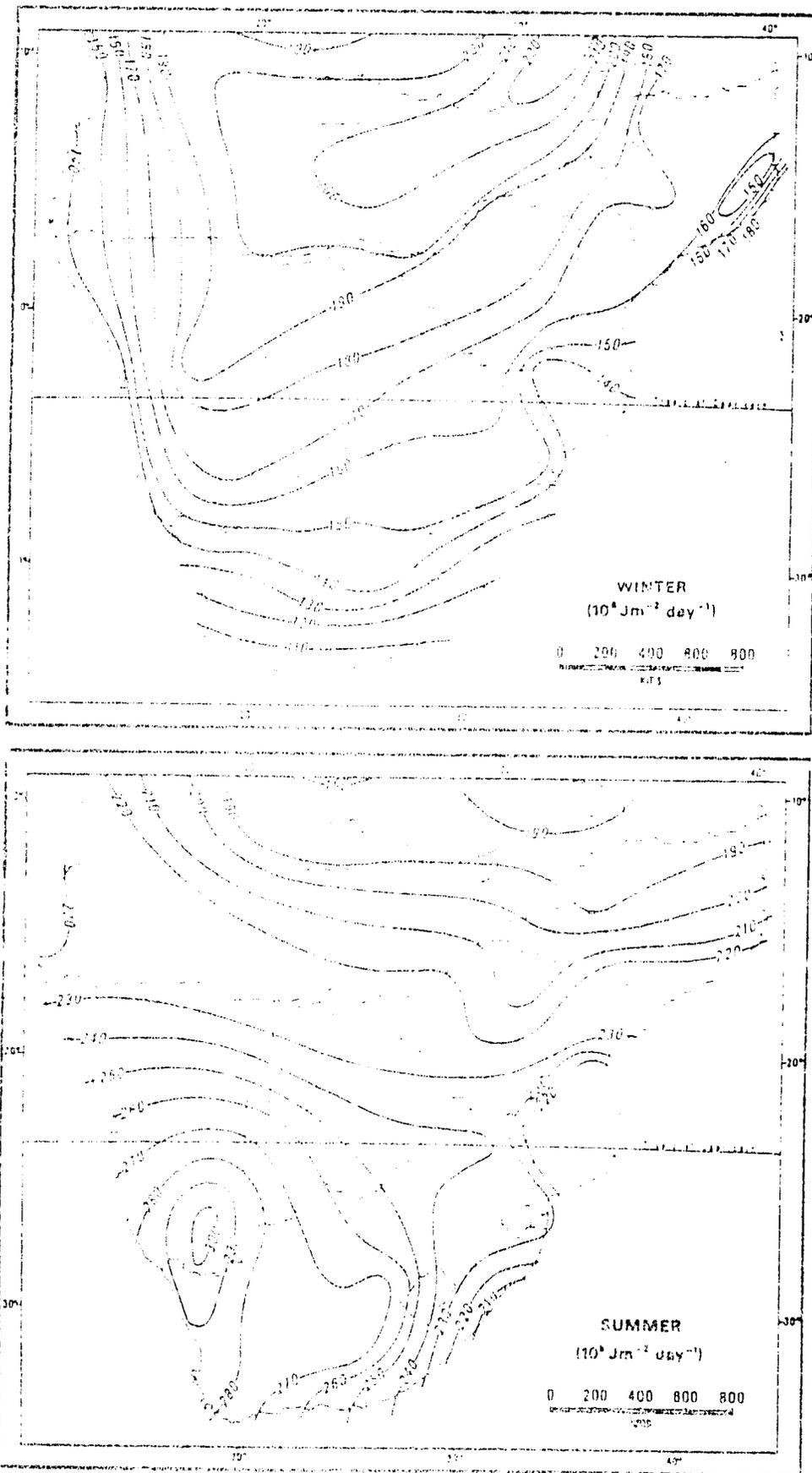


Figure 8. Incoming Solar Radiation in Winter and Summer

Source: Scudlone and McCall, 1979.

2.2 Population

2.2.1 Historical Background ⁴/

Humans have inhabited the region comprising Malawi since the Late Stone Age, some twelve thousand years ago (Pachai 1978). The area's elevated plateau, long lake shore, and relative freedom from tsetse infestations provided a hospitable environment for both transitory herdsman and settled cultivators. The fertile lakefront and Shire River Valley drew migrants from all directions--across Lake Malawi, from the Indian Ocean coast; south from the Zambezi Valley; west from Katanga in present Zaire; and north from the land east of the Great Rift.

Recent research indicates that the earliest communities consisted of nomadic hunters and gatherers. Not until the Iron Age did Bantu-speaking pastoralists migrate to the region, displacing the earlier residents. Although much of the detailed history of the subsequent period remains to be reconstructed, it has been confirmed that the country has been inhabited continuously throughout this time. Regional migrations and settlement patterns continued to alter the cultural composition, social and political organizations, and modes of livelihood of the endemic populations. According to reliable oral tradition, by the thirteenth century a wave of Bantu-speaking Malawi or Chewa migrants began entering the region adjacent to Lake Malawi. More than two centuries of conflict resulted in the eventual dominance of the Chewa peoples (including the Banda, Mbewe, Mwale, Nkhoma, and Phiri clans) over other groups.

By the early sixteenth century the Chewa clans were consolidated under the political leadership

⁴ Sources: Agnew. 1972a.
Clark. 1972.
Nelson et al. 1975.
Pachai. 1972a, 1978.
Pike. 1968a.
Pollock. 1971.
Rotberg. 1965.
Tobias. 1972.
Williams. 1978.

of a ruler called the Karonga. The title became hereditary, passed on through matrilineal descent. The Karongas wielded power by controlling land charters for the regions they dominated. In spite of the arrival of non-Chewa groups (Fig. 9), the Chewa and their traditional political system (sometimes termed the Malawi, or Maravi, Confederation) continued to hold paramountly over the area well into the nineteenth century.

Beginning in the third decade of the nineteenth century the Chewa domain was repeatedly invaded by southern peoples known as Ngoni, entering from across the Zambezi River. By the middle of the century factional disputes split the Ngoni and various groups moved to the northern and central regions of Malawi. Simultaneously Yao residents from across Lake Malawi, traditionally agriculturalists and merchants, intensified their activities as facilitators of the prosperous slave trade. Economic incentives and concurrent pressure from hostile communities encouraged significant Yao migration into the Shire Highlands and the southern portions of Malawi. Descendants of Yao and Ngoni settlers remain in modern Malawi and comprise about 15 percent of the population.

Malawi escaped direct colonial rule until the close of the nineteenth century. Prior to that time the Chewa state was subjected to Portuguese hegemony during the sixteenth and seventeenth centuries and to Arab influence thereafter. Neither the Portuguese nor the Zanzibar-based Arabs, however, imposed administrative control beyond the Zambezi or Lake Malawi. Instead, both powers were content to dominate commerce and exact tribute.

After initial explorations of the Zambezi and Shire Valleys during the 1850s by David Livingstone, a Scottish missionary, British interest in the region was aroused. In 1861 an Anglican mission sponsored by the University Mission to Central Africa was opened at Magomero in the Shire Highlands. It was the first of several Christian establishments--both Protestant and Catholic--which led to eventual government involvement. The area adjacent to Lake Malawi was formally administered by the British Crown from May 1891, when it was designated the Nyasaland Districts Protectorate.

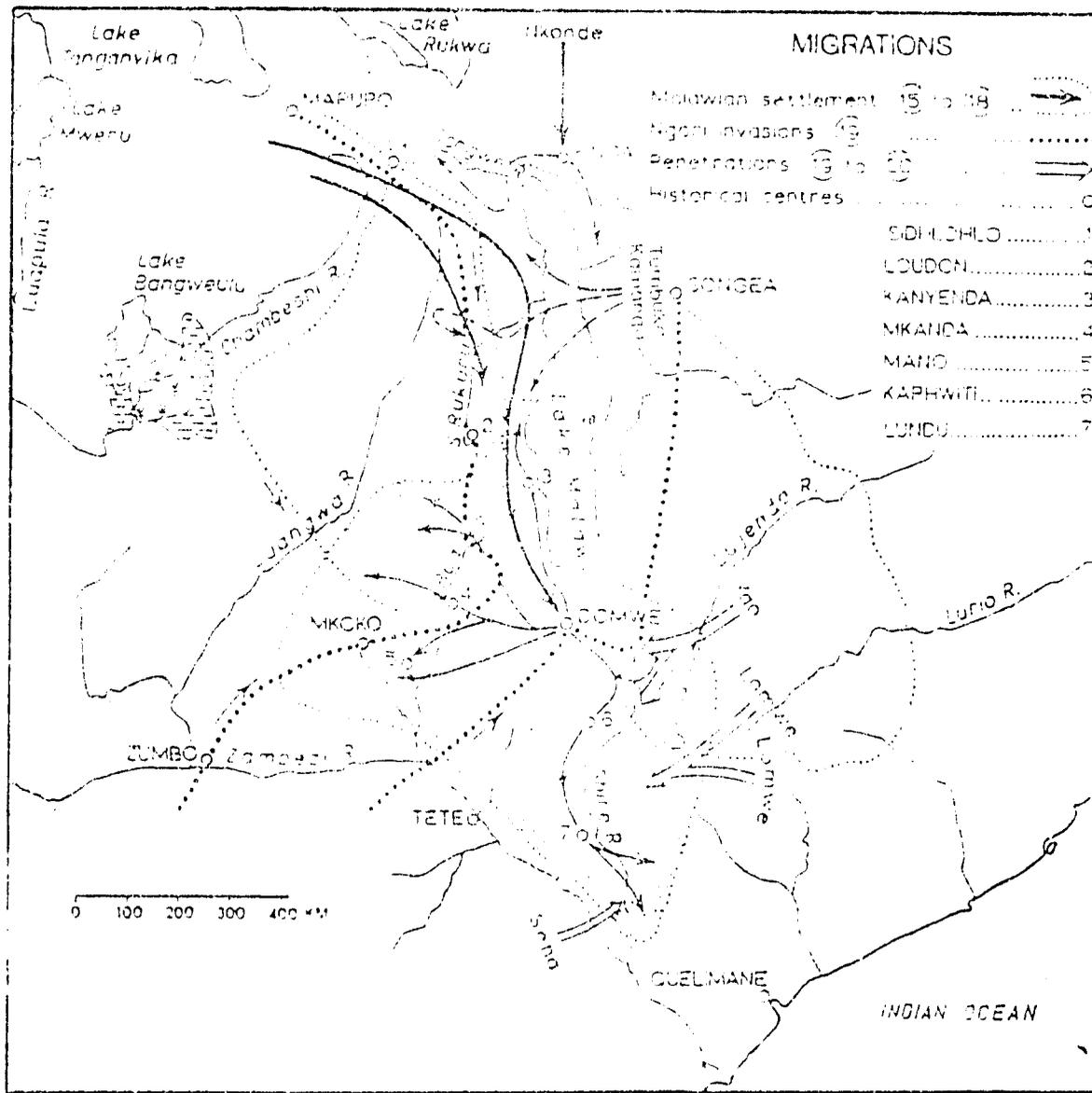


Figure 9. Historical Migrations

Source: Pachai. 1972b.

Although the name of the territory later was changed to the British Central Africa Protectorate, the colony's political status remained essentially unchanged until 1953. In August of that year Great Britain united the adjoining territories of Nyasaland, Northern Rhodesia (now Zambia), and Southern Rhodesia (now Zimbabwe) into the Federation of Rhodesia and Nyasaland. The Federation, although generally unpopular survived until 1964, when Nyasaland obtained its independence under the new name of Malawi.

2.2.2 Ethnicity and Language ^{5/}

Distinctions between the various ethnic communities residing in Malawi are somewhat clouded by a combination of cultural and historical factors. First, although familial clans are identifiable, delineation of broad "tribal" groups remains imprecise among Bantu-speaking Africans; no clear concept exists to define membership in a given society or political unit (Nurse 1978). Secondly, the extensive folk migrations and invasions prior to the twentieth century, and subsequent intermarriages have further confounded attempts at categorization. Nevertheless, some groups who entered relatively recently continue to be perceived as immigrants or strangers. The Ngoni, descended from patrilineal southern African herders, and the Yao, matrilineal clans of farmers and traders from across Lake Malawi, are perhaps the two most clearly identifiable communities of non-Malawian origin. The other resident groups are identified chiefly on the basis of their linguistic traditions.

According to that criterion, the Chewa and Nyanja (or Achewa and Anyanja) communities--closely linked culturally and linguistically--comprise approximately half the country's population. Collectively, these peoples were known as the Malawi, or Maravi, prior to the nineteenth century. Their language, Chichewa or Chinyanja,

⁵ Sources: Nelson et al. 1975.
Nurse. 1978.
Pachai. 1972b.
Stubbs. 1972a.
Tew. 1950.

has been declared the national language of Malawi. According to the latest census (1966), 76.6 percent of Malawian residents understand Chichewa (Stubbs 1972a). As Figure 10 illustrates, Chewa people reside primarily in Central Malawi, and the Nyanja reside in the south along the Shire River Valley and near Lake Chilwa.

The next most populous community is that of the Lomwe, or Alomwe. In 1966 approximately a seventh of the population specified Chilomwe, a Bantu tongue, as their maternal language. The Lomwe inhabit the region south of Lake Chilwa. Other important groups of indigenous Malawians are the Tumbuka, Khokhola, and Tonga peoples. Along with the immigrant Ngoni, Yao, and Sena, members of the Ngonde, Nyakyusa, Lambya, Sukwa, and Kunda societies make up the remainder of Malawi's population. Table 7 lists the numbers and percentages of speakers of the nation's languages.

While Chichewa has been Malawi's "national" language since 1968, English continues as the official language. In 1966 only 5.0 percent of Malawians understood English, but it remains the language in which administration is conducted.

2.2.3 Population Size, Growth, and Distribution ^{6/}

Malawi's 1980 population of 6.2 million (Futures Group 1981) is Africa's 20th largest (of 37). The nation's average population density of 49.1 persons per square kilometer is exceeded in only four African countries (Uganda, Nigeria, Burundi, and Rwanda). In comparison to its neighbors, Malawi is seven times as densely populated as Zambia, four times as densely as Mozambique, and two and a half times as densely as Tanzania.

The distribution of Malawi's population is uneven and conforms generally to availability of perennial water and to hospitable physiography.

⁶ Sources: Agnew. 1972a.
Futures Group. 1981.
Nelson et al. 1975.
Pike. 1968a.
Pike and Rimmington. 1965.
Stubbs. 1972b, 1972c.
World Bank. 1981.



Figure 10. Ethnic Communities

Source: Pike and Birmingham. 1965.

Table 7. Population of Linguistic Communities

Community	Language	No. of persons speaking language at home	Percentage of total
Chewa } Nyanja }	Chichewa or Chinyanja }	1,654,095	50.4
Lomwe	Chilomwe	476,300	14.5
Yao	Chiyao	452,300	13.8
Tumbuka	Chitumbuka	298,900	9.1
Sena	Chisena	115,100	3.5
Khokhola	Chikhokhola	74,500	2.3
Tonga	Chitonga	62,213	1.9
Ngoni	Chingoni	37,480	1.1
Ngonde	Chingonde	31,000	*
Lambya	Chilambya	18,600	*
Sukwa	Chisukwa	18,000	*
Nyakyusa	Chinyakyusa	3,000	*
-----	Kiswahili	2,900	*
-----	Other African languages	39,500	1.2
Total	-----	3,283,888	100.0

* Less than 1 percent.

Source: Adapted from Stubbs (1972a).

Accordingly, the most densely populated regions are in the Shire Highlands, on the Central Province Plateau, and along a narrow lake coastal strip by Nkhata Bay. Maximum densities in those areas exceed 1,300 persons per sq km (Stubbs 1972c). Figure 11 illustrates the pattern of population density according to the 1966 census, and Figure 12 maps the distribution of Malawi's population.

The country's population growth rate is high by African standards--2.8 percent per annum between 1960 and 1970, and the same from 1970 to 1979 (World Bank 1981). This results from high fertility (7.0 births per woman) and high crude birth rate (51 per 1,000 in 1979), and from a rapidly declining crude death rate (19 per 1,000 in 1979 vs. 27 per 1,000 in 1960). Consequently, Malawi's population doubled between 1950 and 1975, and unless fertility and mortality rates vary substantially, it is expected to double once again to more than 12 million by the turn of the century (Fig. 13a), raising the average density to nearly 100 persons per sq km.

Because of the sustained elevated birth rate, Malawi's population is young and yearly growing younger. Nearly half of all Malawians are under 15 years of age (Fig. 13b), thus placing a large burden on the work force and on the country's resources. Further straining public and private resources is the growing rate of urbanization, 6.8 percent per year between 1970 and 1980, and 7.3 percent in 1978 (USAID 1981a; World Bank 1981). Urban residents, who accounted for just four percent of total population in 1960, now comprise ten percent of the total. One of every five city dwellers resides in the largest urban center, Blantyre.

2.2.4 Migration ^{7/}

Malawi has experienced considerable levels of three types of migration: (1) immigration by residents from more drought-prone regions;

⁷ Sources: Boeder. 1973.
Coleman. 1974.
Nelson et al. 1975.
Webster. 1978.

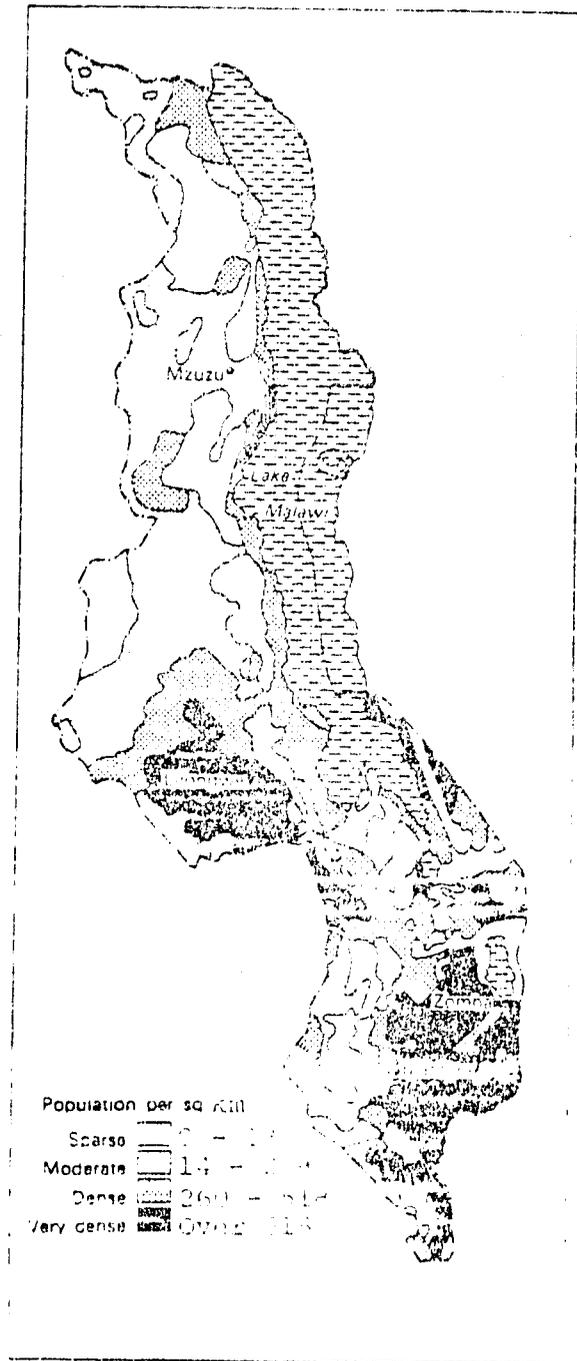


Figure 11. Population Density, 1966

Source: Agnew. 1972a.

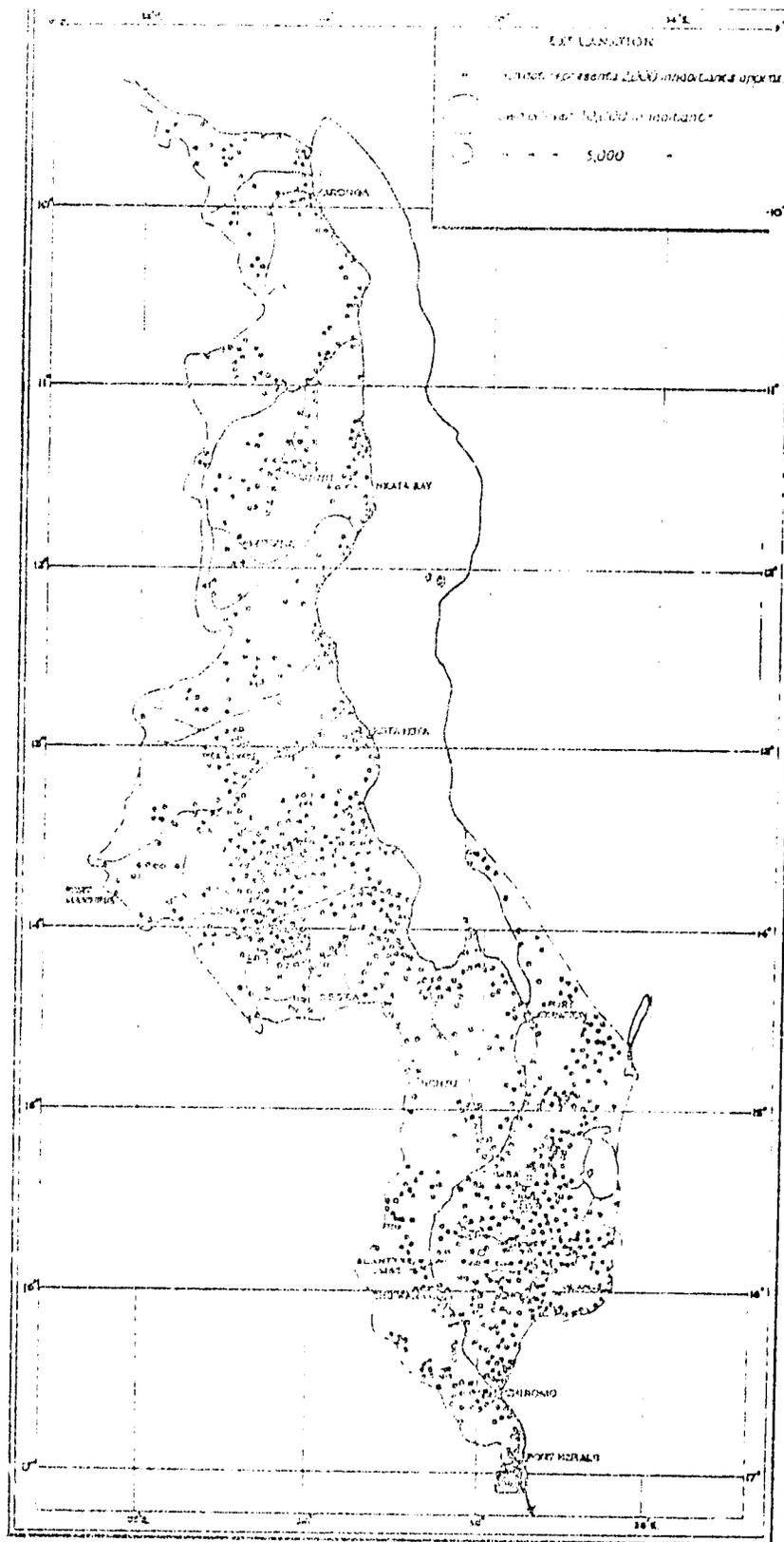
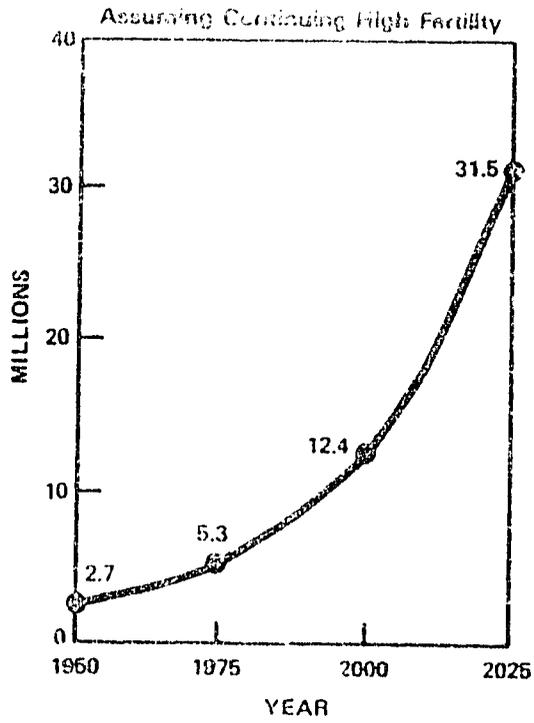
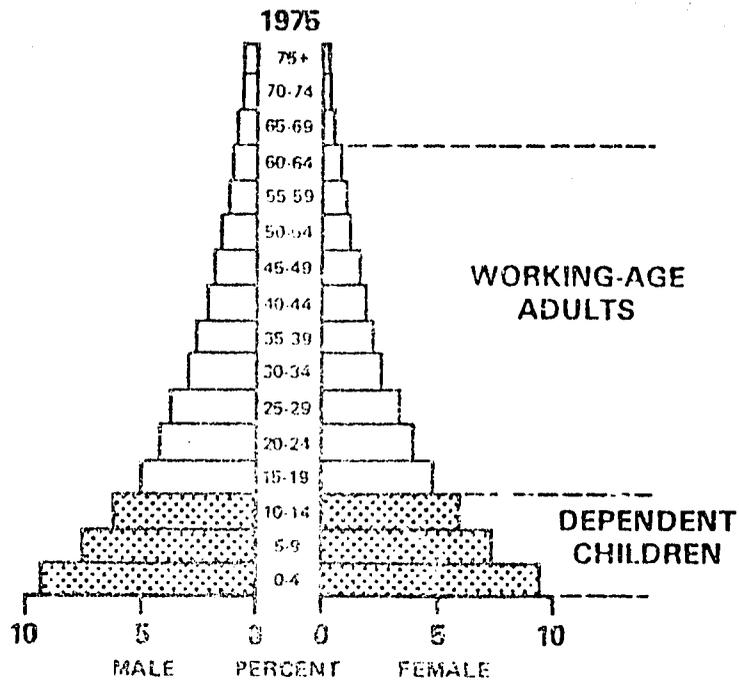


Figure 12. Population Distribution

Source: Pike and Rimmington. 1965.



a. Population Growth, 1950 - 2025



b. Age - Sex Distribution

Figure 13. Population Characteristics

Source: Entures Group, 1981.

(2) emigration by laborers seeking wages in more prosperous economies; and (3) internal migration from rural to urban environments. The last of these phenomena has already been discussed in the preceding section. While urban migration causes considerable social reorientation and strains resources, it does not have a direct effect upon total population size. Both in- and out-migration have altered the size and nature of the country's population, particularly affecting ethnic distribution and sex characteristics.

Of the two types of migration, immigration is the more established process. Malawi's relative safety from drought and neighboring regions' susceptibility have drawn immigrants for centuries. Documented evidence has recorded such movements in the the Lake Malawi littoral and surrounding highlands at least since the sixteenth century (Webster 1978). During the present century Mozambique has been the origin of several substantial waves of migration. Although authoritative statistics are lacking, it appears that by 1966 about a quarter million resident Malawians were of Mozambiquian origin (Nelson et al. 1975). Southern districts such as Nsanje, Thyolo, and Mulanje particularly have been affected by incoming persons seeking a more hospitable environment.

Emigration from Malawi to neighboring countries has occurred since the advent of British administration at the close of the nineteenth century. By 1921 perhaps 20 percent of the population was employed outside the territory. Those Malawians who have participated in this process have been almost exclusively landless rural residents, and predominantly male (75 percent). According to a report by Malawi's Ministry of Labor, between 1948 and 1962 alone, 684,000 persons went to Southern Rhodesia, another 360,000 to South Africa, and 124,000 to Zambia (Boeder 1973). In the mid-1970s it was estimated that each year as many as 300,000 Malawian citizens earned wages in those three countries and in Mozambique, Zaire, and Tanzania (Nelson et al. 1975). The cumulative number of wage-seeking emigrants during this century is thought to be in the millions.

The resulting displacement has been responsible for influencing virtually all of Malawi's

economic, political, and social policies. Perhaps the most notable consequences of this large exodus have been: (1) official reluctance to develop agriculture, industry, and resource exploitation on account of insufficient labor; (2) observable and significant alterations in the male to female ratios in many districts (in Mzimba District, for example, as many as 65 percent of males were absent in 1935, and in the Lilongwe area several communities have reported that more than three-fifths of the men had worked outside Malawi; and (3) substantial remittances of earnings by Malawians working outside the country. Throughout the 1950s and 1960s, Malawi earned five million dollars annually from labor emigration (Boeder 1973).

2.3 Land Use

2.3.1 General Features ^{8/}

Table 8a lists land use patterns in Malawi from 1961 to 1978. Insofar as these FAO data are reliable, with one exception, the nation's use of available land has remained nearly unchanged over the past two decades. Only two important variations are apparent from the tabulation: the amount of arable land increased by 15.7 percent (from 1.95 to 2.28 million hectares); and simultaneously, the amount of "other land" decreased by the same amount, from 3.28 to 2.96 million ha (a 9.8 percent drop). Otherwise, area under permanent crops, forested and wooded land, and pastureland all remained unchanged between 1961 and 1978. As of the latest report, "other" lands cover the largest area, followed by forests, arable land, and meadowlands, in that order (Table 8a).

Table 8b divides Malawi's terrain differently, and thus provides a somewhat different picture of the allocation of land. According to that categorization, cultivated land (including estates) comprises the largest group, slightly exceeding the amount of land that is not arable. Figure 14 shows the geographical distribution of land that remains unoccupied, and thus

⁸ Source: FAO. 1980.

Table 8. Land Use

a. According to FAO (1961 to 1978)

Row	Land Type	Area							
		1961-65		1968		1973		1978	
		Millions of ha	Percentage						
1.	Arable and under permanent crop	1.97	(16.0)	2.01	(16.7)	2.25	(19.1)	2.30	(19.4)
2.	Arable land ^a	1.95	(16.5)	1.99	(16.8)	2.25	(19.3)	2.28	(19.2)
3.	Land under permanent crop ^b	0.02	(0.2)	0.02	(0.2)	0.02	(0.2)	0.02	(0.2)
4.	Permanent meadows and pastures ^c	1.84	(15.5)	1.84	(15.5)	1.84	(15.5)	1.84	(15.5)
5.	Forests and woodlands ^d	2.31	(19.5)	2.31	(19.5)	2.31	(19.5)	2.31	(19.5)
6.	Other lands ^e	3.29	(27.7)	3.25	(27.4)	3.41	(29.4)	3.41	(29.4)
7.	Total land area	9.41	(79.4)	9.41	(79.4)	9.41	(79.4)	9.41	(79.4)
8.	Inland water	2.44	(20.6)	2.44	(20.6)	2.44	(20.6)	2.44	(20.6)
9.	Total area	11.85	(100.0)	11.85	(100.0)	11.85	(100.0)	11.85	(100.0)

^a Land under temporary crops, temporary meadows, vegetable gardens, and fallow land.^b Lands that do not need to be replanted after harvest; excludes timber lands.^c Lands used for forage or left as wild prairie for more than five years.^d Includes deforested land which is scheduled to be reforested.^e Unused but potentially productive land, and barren land, parks, roads, built-up land, and all other terrain not previously included.

Source: FAO, 1980.

b. According to World Bank (n.d.)

Row	Land Type	Millions of ha	Percentage
1.	Customary land under cultivation	2.86	24.3
2.	Estates	0.47	4.0
3.	Not arable (incl. meadows, pastures, swamps, steep mountainland)	3.14	26.5
4.	National parks	1.04	8.3
5.	Forest reserves	0.85	7.2
6.	Urban areas, roads, other paved areas	1.04	8.6
7.	Total land area	9.41	79.4
8.	Inland water	2.44 ^a	20.6
9.	Total area	11.85 ^a	100.0

^a From FAO (1980).

Source: Adapted from USAID (1981b).

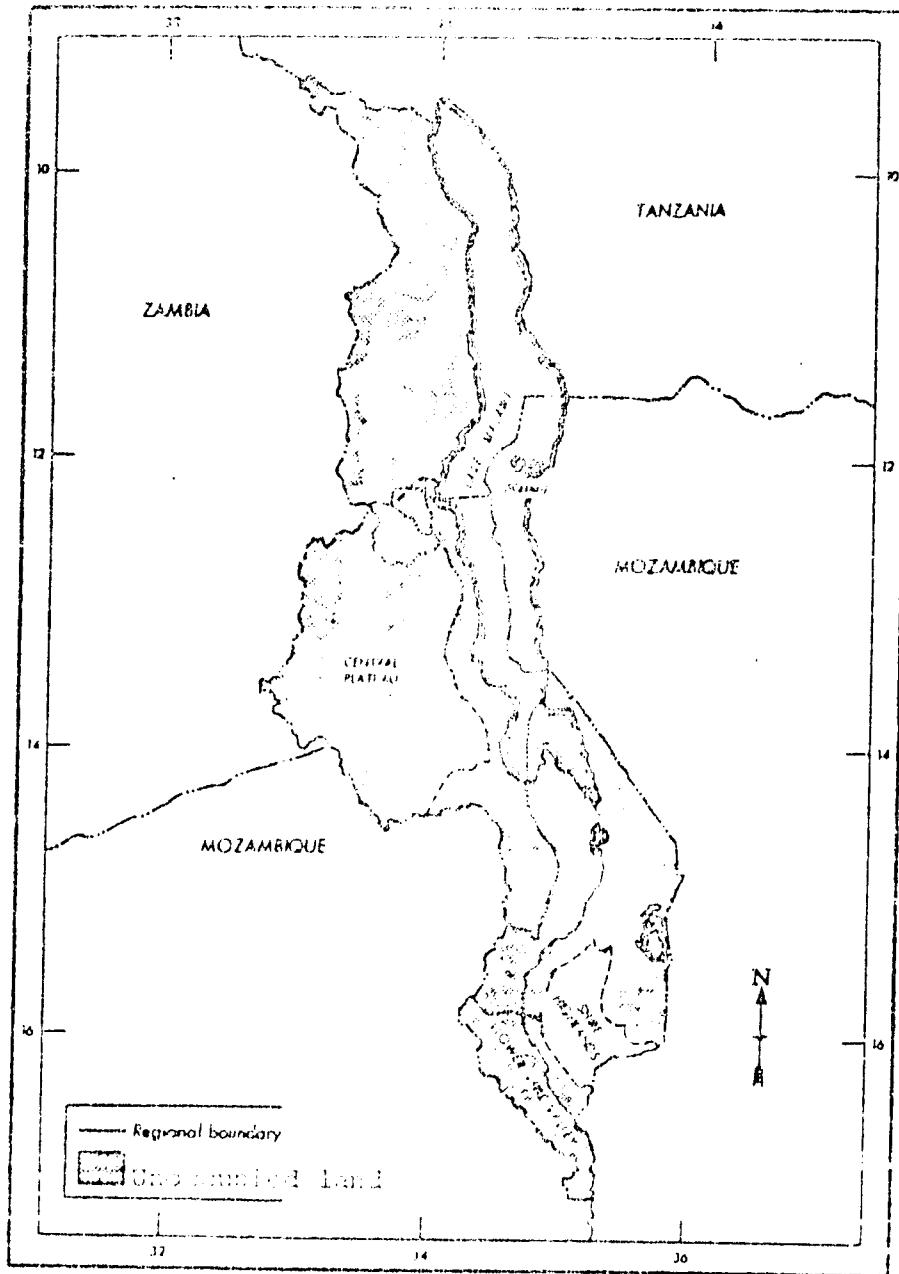


Figure 14. Unoccupied Land

Source: Adapted from Nelson et al. (1975).

uncultivated. It is not possible to know how much of this terrain is potentially arable, but according to Table 8a, "other" land steadily is being converted to arable land at the average rate of 19,000 ha per year (0.2 percent of Malawi's total land area).

2.3.2 Land Tenure ^{9/}

Prior to European entry in Malawi all land was held or employed according to prevailing local customary law. Soon after the establishment of Christian missions and the subsequent declaration of British protectorate status, Europeans began acquiring estates in Malawi's most fertile areas. Already by the turn of the century, nearly a sixth of the protectorate's land area was held by non-Africans. First population pressure, then deliberate policy, and eventually a European exodus have reduced that percentage. By the 1950s just four percent of land was held privately, and on the eve of independence the figure had dropped to two percent. The latest figures indicate a possible renewal of private land ownership; in 1975 the government's Department of Lands reported that 2.6 percent of Malawi's land was held privately by leaseholders and freeholders (Pachai 1978).

Table 9 indicates another trend. Since 1961 less land is governed by customary law, while public lands have grown by 50 percent. The Malawi Land Act of 1965 and three subsequent acts in 1967 were intended to permit the government to manage, regulate, and control the use of all lands. According to its terms, three types of lands have been designated: customary land is defined as land held and used under customary law; public land, or government-held land, includes national

⁹ Sources: Agnew. 1973a, 1973b.
Brietzke. 1973.
Chipeta. 1971.
Lampport-Stokes. 1970.
McLoughlin. 1972.
Nelson et al. 1975.
Pachai. 1978.
Page. 1973b.
Pike. 1968a.
Pike and Rimmington. 1965.

Table 9. Land Tenure, 1961 and 1974

Landholding type	Percentage of total	
	1961	1974
Customary land	87.0	80.7
Public land	11.0	16.7
Leashold	--	2.5
Freehold	2.0	0.1
Total	100.0	100.0

Sources: Chipeta. 1971.
Pachai. 1978.

parks, forests, lapsed leaseholds, and all government-purchased lands; private lands encompass land occupied or held under freehold title, leasehold title, or other official arrangements.

Customary land, still the largest area, varies in nature according to its location and the social and political systems of indigenous communities. Succession rights thus may be through matrilineal descent (75 percent of the time) or through patrilineage, according to local practice. Frequently a headman acts as arbitrator or facilitator in disputes over succession.

Criticism of customary land tenure has generally focused upon its discouragement of agricultural innovation. Others dismiss these charges and attribute Malawi's inadequate agricultural production instead to shortages of capital and inadequate training. In this view, redistributing customary land is seen as inefficient and disruptive (Chipeta 1971).

2.3.3 Agricultural Practices 10/

Insofar as any planting system in Malawi may be termed "traditional," evidence suggests that local farmers engage in "slash and burn," or shifting agriculture. Farming, then as now, it appears was conducted mostly by women. Throughout the nineteenth century, and indeed for nearly half of the present century, population growth was contained and pressure on available land was not intense. Under natural cycling, therefore, shifting agriculture was not necessarily damaging to the environment. With sufficient time, deforested areas were permitted to regenerate and soil regained its fertility.

European administrators, however, were more familiar with conditions of high population density and consequent land shortages. As a result, early colonial officials considered "slash and burn" techniques to be ruinous and wasteful, leading ultimately to deforestation, erosion, and loss of farmland. Already by the late 1890s the British instituted an agricultural policy designed to steer cultivators toward more permanent modes of farming. In addition, colonial administrators disdained what they perceived as indigenous torpor and reluctance to adopt "modern" agricultural practices (Chanock 1973). As late as 1972 British observers were advocating the necessity of "changing in a few years a pattern of life which has remained basically the same ... since man first lived in the country" (Cole-King).

Throughout their rule, therefore, the British encouraged permanent cultivation accompanied by crop rotation and adoption of new crops. Simultaneously, the interests of European cultivators were enhanced by sanctioning the establishment of large estates, usually established on the richest lands. Together, these policies did not always succeed and a frequent

¹⁰Sources: Agnew. 1972a.
Chanock. 1973.
Cole-King. 1972.
Gregson. 1970.
MacDonnell. 1973.
Nelson et al. 1975.
Ruthenberg. 1980.

result among small farmers was extensive monocropping, particularly in maize--now Malawi's most important crop. With increases in population pressure on land and occasional rainfall shortages (as in 1948-49), such monocropping has been extremely destructive of soil and has aggravated land shortages.

As government encouragement of permanent cultivation has succeeded, farmers cultivating ever smaller plots have found the need to decrease the amount of fallow land and the duration of its fallowing. This process further threatens continued availability of fertile land and increases the need for fertilizer imports and more efficient practices. Since independence official responses have concentrated upon land redistribution and population resettlement programs, and provision of agricultural extension services. These extension programs operate on three tiers: the individual method; the group method; and the mass method. Such efforts have succeeded in reaching perhaps a million farm families who have been introduced to fertilizer use, crop rotation, and other techniques aimed at improving crop yields (MacDonnell 1973).

2.3.4 Crops 11/

Malawi's agricultural sector has always provided a major contribution to the nation's economy. Although the growth of industry and services have been eroding agriculture's share of the gross domestic product (GDP)--from 58 percent in 1960 to 43 percent in 1979--that sector continues as Malawi's largest employer. In 1980, 85 percent of the labor force was engaged in agricultural occupations (down from 92 percent in 1960; USAID 1981b; World Bank 1981). The annual growth rate of the agricultural sector was a healthy

¹¹Sources: Agnew. 1972a.
Cole-King. 1972.
Europa Publications. 1980.
FAO. 1980.
Jones. 1973.
Nelson et al. 1975.
Pike. 1968a.
USAID. 1981b.
USDA. 1980.

4.1 percent during the 1970s (World Bank 1981). "Real annual growth rate," according to USAID (1981b) was estimated at an even higher 4.9 percent per year.

Until 1980 the nation's agricultural production facilities supplied all of Malawi's food requirements. Without population control measures and improved crop yields, however, agricultural self-sufficiency is not likely to be attained in the near future. The projected shortfall in food production is most likely to be manifested in Malawi's most important crop--maize. According to a recent World Bank (1980) projection, if unremedied, the deficit in maize may reach 110,000 metric tons by the end of the present decade. As Table 10 shows, maize covers by far the largest planted area and accounts for the overwhelming share of the country's agricultural output. Shortfalls in maize production therefore are likely to have a serious impact on Malawi's long-term economic and social welfare.

Apart from maize, in area planted Malawi's other principal crops are sugarcane, fruits and vegetables, groundnuts, sorghum, and tobacco (Table 10). Of these, only sorghum is considered indigenous. Although the entire nation lies within Africa's sorghum belt, it is economically important only in the Lower Shire Valley. Other native crops such as cassava, bulrush millet (or pearl millet), and eleusine (or finger millet) were at one time staples throughout Malawi. Now, except in isolated areas, they have been replaced by imported crops, principally maize.

Successful cultivation of maize requires careful soil selection and better agronomic practices than farming of millet and other endemic crops. As Table 10 illustrates, over the past decade it appears that maize cultivation has become more efficient; a slightly smaller amount of land has yielded about 13 percent more maize. The areas devoted to maize, moreover are frequently planted with other crops such as tobacco and groundnuts. These may be sold for cash that is used to finance fertilizer application and other "modern" farming techniques (Agnew 1972a).

Recently cash crops such as cotton, tea, tobacco, tung, and sugarcane have been planted over an

Table 10. Area and Production of Principal Crops, 1969 to 1979

Crop	1969-71		1977		1979	
	Area 1,000 ha	Production 1,000 MT	Area 1,000 ha	Production 1,000 MT	Area 1,000 ha	Production 1,000 MT
Rice, paddy	23	23	47	43	52	50
Maize	1,039	1,066	1,000	1,200	1,000	1,200
Sorghum	107	78	120	120	120	110
Potatoes	25	85	28	100	30	110
Cassava	20	90	15	65	15	80
Dry beans	90	50	95	61	96	60
Groundnuts, in shell	233	182	250	174	250	170
Seed cotton	46	21	40	27	34	38
Cottonseed	*	14	*	18	*	23
Cotton (lint)	*	7	*	7	*	10
Vegetables and melons	*	150	*	187	*	194
Fruit	*	172	*	209	*	216
Sugarcane	4	296	9	960	11	1,100
Tea	15	18	17	32	18	33
Tobacco leaves	42	21	67	52	79	54

* Not available.

Source: FAO. 1980.

increasing area. Together these and other crops earn a modest amount of foreign currency for Malawi. In 1977 agricultural commodities accounted for virtually 100 percent of Malawi's export earnings (176,113 katchwa, or US\$ 219,046 at the 1980 exchange rate; Europa Publications 1980). Of this amount, tobacco (49.2 percent) and tea (23.6 percent) accounted for nearly three-quarters of export receipts.

Crop production in Malawi is accomplished through three forms of farming: (1) estate agriculture; (2) smallholder cash cropping; and (3) subsistence farming. Accurate data do not exist on the relative sizes and contributions of these three sectors. It is believed that subsistence farming probably employs the largest number of families, while smallholder cash cropping and estate planting accounts for nearly all foreign exchange earnings. According to a 1971 estimate (Nelson et al. 1975), 64.1 percent of the agricultural sector contribution to the GDP arose from subsistence farming; 25.2 percent from small-scale cash cropping; and the remaining 10.7 percent from private estates and public cooperatives.

Geographical distribution of crops cannot be categorized in a simple manner. Agricultural productivity and crop suitability are determined by a combination of climatic, soil, physiographic, ecological, social, and economic factors. Tsetse fly infestation, a severe hindrance to agriculture and human habitation in much of the neighboring territory, does not constitute a major problem in Malawi (Fig. 15). In tsetse-free areas, therefore, crops are planted according to the above considerations. The resulting distribution is quite complex for a nation of Malawi's size. Figure 16 shows the location of areas devoted to the nation's principal agricultural commodities.

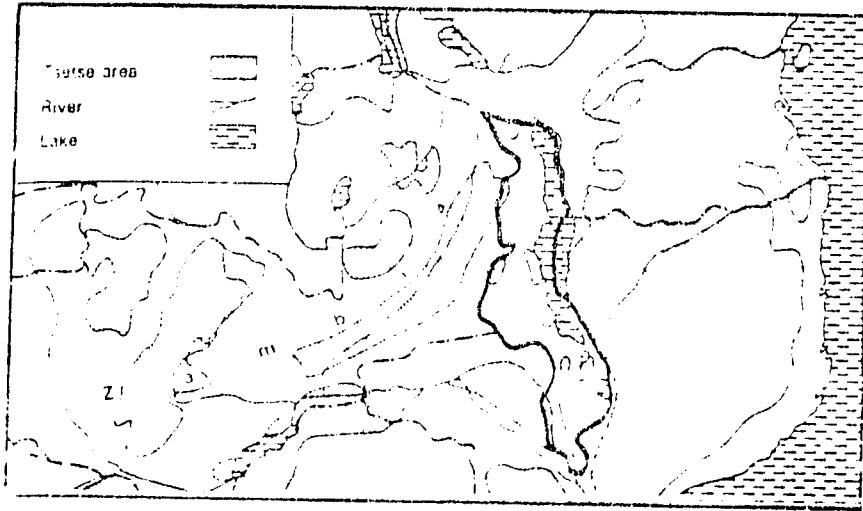


Figure 15. Tsetse Infested Areas

Source: Agnew. 1972a.

2.3.5 Rangeland and Livestock ^{12/}

Although many of the communities presently residing in Malawi are descended from migratory herding societies, raising of cattle and other livestock has become a sedentary activity, occurring alongside cultivation. As a result there are proportionally fewer migratory herds in Malawi than in most neighboring countries. In addition, cattle raising is generally confined to specific communities, and typical rural households do not include cattle.

In spite of these social phenomena, the density of cattle in Malawi (approximately 8.5 head per sq km of land) is 50 percent higher than for Africa as a whole (FAO 1980). The average cattle density has been increasing rapidly over the past two decades, principally as a result of improved veterinary care. The largest increases in herd size have been in customary land areas in the Southern Region around Blantyre, Mulanje, and Nsanje, and in the Northern Region in Mzimba District (Fig. 17).

Table 11 lists the sizes of cattle herds and other livestock population over the past three decades. According to the tabulation, the fastest increases have been in Malawi's goat population (8.7 percent per annum), followed by sheep (6.6 percent), cattle (6.3 percent), and pigs (3.8 percent). The large increase in the size of the goat population is believed to indicate the declining value of pastureland. And although goats provide dietary sustenance by supplying milk and meat, they increase the likelihood of devegetation and deforestation. Furthermore, since animal husbandry and cultivation are poorly integrated, arable lands generally remain unmanured while pasturelands are being overgrazed by cattle, sheep, and goats. These and related problems associated with rangelands will be discussed in Section 4.2 below. Rangeland grasses and other forage will be surveyed in Section 3.3.

¹⁵Sources: Abercrombie. 1974.
FAO. 1980.
Nelson et al. 1975.
Pike and Rimmington. 1965.
Schmidt. 1969, 1972.
Spurling and Spurling. 1972.

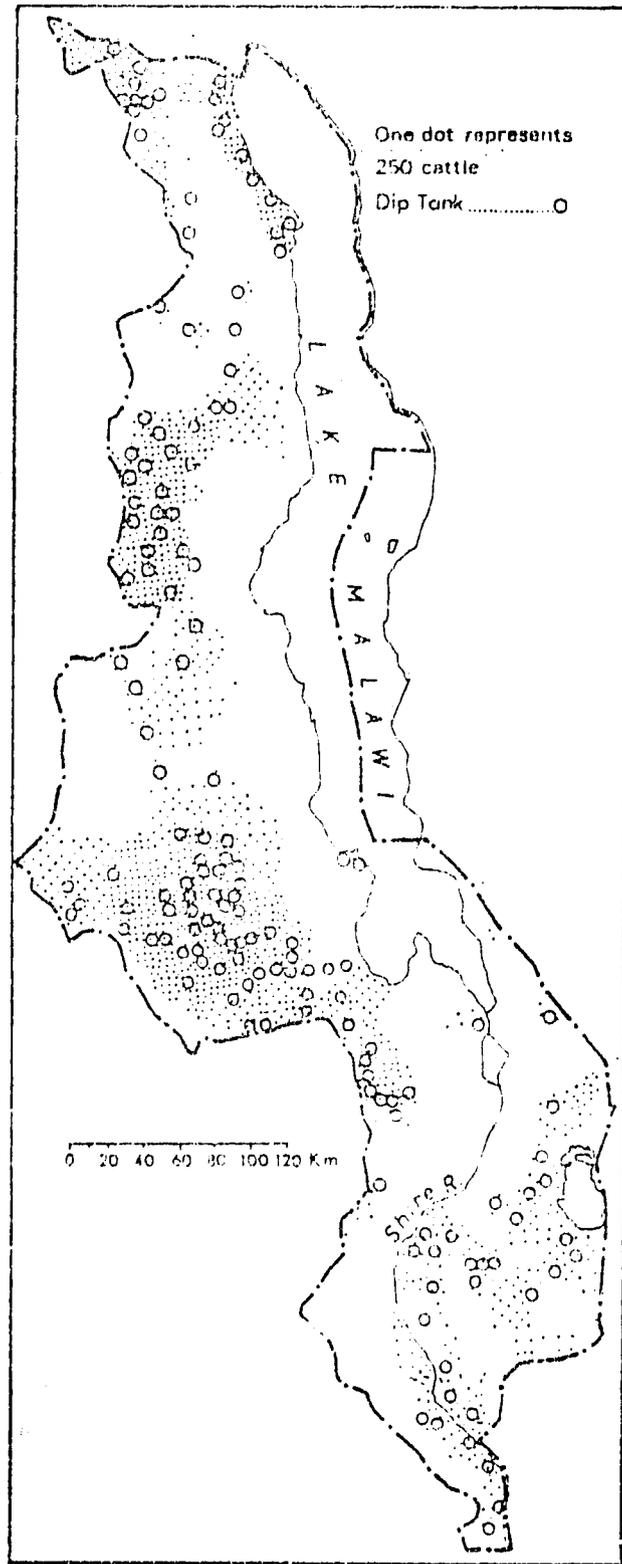


Figure 17. Cattle Distribution, 1969

Source: Schmidt. 1972.

Table 11. Livestock Population

Livestock	Population (1,000 head)								Average annual increase (%)
	1948 ^a	1953 ^a	1958 ^a	1963 ^b	1966 ^b	1969-71 ^c	1977 ^c	1979 ^c	
Cattle	267	273	343	396	450	488	707	790	6.3
Pigs	80	94	82	d	d	159	200	174	3.8
Sheep	46	53	62	d	d	98	135	140	6.6
Goats	233	294	413	d	d	618	828	860	8.7

^a Pike and Rimmington. 1965.

^b Schmidt. 1972.

^c FAO. 1980.

^d Not available.

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3.0 Environmental Resources and Policy

3.1 Geology, Soils, and Mineral and Energy Resources

3.1.1 Geologic Formations ^{13/}

The region defining Malawi is situated at the southernmost end of the African rift system (Fig. 18). These rifts were created by faulting and uplifting over an extended period of perhaps 140 million years. The resulting formations have included a very deep rift lake (Lake Malawi), a series of uplifted and denuded plateaux, and a bordering rim of mountains which separate Malawi from the neighboring areas (v. Section 2. 1.2).

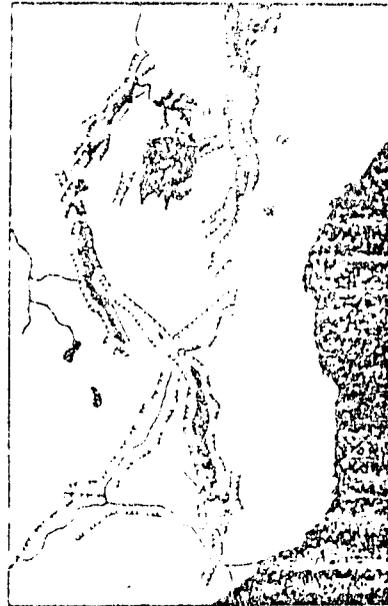


Figure 18. African Rift System

Source: Shroder. 1972b.

¹³Sources: Lister. 1972.
Pike. 1968a.
Pike and Rimaington. 1965.
Pritchard. 1979.
Shroder. 1972a, 1972b.

Geologically, these formations may be considered as three systems: (1) the Precambrian, or Basement Complex; (2) the Karroo Ssystem; and (3) the post-Karroo system. As Figures 19 and 20 illustrate clearly, most of the country is underlain by schists, gneisses, and other metamorphic and igneous rocks of Precambrian to early Paleozoic origin.

The region defined by this ancient Basement Complex is frequently referred to as the "Malawi Province." Included within this zone are isolated pockets of late Paleozoic, Permian-Triassic, Jurassic, Cretaceous, and Tertiary formations. Rocks belonging to these Karroo and post-Karroo systems include igneous intrusions, and alluvial and other sedimentary formations. Karroo beds occur chiefly along the Lake Malawi littoral and in the Shire River Valley (Fig. 21).

Figure 22 shows Malawi's principal erosion surfaces. The earliest of these, the Gondwana, is of Jurassic origin. The most prevalent is known as the "African" erosion surface; it covers most of the area underlain by Basement Complex rock formations. Currently, erosive forces are operating along the shores of Lakes Malawi and Chilwa, and within the Shire River Valley.

3.1.2 Soils ^{14/}

Most of Malawi's surface, as the above section has indicated, covers ancient Basement Complex rocks that are principally granites, limestones, schists, gneisses, and quartzites. Accordingly, most of the country's soils have been derived from this basement-especially from granites and limestones.

Anthony Young (1972), an acknowledged authority on Malawi's soils has assigned local soils to four main groups. Following the C.C.T.A. Soils Map of Africa, he identifies: (1) latosols, (2) calcimorphic soils, (3) hydromorphic soils, and

¹⁴Sources: FAO-UNESCO. 1977.
NAS. 1972.
Nelson et al. 1975.
Pike and Rimington. 1965.
Young. 1972, 1976.

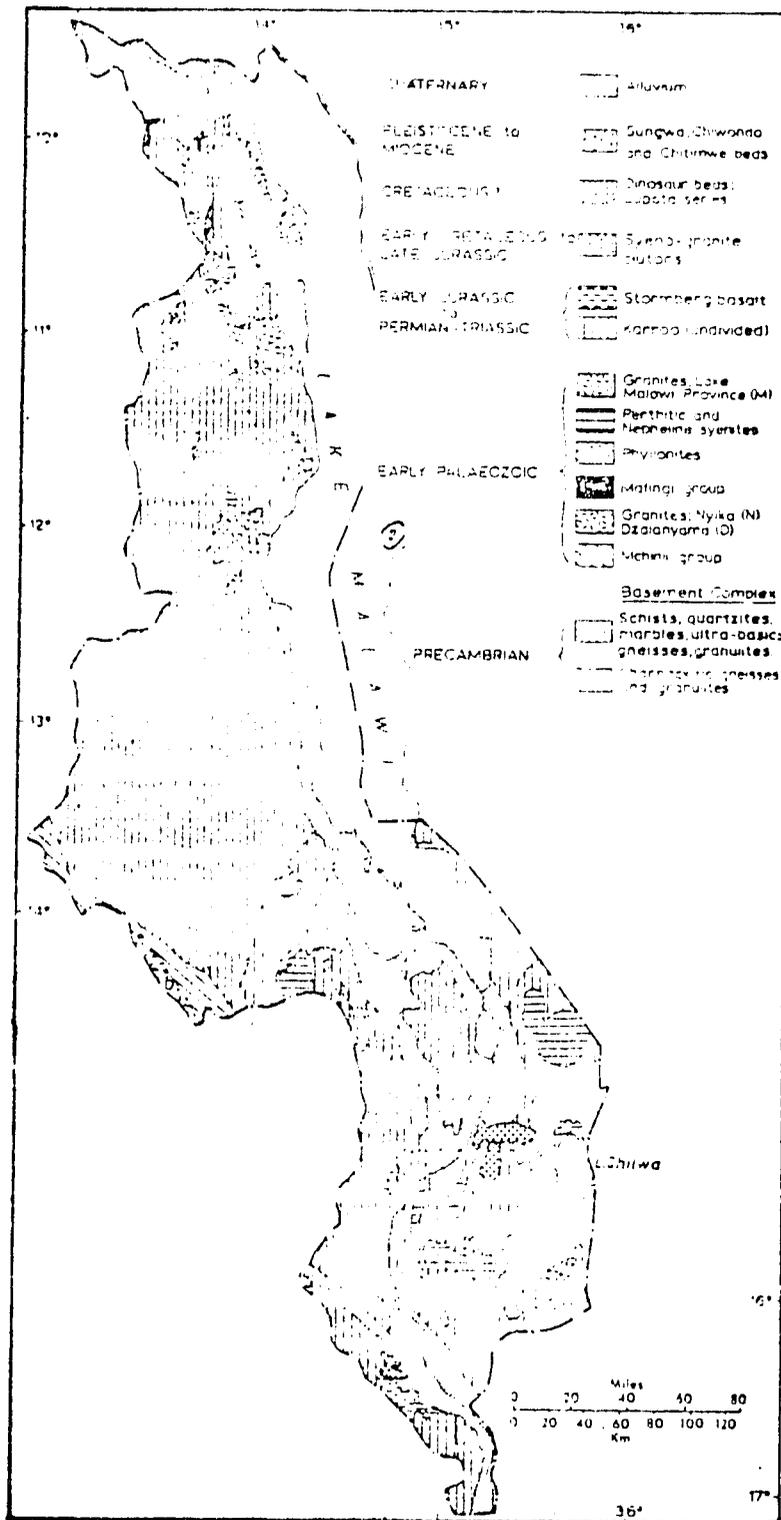


Figure 19. Geology: Origin and Composition

Source: Shroder, 1972a.

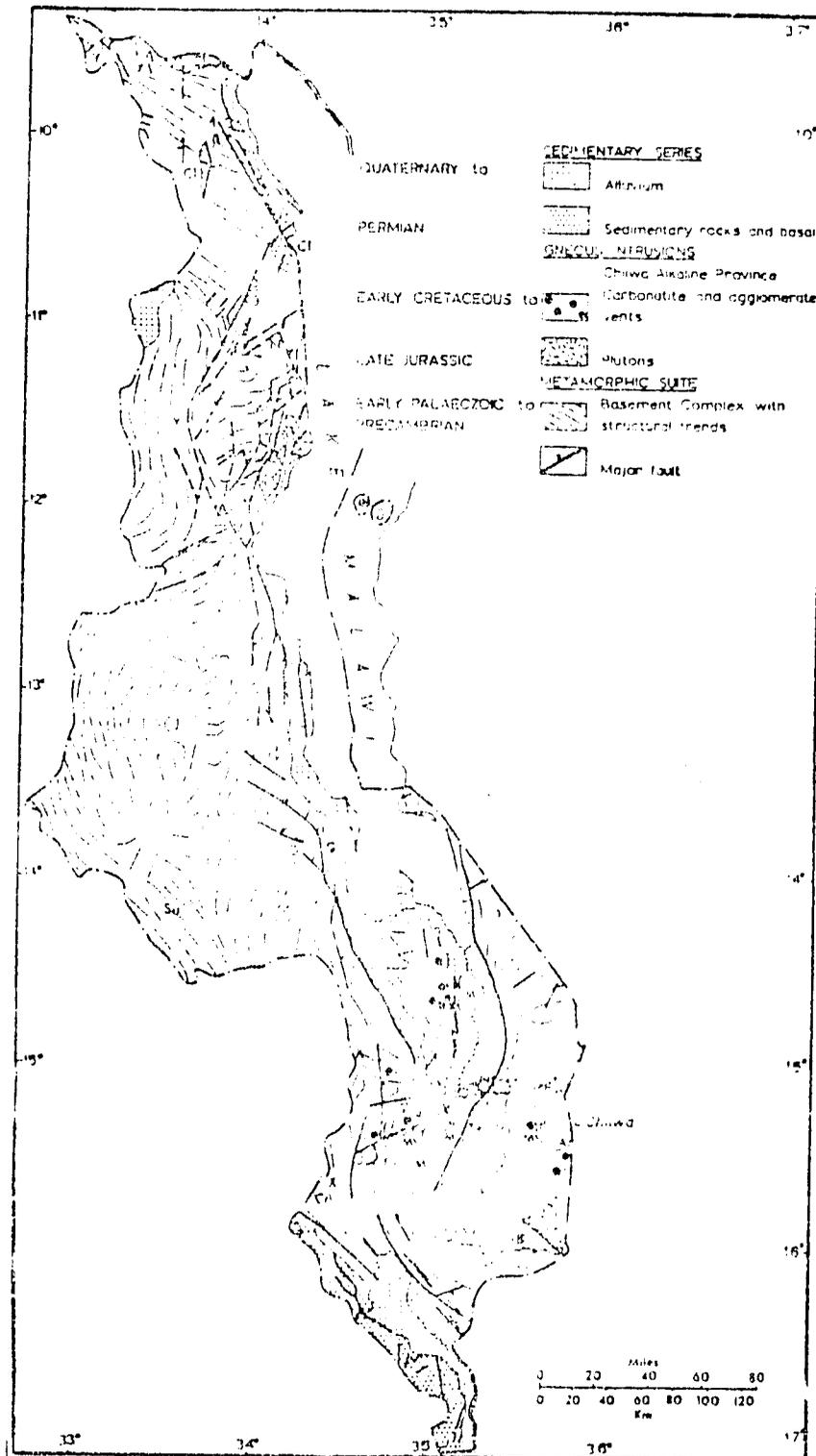
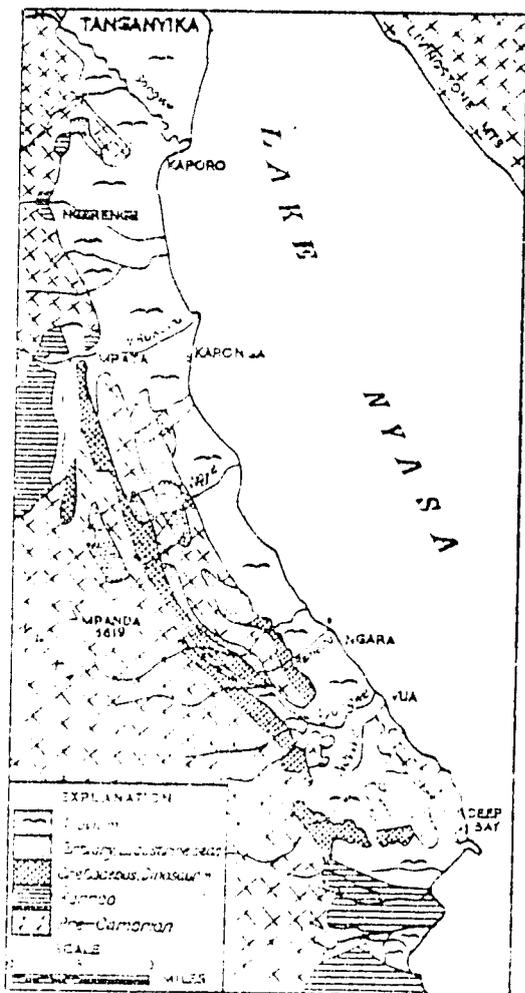
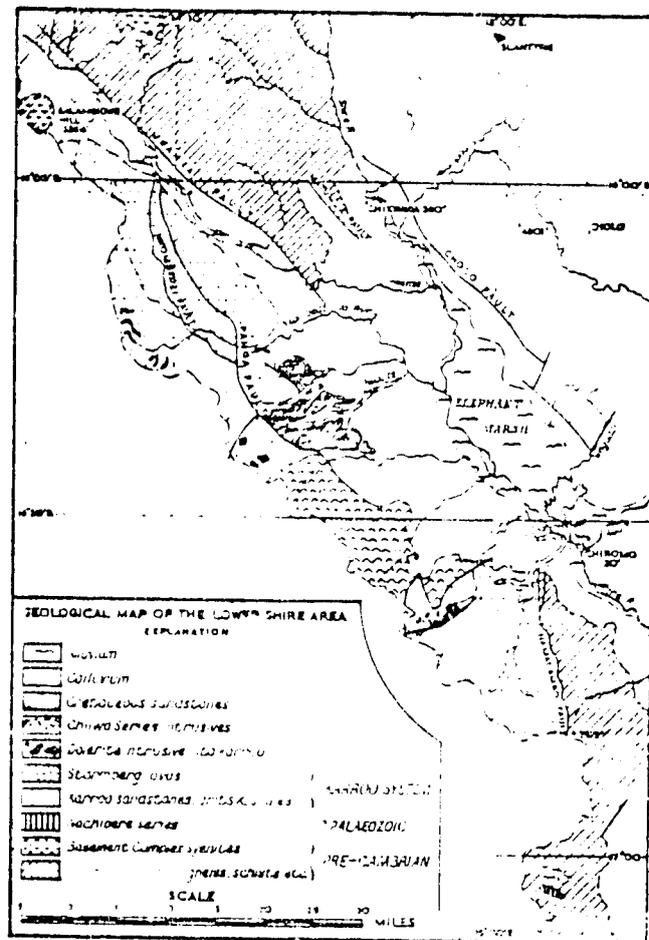


Figure 20. Geology: Origin and Structure

Source: Shroder. 1972b.



a. Northern Lake Malawi Shore



b. Lower Shire Valley

Figure 21. Geology: Northern Lake Malawi Shore and Lower Shire Valley

Source: Pike and Rimmington. 1965.

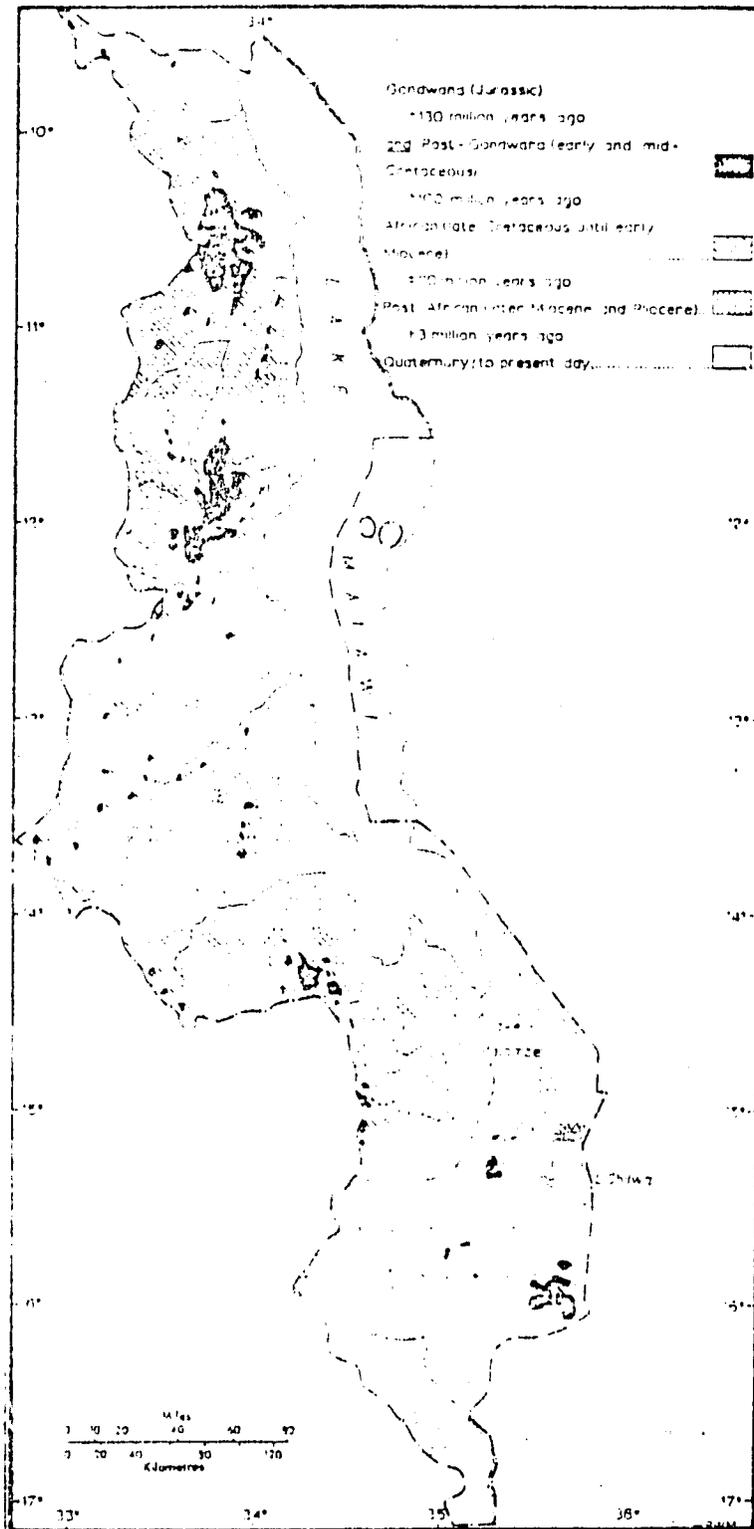


Figure 22. Erosion Surfaces

Source: Lister. 1972.

(4) skeletal soils. Figure 23 shows Malawi's soil groups and soil associations. Table 12 relates soils shown on Figure 23 to the four groupings listed above.

As Figure 23 illustrates, most regions of Malawi contain several soil types. The distribution of soils depends upon the nature of the underlying bedrock, elevation, and climate. The most fertile soils are alluvial deposits near bodies of water. Their presence has occasioned intensive cultivation and corresponding dense population. Perhaps the weakest and least productive soils are those found in elevated savannahs and along steep mountain slopes. The alkaline clays that are common in several areas (Fig. 23) are also relatively infertile and unsuited for most crops, except perhaps cotton.

3.1.3 Mineral Resources ^{15/}

Knowledgeable observers agree that Malawi possesses few exploitable mineral resources. In 1974, the last year for which data exist, mining contributed less than one percent to the nation's GDP (Jolly 1976). Since then, figures indicate that the mining and quarrying sector has weakened further. In 1976 fewer than 1,100 persons were employed by that sector. By the following year only half as many employees were recorded, and in 1979 the Malawi government identified just 600 persons working in mines and quarries (Europa Publications 1980; USAID 1981b). Until 1975, by contrast, more than 130,000 Malawians worked in mines outside the country, predominantly in South Africa and Southern Rhodesia. The current low level of employment in domestic mining reflects the low importance of mining and quarrying in Malawi's economy.

Although as Figure 24 shows, Malawi contains deposits of more than a dozen minerals, most are of low value and are consumed by domestic

¹⁵Sources: Jolly. 1976.
Morse. 1981.
Nelson et al. 1975.
Pelletier. 1964.
Pike and Rimmington. 1965.
Shroder. 1972b.

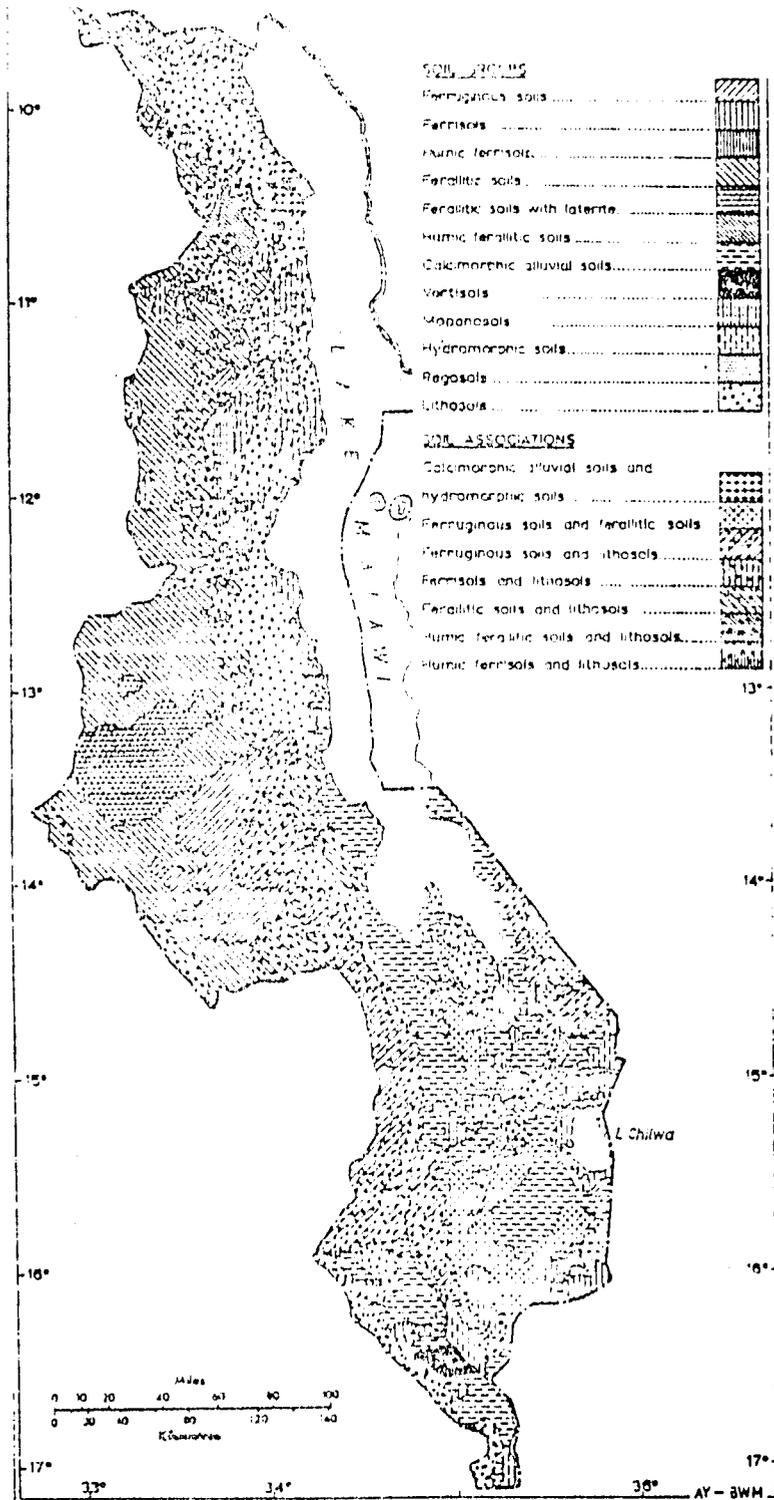


Figure 23. Soils

Source: Young. 1972.

Table 12. Soil Characteristics

Soil group: soil type	Structure	Color	Avg. pH
Latosols:			
Ferruginous soils	Clays and sandy clays	Dark red to reddish brown	5.0 - 6.0
Ferrisols	Clays	Red	4.0 - 5.0
Humic ferrisols	Clays with humic topsoil	Red	4.0 - 5.0
Ferralitic soils	Sandy topsoil with textured subsoil	Yellowish red to red	4.0 - 4.5
Ferralitic soils with laterite	Same as ferralitic with horizon of hard iron	Yellowish red to red	4.0 - 4.5
Humic ferralitic soils	Same as ferralitic with humic subsoil	Reddish to yellowish	4.0 - 5.0
Calcimorphic soils:			
Calcimorphic alluvial soils	Silty	Gray to dark brown	6.0 - 8.0
Vertisols	Blocky	Dark brown to black	7.0 - 8.5
Mopanosols	Poor structure	Dark grayish brown	Alkaline
Hydromorphic soils:			
	Blocky clays	Black-gray	n.a.
Skeletal soils:			
Lithosols	Stony and shallow	Variable	n.a.
Regosols	Sandy	Variable	n.a.

Source: Young. 1972.

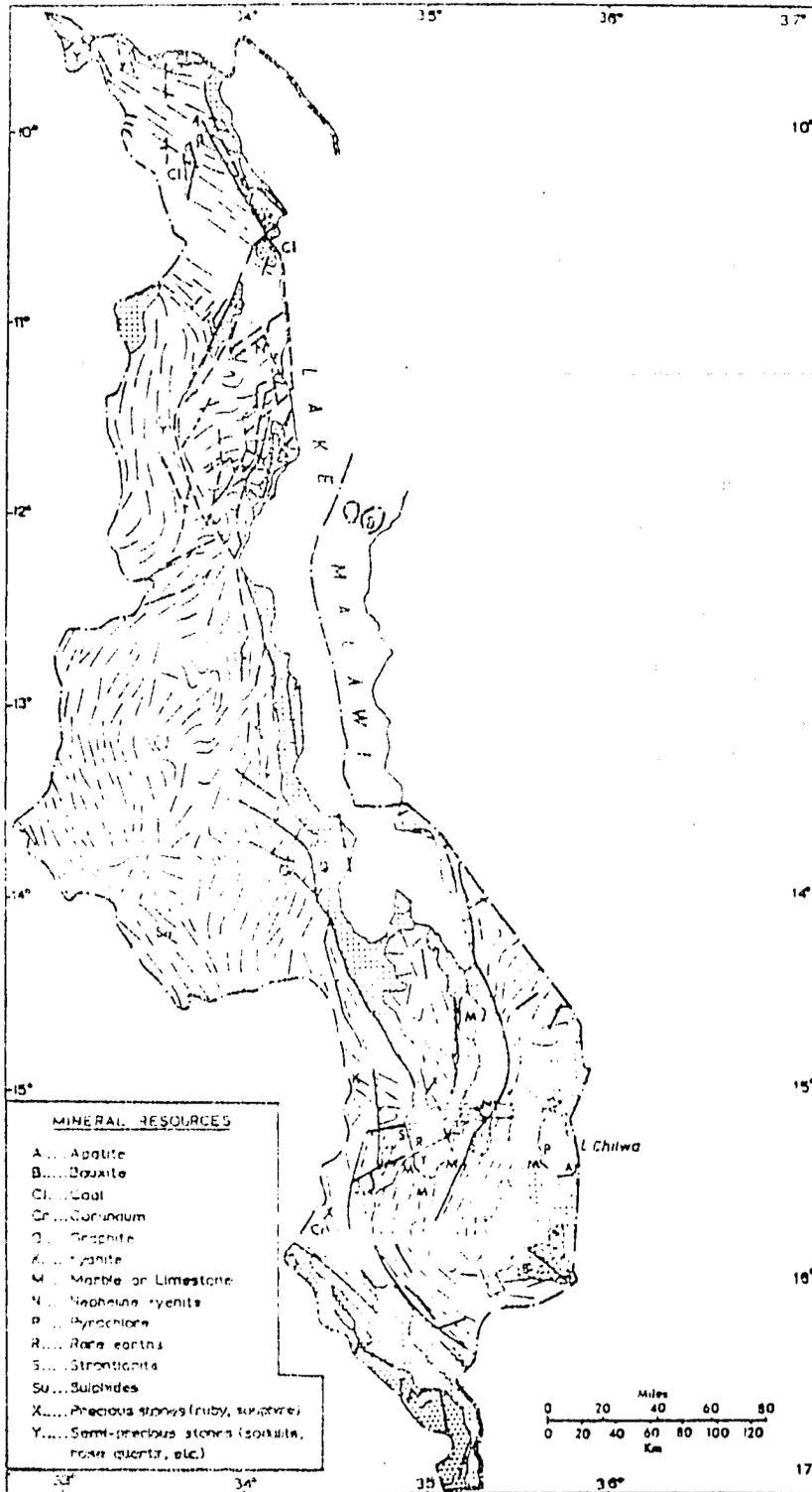


Figure 24. Minerals

Note: Symbols as in Figure 20

Source: Adapted from Shroder. (1972b).

industries. The principal mineral products are low grade marble and limestone used for manufacturing hydraulic cement; in 1979 an estimated 108,000 tons of cement and 115,000 tons of limestone were produced (Morse 1981). Agate, a semiprecious stone is the only other mineral of note; in 1979 six tons were mined.

The other minerals, all of which occur in small deposits scattered throughout the country (Fig. 24), are not presently exploited. Of these, Malawi's carbonatite resources are believed to contain the country's most potentially valuable minerals--apatite, barite, rare earths, and strontianite. Bauxite, pyrite, and pyrrhotite also occur and may be of some eventual worth. Presently, these minerals are often too remote and too difficult to extract for commercial mining. Exploration nevertheless continues, and with more advanced technology and increased world demand, exploitation may become feasible.

3.1.4 Energy Resources ^{16/}

Malawi is somewhat better endowed with energy resources than with minerals. At present coal, hydroelectricity, and solar energy are the most viable sources of exploitable energy; geothermal power may also provide electricity, but its potential remains to be assessed.

Coal. The presence of coal deposits has been acknowledged since the 1920s, when the Chiromo coalfields in southern Malawi were discovered. The coal there is high in ash content and its quality is generally good, but it remains relatively inaccessible due to geologic faulting. The Sumbu fields, situated some 65 km southwest of Chiromo, are larger and richer. In 1965 it was

¹⁶Sources: French and Larson. 1980.
Jolly. 1976.
Kennedy. 1978.
Morse. 1981.
Nelson et al. 1975.
O'Connor. 1978.
Pelletier. 1964.
Pike and Rimmington. 1965.
Stubbs. 1972d.
USAID. 1979

believed that perhaps 45 million tons of fair quality coal were present there. Two other coalfields lie in northern Malawi, one near Livingstonia, the other near Nkana (or Ngana). Reserves at these locations are believed to be 24 million and 14 million tons, respectively (Rimington and Pike 1965; Morse 1981). The Ngana fields near the Tanzanian border are believed to be the more promising of the two and the government appears ready to develop the potential there.

Although Malawi's prospects for developing its coal resources appear promising, the country continues to import most of its industrial quality coal--the majority of it from Zimbabwe.

Hydroelectricity. With support from the government, hydroelectric power has become Malawi's leading source of industrial energy and domestic electricity. Government expenditures in the power sector have risen nearly fourfold, from 2.56 million kwacha (US\$ 3.18 million) in 1972-73 to 9.28 million kwacha (US\$ 11.54 million) by 1978 (USAID 1979). Even more strikingly, between 1956 and 1974 Malawi's installed hydroelectric capacity increased from eight megawatts (MW) to 71 MW, and production rose from nine million kilowatt-hours to 230 million kilowatt-hours (O'Connor 1978).

Nkula Falls on the Shire River northwest of Blantyre was the site of Malawi's first modern hydroelectric station. Completed in 1967, it generates up to 24 MW, about a third of the country's total installed capacity. Elsewhere on the Shire River, Tedzani Falls was selected as the location of a second generating plant. It was inaugurated in 1973 with a 16 MW capacity that was expected to rise to 24 MW by 1977. Figure 25 shows the location of Malawi's main hydroelectric plants and transmission lines.

As Malawi's industrial sector expands, the government is likely to develop further the country's substantial hydroelectric potential. Suitable sites exist along the Shire and Ruo Rivers in Malawi's Southern Province but development and implementation awaits additional rises in demand for electricity. In 1979 per capita consumption of energy stood at 70 kg of coal equivalent--the eleventh lowest rate in Africa (World Bank 1981).

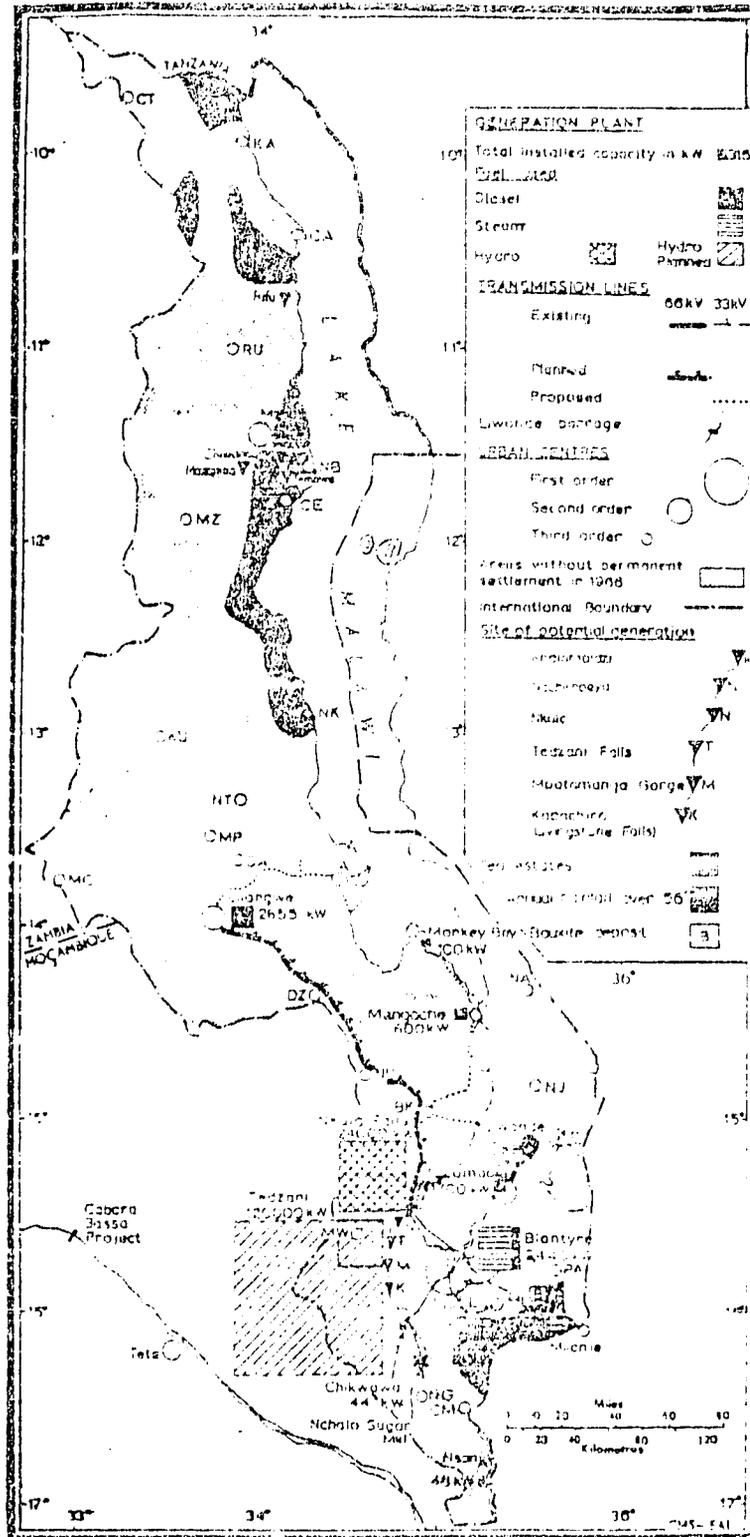


Figure 25. Hydroelectric Supply, 1969.

Source: Stubbs. 1972d.

Solar Energy. Although Malawi has adequate sources of electrical energy supply, the country presently seriously lacks fossil fuels and firewood--the former physically lacking, and the latter having been mostly depleted. Because these substances are required for industrial, domestic, and agricultural uses, Malawi now imports virtually all of its required liquid and solid fuels. Petroleum, which is not present in the country (McGrew 1981), must be imported at high cost. In 1973 Malawi expended US\$ 17 million on oil imports; by the following year refined petroleum imports rose to US\$ 29 million (Jolly 1976). While fuel imports have fallen recently (US\$ 24.6 million in 1977), they still account for nearly ten percent of the nation's total imports (Europa Publications 1980). For that reason, the government has established an Alternative Energy Development and Implementation Unit designed to study and promote the use of nonconventional energy sources (Kennedy 1978).

Initial investigations published in 1976 recommended the targeting of rural development schemes for such alternative energy programs. In this connection, low-cost solar energy units were suggested for implementation in three priority areas: (1) food and agriculture (production, preservation, and storage); (2) rural industrialization and small-scale power systems; and (3) improvements in water supplies and health programs within rural facilities. Table 13 lists possible uses of solar energy in Malawi. Although such programs remain largely unimplemented, they offer prospects for making Malawi less dependent on imported fuels.

3.1.5 Administration, Policy, and Planning ^{17/}

Under Malawi's highly centralized form of government, many aspects of the nation's physical resources are administered publicly. Although, as of 1980, natural resources were represented in a

¹⁷Sources: Europa Publications. 1980.
Johnson and Johnson. 1977.
Jolly. 1976.
Kennedy. 1978.
Kurian. 1978.
Nelson et al. 1975.

Table 13. Prospective Solar Energy Applications

AREA OF SOLAR UTILISATION	APPLICATION	USE
Water Heating	Low-cost solar water heaters	domestic/industrial urban use and rural institutions
Agricultural Processing & Preservation	Solar driers	rural and urban applications (both small and medium scale)
	Solar steam cookers/ovens	small-scale, rural industries and institutions
	Solar cooling	low-cost solar buildings and simple solar cooling devices for rural areas
Rural Water Supplies	Solar pumps	rural water supplies and irrigation (subject to low-cost pumps being developed)
	wind Power	rural water pumping

Source: Kennedy. 1978.

federal ministry, that ministry is an omnibus institution that combines the functions of external affairs, justice, works and supplies, agriculture, and natural resources with the country's presidency. With the devolution of so many responsibilities upon a single person (the President), affairs relating to Malawi's mineral and energy resources remain inadequately represented.

More directly, specific issues relating to exploitation and management of soil, mineral, and energy resources are handled by a number of state agencies, public corporations, financial institutions, and educational and research establishments. Table 14 lists some of these organizations and their functions.

Legislative protection of Malawi's soil, mineral, and energy resources originated during the colonial period. With few exceptions, the statutes currently in force are revisions of pre-independent origin. Mining, quarrying, and petroleum storage are the principal activities regulated by legislation. Appendix III, Table 1 lists current legislation relating to minerals and energy.

3.2 Water Resources

3.2.1 Surface Water ^{18/}

One of Malawi's most outstanding features is perhaps its extensive surface water resources. The largest and dominant body of water is, of course, Lake Malawi--the world's ninth largest lake in area, and fifth largest in volume (c. 30,000 sq km and c. 8,400 cu km, respectively; Van der Leeden 1975). In addition, the landscape is marked by Lake Chilwa, Lake Malombe, and Lake Chiuta, and drained by a network of rivers of which the most important is the Shire River (Fig. 26).

¹⁸Sources: Anon. 1978a.
Balek. 1977.
Dyer. 1976.
Pike. 1968b, 1968c, 1972.
Van der Leeden. 1975.

Table 14. Organizations Relating to Soil, Mineral, and Energy Resources

Name of organization	Sector	Function
Ministry of External Affairs, Justice, Works and Supplies, Agriculture and Natural Resources	Public (federal)	Overall responsibility for all natural resources.
Ministry of Trade, Industry and Tourism	Public	Control of industrial affairs.
Economic Planning Division	Public (federal)	Establish priorities for development.
Regional Ministries: Northern, Central, and Southern Regions	Public (regional)	Administration of regional affairs.
Investment and Development Bank of Malawi Ltd.	Private	Finance investment.
Minister of Commerce and Industry of Malawi	Private	Promotion of commerce and industry.
Malawi Development Corporation (MDC)	Public	Provide loans and management advice.
Building Construction, Civil Engineering and Allied Workers' Union	Private	Represent miners and other workers.
National Research Council	Public	Promote and oversee scientific research.
University of Malawi Polytechnic College	Public	Instruction and research in science technology.
Electricity Supply Commission of Malawi (ESCOM)	Public	Administer electricity generation and distribution.
Malawi Geological Survey	Public	Assess mineral reserves.
Society of Malawi	Private	Promote and publish scientific and cultural research.

Sources: Europa Publications. 1980.
Kennedy. 1980.
Nelson et al. 1975.
USAID. 1979, 1981b.

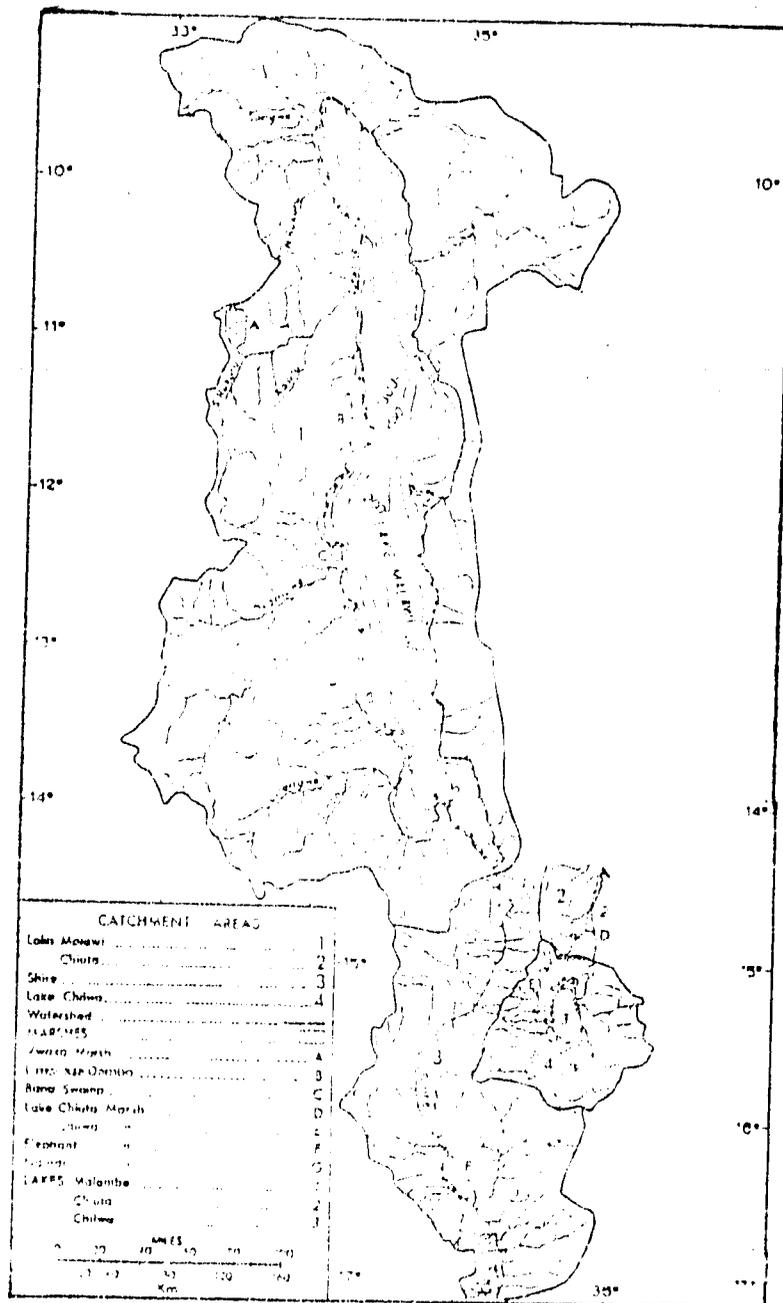


Figure 26. Drainage System

Source: Adapted from Pike (1972).

Lake Malawi's catchment area, more than two-thirds of which lies within Malawi, is nearly 100,000 sq km in area. It includes all of Malawi's Northern Region, nearly all of the Central Region, and a small portion of the Southern Region (cf. Figs. 1 and 26). Table 15 summarizes the main characteristics of Lake Malawi and its catchment area; Figure 27 shows the long-term variation in the level of Lake Malawi, and Figure 28 maps annual runoff for the Lake Malawi Basin.

Malawi's three other lakes--Chilwa, Malombe, Chiuta--are not as significant as Lake Malawi in determining drainage patterns and affecting local climate. Nor are these lakes as deep, for unlike Lake Malawi, they are not rift lakes. Lake Chilwa, which is saline, is noted as a large repository of commercially exploitable fish (see Section 3.4.5 below).

The Shire River which arises from Lake Malombe, and indirectly from Lake Malawi, extends some 500 km southward. In its path, it bisects Malawi's Southern Region and just beyond the border it joins the Zambezi in Mozambique. It may be divided into three sections: a relatively steep (5.29 m per km) 130 km upper portion from its source to Matope; a central section some 80 km long, falling 384 m; and a lower, virtually ungraded, portion stretching 280 km through an alluvial valley to the Zambezi. Table 16 presents discharge characteristics of the Shire River.

3.2.2 Groundwater ^{19/}

While the preceding section indicates that Malawi is well endowed with surface water resources, the country nevertheless experiences chronic shortages in available water. This situation is a result of climatic factors--principally sharp variability in annual rainfall, variations in isohyetal patterns, and the extended length of the dry season. Decades of forest denudation have been causing increasing runoff and further lowering supplies of water.

¹⁹Sources: Davis. 1969.
Pike and Rimmington. 1965.
UNDESA. 1973.

Table 15. Lake Malawi Characteristics

Feature	Characteristic		
	Fike (1972)	Van der Leeden (1975)	Balek (1977)
Size			
Lake area (sq km)	29,604	30,790	30,800
Catchment, incl. lake (sq km)	96,918	95,790	
Maximum length (km)		603	
Maximum width (km)		87	
Length of shoreline (km)		1,500	
Elevation (m)		472	
Maximum depth (m)		758	
Mean depth (m)		426	
Annual water level fluctuation (m)		6	
Volume (cu km)		8,400	
Climatic features			
Mean annual rainfall, land (mm)	1,179		
Mean annual rainfall, lake (mm)	1,359		
Mean air temperature (°C)	25.7		
Mean evaporation (mm)	1,945		2,078
Flow characteristics			
Inflow (mm)			472
Outflow (mm)	343		666
Runoff (mm)	259		
Runoff (percent rain)	22		
Mean free water (mm)	+295		
Major inflowing rivers		Ruhuhu, Songwe	
Major outflowing rivers		Shire	
Physical characteristics			
Conductivity K ₂₀ (micromhos)	220		
Dissolved solids (mg/l)	--		
pH	7.7-8.6		

Sources: Balek. 1977.
 Fike. 1972.
 Van der Leeden. 1975.

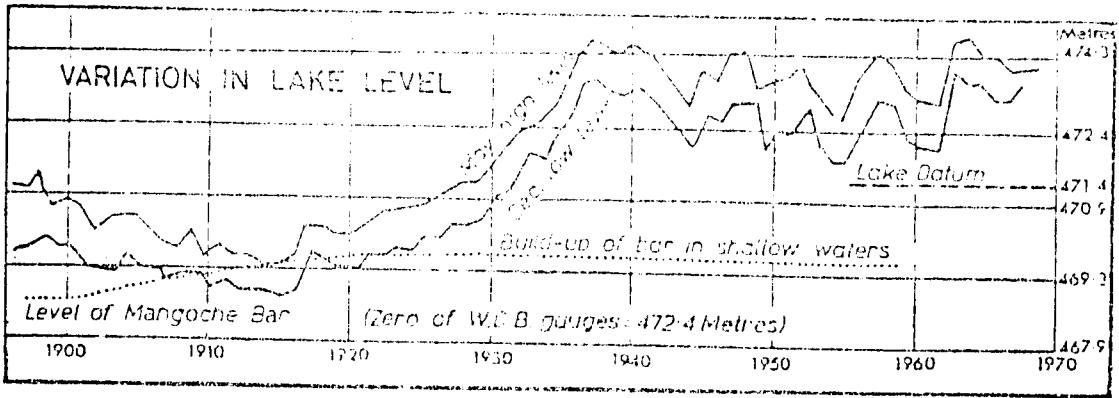


Figure 27. Variation in Level of Lake Malawi, 1900 - 1970

Source: Adapted from Pike (1972).

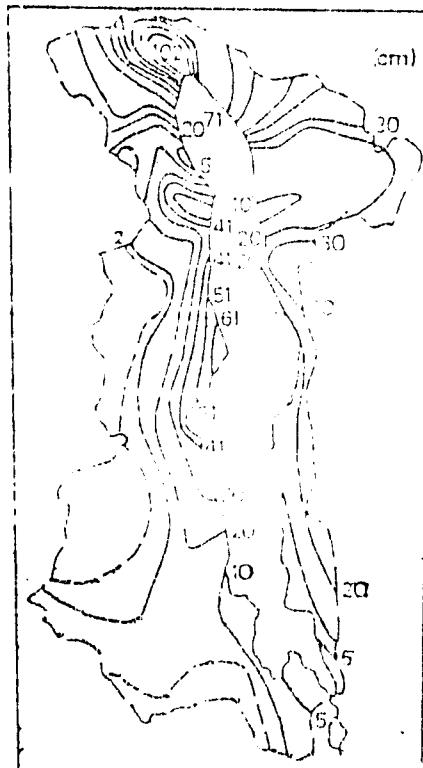


Figure 28. Average Annual Runoff for Lake Malawi Basin

Source: Pike. 1972.

Table 16. Shire River Discharge Characteristics

Year	Mean Annual Flow (cusecs)				
	Gaging Station				
	Liwonde	Matope	Chikwawa	Chromo	Port Herald
1948-49	10,557	10,265	N.A.	10,798	9,459
1949-50	10,392	10,804	N.A.	11,480	9,677
1950-51	10,474	10,754	N.A.	11,089	9,534
1951-52	12,090	12,808	14,243	14,743	11,022
1952-53	10,468	10,754	11,165	11,545	10,023
1953-54	7,855	8,179	8,215	7,729	7,349
1954-55	7,179	7,828	8,309	9,108	8,529
1955-56	8,106	8,616	9,493	9,633	8,475
1956-57 *	2,667	2,810	3,424	3,091	4,932
1957-58	14,070	14,317	14,674	15,168	10,875
1958-59	11,422	11,497	11,644	12,300	10,106
1959-60	9,942	10,064	10,186	9,983	9,819
1960-61	9,342	9,613	10,388	10,374	10,191

*Flow from Lake Malawi ceased owing to river obstruction

Source: Van der Leeden. 1975.

Already by 1931 the government recognized the potential seriousness of the water shortage and embarked on a program of groundwater exploitation. By the mid-1960s, 900 wells had been sunk by the Water Development Department. These wells, whose average depth is 35 m generally yield three cubic meters per hour. The water thus obtained is consumed by residents and by the country's growing livestock herd. Nearly all of Malawi's agriculture is rainfed, and groundwater is thus not employed for irrigation.

The government has been concentrating its groundwater development schemes in densely inhabited regions, particularly in areas where available surface water has become contaminated by livestock. As of 1973 Lilongwe, Bwanje, Palombe, and Balaka were considered priority locales for groundwater exploitation. Figure 29 identifies the location of Malawi's aquifers, and Table 17 outlines the characteristics of wells sunk in various subsurface strata.

3.2.3 Irrigation ^{20/}

Until 1965 Malawi's government assigned little priority to irrigation projects. That year just 2,000 ha of agricultural land was irrigated. By 1968 an additional 1,000 ha were added, but in all the total accounted for less than 0.2 percent of Malawi's arable land. Since then, with added emphasis on increasing crop yields, the government has brought an additional 7,000 ha of land under irrigation. The 1978 total of 10,000 ha still represent a minuscule portion (0.44 percent) of arable land (FAO 1980).

In the past decade the government has attempted to encourage small-scale farm irrigation through its extension program and as part of its Integrated Rural Development Projects. To date, however, only rice crops grown along the shore of Lake

²⁰Sources: Anon. 1978.
Davis. 1969.
FAO. 1980.
Nelson et al. 1975.
Pike and Rimmington. 1965.
UNDESA. 1973.
USAID. 1979, 1981b.

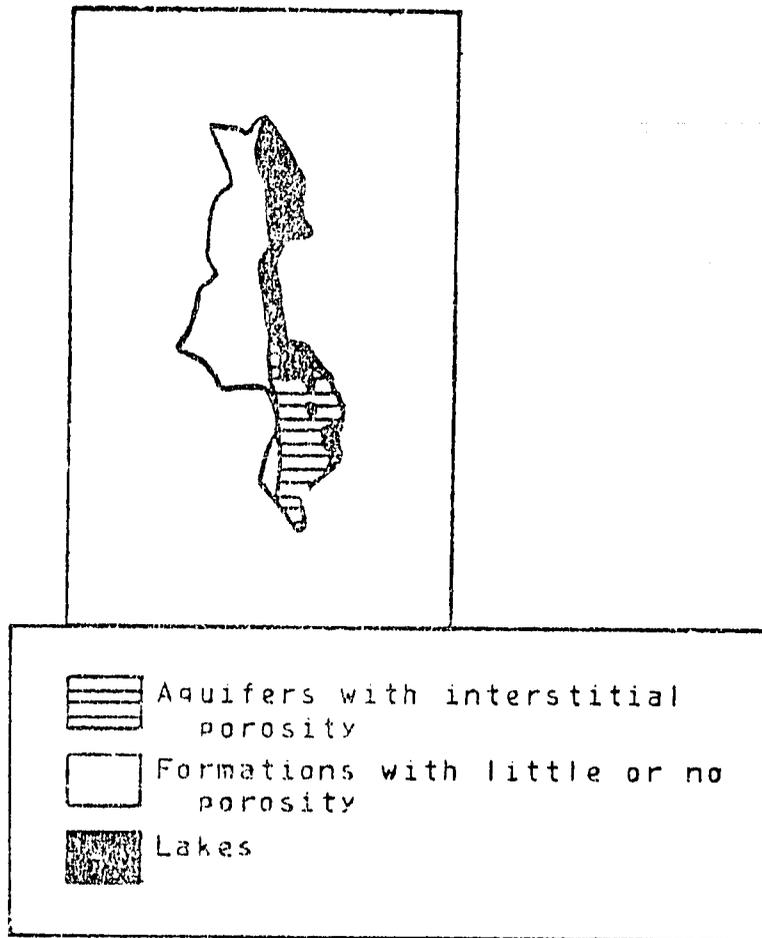


Figure 29. Aquifers

Source: Adapted from UNDESA (1973).

Table 17. Artesian Well Characteristics

Formation	Depth of wells (m)	Yield (m ³ /hr)
Biotite gneisses	60	5
Gneisses with dolerites	30	0.5
Graphitic gneisses	45	4
Gneisses of the basal complex	25 to 40	1.2 to 3.6 (average 1.8)
Weathered zone of gneisses, sand and clay	25 to 45	1.2 to 5 (average 3.5)
Weathered zone of gneisses, mainly clay	25 to 40	Average 2
Dambos (temporarily flooded areas, bottoms of ponds)	30 to 50	1 to 4
Thick alluvial deposits	30 to 50	1 to 5
Thick sands	30 to 60	1.2 to 3.6
Thick gravels	35	5
Argillaceous sediments	35 to 60	0.5 to 6 (average 2.5)

Source: UNDESA. 1973.

Malawi, in the Lower Shire Valley, and south of Lake Chilwa, and occasional tea crops have been irrigated. The government does not anticipate that irrigation will enhance Malawi's agricultural output significantly in the immediate future (USAID 1979). The country's plentiful surface water resources may someday be tapped and made to irrigate cropland. Table 18, based on a 1969 study lists the irrigation potential of Malawi's important rivers and streams.

3.3 Vegetation

3.3.1 General Features 21/

For a country its size, Malawi exhibits a considerably varied vegetation. While elevation is perhaps the single most important determinant of vegetative zonation, local climatic, geologic, and soil conditions, it also affects vegetation directly. According to Holdridge's general system for classifying natural life zones, Malawi's terrain includes very dry, dry, moist, and wet forests--an unusually diverse range for such a small territory. Figure 30 shows Malawi's natural life zones, as defined by Holdridge.

More specifically, Malawi can be subdivided into several vegetative zones. Pike and Rimmington (1965), in their standard geography of the country, specify four major regions. These are (1) mixed savannah woodlands; (2) Brachystegia-Julbernardia woodlands; (3) Combretum-Acacia-Piliostigma woodlands; and (4) montane forests and grasslands.

Subsequent observers have determined that these categories are too broad, encompassing too many

-
- ¹⁵Sources: Agnew. 1972a.
Anon. (W.E.L.). 1971.
Chapman and White. 1970.
Director of Forestry and Game. 1972.
Hardcastle. 1977.
Jackson. 1968, 1972.
Nelson et al. 1975.
Pike and Rimmington. 1965.
Werger and Coetzee. 1978.
White. 1978.

Table 18. Discharge and Irrigation Potential of Major Rivers, 1969

River	Estimated maximum flow m ³ /s	Estimated minimum flow m ³ /s	Potential reservoir site
Songwe (Internat. boundary)	Very high	4.25	No
Lufira	113.27	0.057 - 0.141	No
N. Rukuru	619.60	0.085 - 1.13	Yes
Waye and Chiwondo Lagoon	Moderate	Nil	Yes
Nyungwe	Moderate	Nil	Yes
Wovwe	56.63	0.85 - 1.13	No
Chananga and Hara	56.63 - 84.95	0.142	No
Runvina	50.97	0.85	No
Kasitu and Henga Valley	Flood control with irrigation and power possible		
Upper S. Rukuru Valley	Irrigation from reservoirs possible		
Limpasa	254.85	0.28 - 0.42	No
Luweya	665.44	0.57 - 0.85	Yes
Dwembazi	Moderate	1.416 - 1.7	No
Dwanga	High	0.85 - 1.13	Yes
Bua	184.06	0.141	Yes
Kaombe	High	Very low	Yes
Linthipe/Lilonawe	962.77	Very low	Possible
Lifisi	56.63 - 113.26	0.42	No
Shire (Internat. boundary in South)	Very high	141.58	No
Rou and tributaries (Internat. boundary)	Irrigation of tea areas with river water supported by storage possible		

Source: Van der Leeden. 1975.

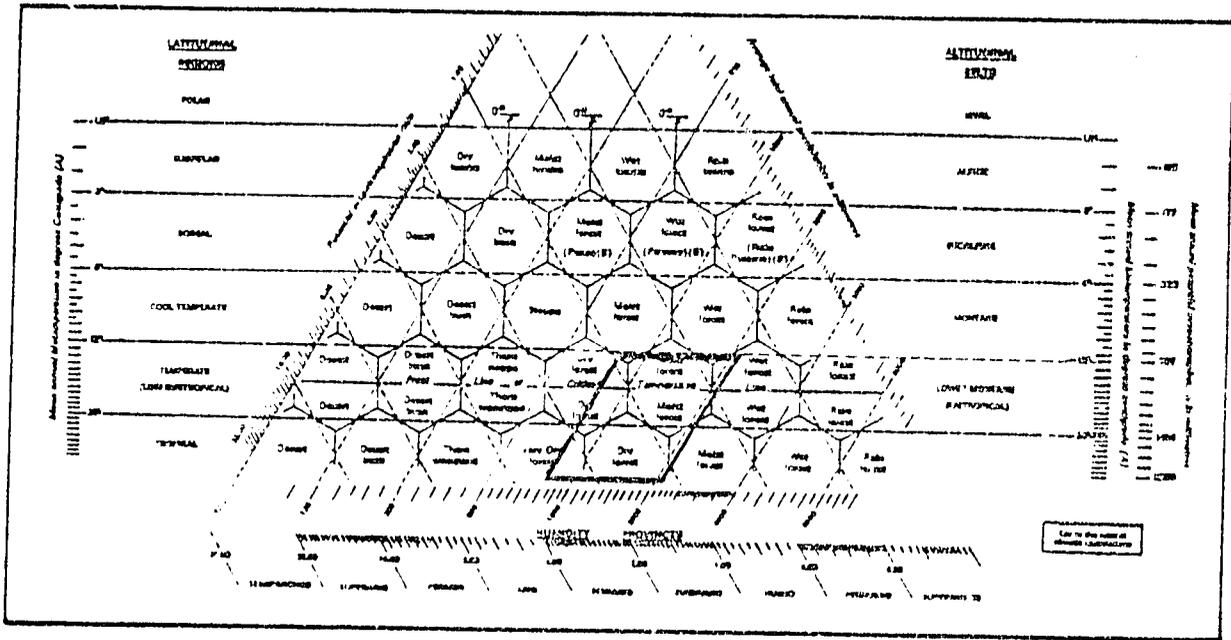


Figure 30. Holdridge's Scheme for Natural Life Zones

Source: Rosayro. 1974.

varying vegetative associations. Accordingly, a more detailed system developed by George Jackson, an ecologist employed by the colonial government of Nayasaland, has been adopted by most researchers. In this scheme, which is illustrated in Figure 31, there are nine major zones and two subzones.

In the order in which they appear on Jackson's map, these zones are: (1) montane forests, scrubs, and grasslands; (1a) moist semideciduous forest; (2) Brachystegia woodlands; (2a) Brachystegia-evergreens closed woodlands; (3) Combretum-Acacia-Piliostigma broad-leaved deciduous woodlands; (4) woodlands scrubs and thickets of the rift escarpment and its foothills; (5) woodlands, thickets, scrub, and parklands of low altitude; (6) mopane woodlands; (7) parklands on fertile alluvia; (8) Terminalia woodlands; and (9) swamp and swamp grasslands.

3.3.2 Natural Forests ^{22/}

According to figures published in the FAO Production Yearbook (FAO 1980), Malawi's forested area covers 23,140 sq km, an amount that has remained constant since 1961. The constancy of these reported figures is not entirely credible, but insofar as the data are reliable, it would appear that a quarter of Malawi's terrain consists of forests and woodlands. Of these lands, the government's Department of Forestry and Game reports that 70 percent (15,993 sq km) are "protected" forests--half of those (8,000 sq km) designated as "state forest reserves." Table 19 summarizes information on the stated area of Malawi's forests.

Many of Malawi's forested areas, as Figure 31 and the explanatory text indicate, occur in association with grasslands, thickets, and scrubs. It is therefore difficult to discuss forested

²²Sources: Anon. (W.E.L.). 1971.
Chapman and White. 1970.
Director of Forestry and Game. 1972.
Hardcastle. 1977.
Jackson. 1968, 1972.
Nelson et al. 1975.
Pike and Rimmington. 1965.

Table 19. Forested Area

Land type	Area (sq km)	Percent of total land area	Percent of forested area
Total area	118,480 ^a	--	--
Total land area	94,080 ^a 95,300 ^b	100.0	--
Forests and woodlands	23,140 ^a 21,900 ^b	24.6 ^a 23.0 ^b	100.0 ^c
Protected forests	15,993 ^b	16.8 ^c	73.0 ^c
State forest reserves	8,000 ^b	8.4 ^c	36.5 ^c
Productive forests	402 ^b	0.4 ^c	1.8 ^c
Plantations	340 ^b	0.4 ^c	1.6 ^c
Other protected forests (game reserves, local authority forests, village forests, and private forests)	7,993 ^b	8.4 ^c	36.5 ^c
Unprotected forests	5,907 ^b	6.2 ^c	27.0

Note: Indentations indicate subgroupings.

^a FAO. 1980.

^b Director of Forestry and Game. 1972.

^c Figures calculated from area according to Director of Forestry and Game (1972).

areas separately, and for this reason, the figures in Table 19 must be interpreted with caution. In general, all of the regions identified in Figure 31 support some tree growth, even if trees remain secondary to the predominant vegetation.

In the highlands, particularly above 1,500 m, grasslands are interspersed with Mlanje cedar (Widdringtonia whytei), African juniper (Juniperus procera), and other evergreens. Figures 32a, 32b, and 32c illustrate typical profiles of three Malawian mountain forests. The first diagram is of an Aningeria-Entandophragma Afromontane rainforest; the second represents an undifferentiated montane forest; and the third shows a Mlanje cedar forest.

At lower elevations Brachystegia woodlands are the most prevalent. They are characterized by a number of species of Brachystegia and by Jubernalia globiflora. Elsewhere common trees are Acacia spp., the broad-trunked Baobab (Andansonia digitata), mahogany (Entandophragma spp.), mopane (Colophospermum mopane), palms, bamboos, and a host of swamp species. Table 20 lists the predominant forest species, as described by Jackson (1972); the numbers correspond to vegetative zones appearing in Figure 31. (The IUCN Plant Red Data Book, 1978b, lists no endangered plant species in Malawi.)

3.3.3 Grasslands and Range ²³/

According to FAO (1980), and as shown previously in Table 8, there are 18,400 sq km of permanent pastureland in Malawi. This total, apparently unchanged since 1961, is equal to 80 percent of the reported forested land. But as has been indicated in Section 3.3.2 above, it is not always possible to distinguish grasslands from woodlands because the two usually occur in conjunction. Vegetative cover of this type, generally termed savannah woodland (or miombo), is Malawi's most

²³Sources: Howard-Williams. 1970.
Jackson. 1969a, b, c; 1972.
Nelson et al. 1975.
Pike and Rimmington. 1965.
Rattray. 1968.
White. 1978.



31. Profile diagram of *Anigeria, Entandrophragma* Afrotropical rain forest, Mugesse Forest, Misuku Hills (From Chapman & White 1970). ad: *Adacocalyx derylloides*, AN: *Anigeria ado*, *friederici*, cb: *Craibia brevicaulata*, cl: *Coffea ligustriformis*, COL: *Cola greenwayi*, DIO: *Diospyros abyssinica*, DRY: *Drypetes gerrardii*, ENT: *Entandrophragma excelsum*, ep: *Erythrococca polyandra*, gm: *Garcinia mlansiensis*, gv: *Garcinia volkensii*, ix: *Ixora* sp., p: *Pavetta* sp., ps: *Psychotria* sp., r: *Rumicaceae*, so: *Sclerochiton obtusiseptus*, STR: *Strombosia schefleri*, xm: *Xylocarpus monosperma*.



32. Profile diagram of undifferentiated montane forest, Dedza Mt (From Chapman & White 1970). a: *Allophylus abyssinicus*, AP: *Apodytes unguiculata*, ca: *Clausena aristata*, cs: *Cussonia spicata*, dw: *Diospyros whyteana*, ec: *Ekebergia capensis*, ee: *Erythroxylum emarginatum*, ka: *Kigelia africana*, lv: *Leptodermis volkensii*, ml: *Maesa lanceolata*, ms: *Maytenus senegalensis*, pa: *Peddiea africana*, pv: *Pittosporum undulatum*, PYG: (*Pygeum africanum* =) *Prunus africana*, rl: *Rawsonia lucida*, rm: *Rapanea melanophloeos*, rs: *Rapanea* sp.

Figure 32. Montane Forest Profiles

Source: White. 1978.



©. Profile diagram of *Widdringtonia montana* forest, Chambe Plateau, Mt. Mlanje (from Chapman & White 1970). at: *Aphonia theiformis*, ca: *Clusia amata*, CAS, *Cassipourea congoensis*, dw: *Diospyros sphyteana*, ec: *Elebergia sapensis*, ka: *Kiggelaria africana*, ma: *Melastomys acuminata*, ne: *Nuxia congesta*, os: *Oxvanthus speciosus*, pt: *Pterocelastrus tricuspidatus*, pv: *Pittosporum viridiflorum*, rs: *Rapanea* sp., WID: *Widdringtonia nodiflora*, xm: *Xymalos monospora*

Figure 32. (continued). Montane Forest Profiles

Source: White. 1978.

Table 20. Representative Species by Vegetative Zone

Zone Number (From Fig. 31)	Vegetative Zone	Representative Species
1	Montane grasslands, scrubs and forests	Evergreen forest relics; <i>Euclea</i> ; <i>Inarctogon</i> ; <i>Monocymbium</i> ; <i>Loudetia</i> Grass- lands, <i>Protea</i> Shrub-Grasslands; Montane Evergreen Scrub. <i>Acacia aboriginica</i> .
1a	Moist semi-deciduous forest	<i>Barringtonia ovata</i> ; <i>Chlorophora</i> <i>richii</i> ; <i>Piptadeniastrum</i> <i>buchananii</i> .
2	<i>Brachystegia</i> woodlands and scrubs	<i>Brachystegia pterocarpa</i> ; <i>B.</i> <i>manga</i> ; <i>B. floribunda</i> ; <i>B. boehmi</i> ; <i>B. longifolia</i> ; <i>B. alleni</i> ; <i>B.</i> <i>tamarindoides</i> ; <i>B. taxifolia</i> woodlands and scrubs. <i>Jubiterardia glaberrima</i> ; <i>J. paniculata</i> ; <i>Lobelia</i> <i>angolensis</i> ; <i>L. tomentosa</i> woodlands and scrubs, <i>Burkea</i> <i>africana</i> , <i>Uapaca kirkiana</i> woodlands and scrubs, <i>Hyparrhenia</i> and <i>Arundinellea</i> swamps and seasonal swamps.
2a	<i>Brachystegia</i> and evergreens	<i>Brachystegia pterocarpa</i> , <i>Erythrophloeum maraviense</i> , <i>Saba</i> woodland, <i>Brachystegia</i> <i>longifolia</i> , <i>Uapaca</i> spp. woodland, <i>Piptadeniastrum</i> <i>buchananii</i> .
3	<i>Combretum</i> ; <i>Acacia</i> ; <i>Piliostigma</i> woodlands and scrubs	<i>Combretum</i> spp.; <i>Piliostigma</i> <i>thonningii</i> ; <i>Acacia polycantha</i> var. <i>campylacantha</i> ; <i>Pterocarpus</i> <i>angolensis</i> ; <i>P. rotundifolius</i> ; <i>Erythrina tomentosa</i> woodlands. <i>Markhamia</i> ; <i>Securinega virosa</i> ; <i>Boyaia ericea</i> scrubs, <i>Hyparrhenia</i> and <i>Arundinellea</i> swamps and seasonal swamps.
4	Escarpment and foothill woodlands, scrubs and thickets	<i>Grewia</i> spp.; <i>Hymenocardia</i> ; <i>Capparis</i> ; <i>Papawia obovata</i>

		thickets. <i>Adansonia digitata</i> ; <i>Sclerocarya birrea</i> ; <i>Kirkia</i> <i>acuminata</i> ; <i>Sterculia quinqueloba</i> standards and thicket. <i>Oxytenanthera abyssinica</i> brakes. <i>Brachystegia beccarii</i> ; <i>Jubbernardia</i> <i>globiflora</i> ; <i>Bambusa petersiana</i> ; <i>Pterocarpus angolensis</i> woodlands.
5	Lowland, lake and river plains, woodlands, thickets, scrubs and parklands	<i>Adansonia digitata</i> ; <i>Sterculia</i> <i>appendiculata</i> ; <i>S. africana</i> ; <i>Sclerocarya birrea</i> ; <i>Oxyderris</i> <i>stuhlmanni</i> ; <i>Cordyla africana</i> parklands. <i>Hypnaene</i> <i>ventricosa</i> ; <i>Ricinodendron</i> <i>rautanenii</i> ; <i>Terminalia sericea</i> ; <i>Albizia harveyi</i> ; <i>Debergia</i> <i>melanoxylon</i> ; <i>Acacia polyacantha</i> var. <i>campylacantha</i> ; <i>A. spirocarpa</i> <i>A. xanthophloea</i> ; <i>Dichrostachys</i> <i>cinerea</i> woodlands and thickets. <i>Pterocarpus atunsi</i> ; <i>Fagara</i> sp. ; <i>Grewia</i> spp.; <i>Acacia pennata</i> ; <i>Leimnataea</i> thickets and standards. <i>Euphorbia ingens</i> ; <i>Commiphora</i> sp. thickets.
6	Mopane woodland	<i>Calophospermum mopane</i> woodland with glades.
7	Alluvia parkland	<i>Acacia robusta</i> ; <i>Cordyla africana</i> standards with cultivations.
8	<i>Terminalia</i> woodlands	<i>Terminalia sericea</i> semi-swamp woodlands. <i>Terminalia sericea</i> . <i>Brachystegia beccarii</i> woodland. <i>Terminalia sericea</i> on sandbars.
9	Swamp and swamp grasslands	<i>Lypha australis</i> ; <i>Vossia cuspidata</i> ; <i>Panicum mauritianus</i> ; <i>Pennisetum purpureum</i> ; <i>Echinochloa pyramidalis</i> swamps. <i>Chloris gayana</i> ; <i>Hyparrhenia</i> <i>rufa</i> ; <i>Setaria palustris</i> ; <i>Bothriochloa</i> ; <i>Cynodon</i> spp. ; <i>Panicum</i> spp. grasslands

Source: Jackson. 1972.

widespread (Nelson et al. 1975). Typically, it consists of mixed grasses, scrub, and low trees such as Acacia spp., Brachystegia spp., and Zizyphus spp.

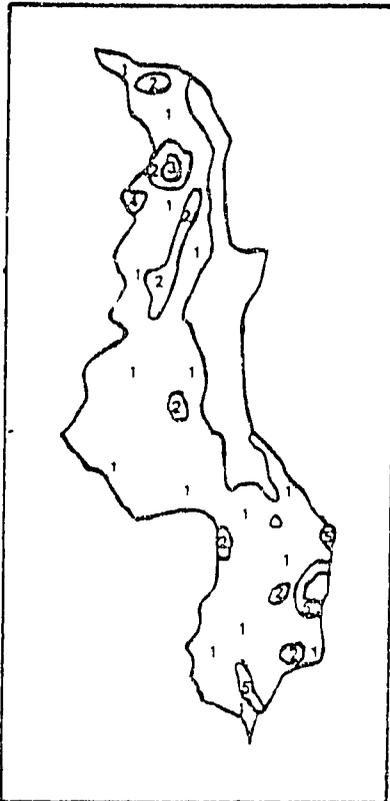
Rimmington and Pike (1965) divide Malawi's pasturelands into two groups: (1) natural dry land pastures; and (2) dambo (shallow, sandy depressions which become waterlogged during the wet season) pastures. Among the former are tall grass woodlands known as chipeta, and Hyparrhenia grasslands. Swamp grasslands, occurring commonly in the vicinity of lakes and rivers support grass species such as Bothriochloa spp., Chloris gayana, Cynodon spp., Cyperus papyrus, Echinochloa pyramidalis, Hyparrhenia rufa, Panicum repens, Pennisetum purpureum, Typha australis, and Vossia cuspidata.

Listings of grasses found in Malawi appear in Table 20 above, and in Appendix IV below. Their distribution is shown on Figure 33, and their nutritive value for grazing is summarized in Table 21.

3.3.4 Forest Exploitation ^{24/}

While, as Section 3.3.2 indicated, a quarter of Malawi's land area is covered by woodlands, very little of this land contains economically valuable timber. Over the past generations much of the natural forest has been modified to suit human requirements. Population pressure and shifting cultivation have been responsible for converting forested land to cropland, and demand for fuel has taken a heavy toll on the nation's trees. In 1979 it is estimated that 94 percent of Malawi's energy was supplied by domestic firewood--40 percent of it to cure tobacco (USAID 1981b). In light of this continuing dependence on firewood fuel, it is difficult to imagine that the nation's forested area has remained unchanged since 1961 (v. Table 8 and Section 3.3.2). And although nearly three-quarters of Malawi's forestlands are officially protected, it must be assumed that removal of timber for use as fuel is extensive even in these regions.

²⁴Sources: Director of Forestry and Game. 1972.
Europa Publications. 1980.
Nelson et al. 1975.
Pike and Rimmington. 1965.



- 1 Hyparrhenia
- 2 Themeda
- 3 Exothea
- 4 Aristida
- 5 Undifferentiated swamp

Figure 33. Grasses

Source: Rattray. 1968.

Table 21. Grasses and Grazing Quality

Grass type	Species found in Malawi	Altitudes at which found (m)	Grazing quality for forage
<u>Aristida</u>	<u>A. adscensionis</u>	300 - 900	Woody, tough; not generally palatable; undesirable for grazing.
<u>Exothea</u>	<u>E. abyssinica</u>	2,000 - 2,800	Good grazing for a few months; unpalatable during remainder of year.
<u>Hyparrhenia</u>	<u>H. gazensis</u>	Below 600	Good grazing when short and young; protein content too low to maintain cattle when grass is mature.
	<u>H. variabilis</u>	Below 600	
	<u>H. dichroa</u>	Below 600	
	<u>H. filipendula</u>	600 - 1,500	
	<u>H. gracilescens</u>	900 - 1,500	
	<u>H. nyassae</u>	600 - 1,200	
<u>Themeda</u>	<u>T. triandra</u>	1,500 - 2,100	Palatability varies, but among the best in Africa for grazing.

Source: Rattray. 1968.

By most standards, Malawi has had no large timber-producing forests. Nevertheless, some woodlands contain high quality timber trees such as softwood Mlanje cedar (Widdringtonia whytei) and juniper (Juniperus procera), and hardwoods such as mlombwa (Pterocarpus angolensis), mbawa (Khaya nyasica), mwenya (Adina microcephala), and mvule (Chlorophora excelsa).

In addition, under recent government afforestation programs, exploitable hardwoods (Gmelina arborea) and Eucalyptus saligna) and pines (Pinus patula) have begun to yield commercial stocks of timber (Director of Forestry and Game 1972). With a view towards eliminating imports of construction timber and pulp, the government has established a plantation development program whose target is to reforest 29,000 ha by 1990. Toward this end expenditures on forestry have been increasing steadily since 1964. Although there are no figures for government allocations for forestry alone (they are grouped with spending on "game"), Table 22 clearly shows the fluctuating priority of the forestry sector in Malawi's public sector.

Table 22. Government Expenditures on Forestry and Game, 1964 to 1980

Year	Expenditures on forestry and game (millions of kwacha)	Percent of total government development expenditures
1964	0.41 ^a	
1972-73	0.64 ^a	7.6 ^a
1973-74	0.95 ^a	2.4 ^a
1974-75	2.76 ^a	3.1 ^a
1975-76	2.30 ^a	6.8 ^a
1976-77	2.33 ^a	3.3 ^a
1977-78	3.02 ^a	3.9 ^a
1979-80	3.43 ^c	3.5 ^a
		2.1 ^c

^a USAID. 1979.

^b According to the Director of Forestry and Game (1972), 360,000 kwacha were allocated for forestry alone in 1972.

^c Average based upon figures for 1977-80 in Europa Publications (1980).

With regard to forest exploitation, Table 23 summarizes roundwood removals and sawnwood production to 1976.

3.3.5 Administration, Policy, and Planning ^{25/}

Under current organizational structure, Malawi's Department of Forestry is a branch of the composite Ministry of External Affairs, Justice, Works and Supplies, Agriculture and Natural Resources. Government expenditures for forestry are generally reported together with outlays for "game " but judging by the total for the two (just 2.43 percent of public investment in the development program), forestry does not enjoy especially high priority. This is somewhat surprising for a nation which states that a quarter of its land area is forested.

The list of current forestry legislation confirms this apparent underattention. As Appendix II, Table 3 shows, nearly all of the country's statutes were enacted prior to independence and occasionally revised during the late 1960s. No information was available to this report on the ability of the government to enforce existing legislation, or its likelihood of enacting new regulations. The potential problems caused by inadequate forest protection are underlined by the Department of Forestry's own estimates that if current deforestation continues, Malawi's forest resources will be exhausted by the end of the century (USAID 1981b).

Figure 34 locates current and projected government-sponsored facilities and reserves.

²⁵Sources: Director of Forestry and Game. 1972.
Europa Publications. 1980.
Nelson et al. 1975.
USAID. 1981b.

Table 23. Forest Exploitation and Wood Production

a. Roundwood Removals

Eventual Use	Volume (1,000 cu m)								
	Coniferous			Broadleaved			Total		
	1974*	1975	1976	1974*	1975	1976	1974*	1975	1976
Sawlogs, veneer logs and logs for sleepers	79	37	33	22	47	52	101	84	85
Other industrial wood	--	--	--	195	195*	195*	195	195*	195
Fuel wood	28	18	13	2,878	2,950*	3,023*	2,906	2,968*	3,036
06 Total	107	55	46	3,095	3,192	3,270	3,202	3,247	3,316

* FAO estimate.

b. Sawwood Production

Timber type	1972*	1973*	1974	1975	1976
Coniferous	15	15	15	18	19
Broadleaved	12	18	18	23*	15
Total	27	33	33	41	34

* FAO estimate.

Source: Europa Publications, 1980.

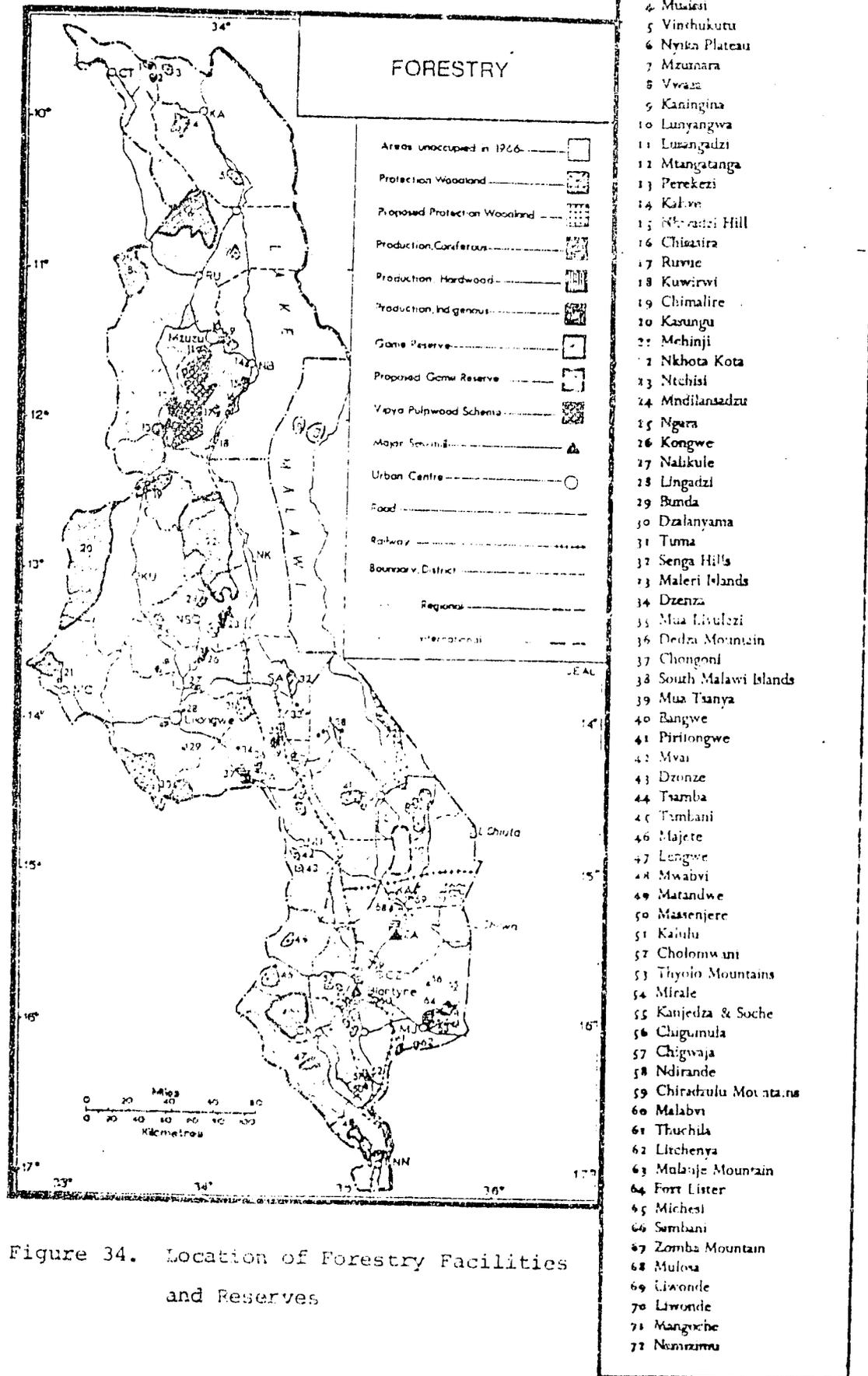


Figure 34. Location of Forestry Facilities and Reserves

Source: Director of Forestry and Game. 1972.

3.4 Faunal Resources, Exploitation, and Conservation Measures

3.4.1 Mammalian Fauna

There is extensive literature on most groups of terrestrial vertebrates in Malawi. Some works that treat mammals in Malawi, or include Malawi as part of a broader regional or continent-wide survey include: Hillerman et al. (1953), Lawrence and Loveridge (1953), Sweeney (1959), Hanney (1960-1961), Ansell et al. (1962), Hanney and Morris (1962), Morris (1964), Smitners (1966), Coetzee (1967), Davis (1968), Lemon (1968), Kingdon (1971), Stewart (1972), Myers (1976), Jachmann and Bell (1979), Long (1973a), Dorst and Dandelot (1970), and Macpherson (1973).

Five species of mammals are listed as vulnerable, threatened or endangered by the IUCN Red Data Book (1975). Four are listed by the U.S. Department of Interior (1980), one of which is not shown by IUCN, making a total of six species listed in Table 24. Others may soon be added to this list. Reports by Macpherson (1973) and Hayes (1972) suggest that there has been a great deterioration in the numbers of all species of wild animals in Malawi over the last one hundred years.

"When Livingstone first visited Malawi in 1859 he recorded that the country was teeming with wildlife" (Hayes 1972). He wrote that the Shire River was full of hippos, and large herds of elephants, buffalo, and antelope were encountered on the flood plain. For the next fifty years others verified Livingstone's accounts of wild animals in Malawi. However arrival of the Europeans, a five- to six-fold increase in the indigenous human population, and the destruction of much natural habitat, as well as perhaps other factors, contributed to a sharp decline in animal numbers during the last 30 to 90 years (Hayes 1972).

As early as 1891, when the British declared a Protectorate over what was then Nyasaland, some steps were taken to preserve wild game in parts of the country. Regulations for protection of wild game were published in 1896, and replaced by others in 1897. Between this period and 1946 a succession of ordinances were established and ultimately replaced, all of which were attempts to

Table 24. Vertebrates Listed by the U.S. Department of Interior and the IUCN Red Data Book as Endangered or Threatened ^a

Common Name	Scientific Name	Status	
		Dept. Interior	IUCN
<u>Mammals</u>			
African Wild Dog	<u>Lycaon pictus</u>	X	
Leopard	<u>Panthera pardus</u>	X	E
Cheetah	<u>Acinonyx jubatus</u>	X	E
African Elephant	<u>Loxodonta africana</u>	X	T
Black Rhinoceros	<u>Diceros bicornis</u>	X	
Brown Hyena	<u>Hyaena brunnea</u>		E
<u>Reptiles and Amphibians</u>			
Nile Crocodile	<u>Crocodylus niloticus</u>	X	E

^a T = threatened, E = endangered (Fed. Reg.), X = listed by IUCN.

Sources: U.S. Dept. Interior. 1980.
IUCN. 1966, 1969, 1975, 1978a.

set aside protected areas for such species as elephants, giraffe, and white-tailed Gnu (Hayes 1972).

Macpherson (1973) provides qualitative insight into the numbers and kinds of animals that were common in the early part of the present century. He reports that the Central Region of Malawi, the Bua/Rusa watershed, was "magnificent country for game animals," with almost all the country's antelope occurring there, including Eland, Kudu, Sable (least common), Roan, Hartbeeste (Lichtenstein's) waterbuck, reedbuck, Oribi, and Puku. Macpherson also reports large numbers of hippo, smaller numbers of buffalo and elephants, and large packs of 30 to 40 hunting dogs, as well as Spotted Hyenas everywhere. Chaotah, however, were not common in the Central Region, and caracal were extremely rare. He reports that Burchell's Zebra were more common at higher elevations than the lake, and warthogs common at the lake level. Baboons were reported to be so prevalent and destructive they were considered a pest.

Despite the large body of published literature on wildlife in Malawi, most of it is rather out-of-date. An important exception is Myers' (1976) study of the leopard in Africa. Myers reports that leopards occur in numbers over the northern part of the mountain chain that forms the backbone of the country, but are rare in the central section. They are also still common around Lengwe, especially in the national park. Moreover, he believes that although the leopard's range is shrinking, the remaining habitats in the mountain could well support maximum densities because mountainous terrain is unsuitable to lion or hyena which are its principal carnivorous predators.

The main threat to the leopard appears to be the overall impact of human population and development pressures. He also believes the trend is irreversible, and although small numbers of leopard should persist in Malawi until the end of the century, its present widespread distribution and generally satisfactory status will have declined considerably well before then (Myers 1976).

Current information on the status and distribution of other mammals in Malawi was not available to this report.

3.4.2 Avifauna

No birds were listed by the IUCN Red Data Book (1966), or the U.S. Department of Interior (1980). This may reflect a lack of current data, because as human populations and development increase, larger species, or those with specialized habitat or other requirements will surely suffer.

Benson's (1953) Checklist of Birds of Nyasaland records about 621 species for Malawi. It is likely that a small number of species have been added since Benson's work. A number of regional works on Malawi's birds have been published including: "An Annotated List of the Birds Recorded at Lake Chilwa" (Schulten and Harrison 1975), "Birds of Bunda" (Borden et al. 1975), and "The Birds of Nsanje (Port Herald) District" (Parts I-V; 1973a; 1973b) by Long. The Birds of Malawi (Benson and Benson 1977) is a recent and comprehensive treatment of the avifauna of the entire country. Other texts, that include Malawi as part of a more regional coverage include Roberts (1970), Birds of South Africa, and MacWorth-Praed, and Grant's (1962-1963), The Birds of the Southern Third of Africa. Williams and Arlott's (1980) Field Guide to the Birds of Eastern Africa also covers Malawi.

Benson's (1953) list of about 621 species is very large for a small country like Malawi and reflects a rich and diverse avifauna. The list is composed of both resident and migratory species. Within these categories there are large numbers of wader and aquatic species as well as birds of prey, game birds and a long list of Passeriformes.

3.4.3 Herpetofauna

One reptile, the Nile Crocodile (Crocodylus niloticus) is listed by both the Red Data Book and the U.S. Department of Interior. Information on this species, as given by the IUCN, is presented in Appendix V.

Stewart (1969) reported on a collection of 34 species of reptiles made during 1963 and 1964 in northern Malawi. He noted eight species that were new to the region, but provides no data on status or distribution of these species. A list of the 34 species is shown in Appendix V. In addition to Stewart (1969) a few other collections of reptiles

have been made in the northern region of Malawi, including Boulenger (1897), Loveridge (1953), Sweeney (1960, 1961), and Stewart and Wilson (1965).

No amphibians are listed as threatened or endangered in Malawi by the IUCN Red Data Book (1975) or the U.S. Department of Interior (1980). However, information on this group of vertebrates, is limited.

3.4.4 Aquatic Fauna

The freshwater rivers and lakes of Malawi have a rich and varied fish fauna. Over 200 species are recorded, representing 13 different families. More than 80 percent of the species belong to one family, the Cichlidae, whose center of zoogeographic distribution lies in eastern Africa. In addition, almost 90 percent of the fish fauna of Malawi's watersheds are endemic being found nowhere else in the world. The non-endemic species are almost all hardy forms that are tolerant of still or stagnant water where oxygen content is low.

There is a considerable body of literature on fish and fisheries of Malawi. Jackson's (1961) "Checklist of the Fishes of Nyasaland" provides an inventory of the country's fish species. Regional studies include Kirk's (1975) work on "The Fishes of Lake Chilwa," and Agnew's (1971) "The Lake Kilwa Fisheries." Other literature on Malawi fisheries, includes Lowe (1952), Gosson and Smith (1958), Lowe (1958), Pike (1968a), Remson (1969), Morgan and Malik (1970), and Morgan (1971, 1972). Many of these deal with one or more of the many species of Tilapia, which are important commercial fish in Malawi. An overview of fish ecology and utilization in Africa is given by Leveque and Bruton (1981).

Malawi has a large and productive fishing industry that is of special importance because of the overall low level of animal protein in the diet of most of the population. It is also important because of the rather limited potential for growth within the livestock sector. Malawi's fisheries industry is an important source of income for many people engaged in this occupation. The main commercial fishing center is in the southern corner of Lake Malawi. Other important sources

are Lake Malombe, Lake Chilwa, and the Shire River. Elsewhere, fishing is carried out primarily on a subsistence level. At the northern limit of Lake Malawi a small quantity of fish are caught for export to Tanzania. According to Pike (1968), the fisheries industry in Malawi has been allowed to develop with little control and some species may be overfished. Pike also cites the need to obtain further information on fish management and culture of important commercial species.

Although Malawi is a landlocked country, it produces a large volume of fish. The majority of fish are taken from Lake Malawi although other lakes and rivers are also important. According to USAID (1981b) virtually all of Malawi's waters are fished. The average production has increased steadily from an estimated 13,500 to 18,000 tons in the mid-1960s to 70,000 metric tons between 1974 and 1978 (USAID 1981b; May and McLellan 1970). Production for the years 1963-1969 for several major lakes is shown in Table 25.

Table 25. Estimated Landings of Fish (1963 - 1969)

(by weight in short tons)

YEAR	LAKE MALAWI	LAKE MALOMBE and Upper Shire	LAKE CHILWA	OTHER WATERS	TOTAL
1963	8,100	2,900	3,600	500 ^Δ	15,000
1964	6,800	1,300	5,800	600	14,300
1965	7,100	1,700	9,800	2,200	20,600
1966	6,400	3,200	3,000	1,700	19,100
1967	5,200	4,400	3,600	1,900	15,600
1968	8,600	8,600 ⁺ *	100	2,500	19,600
1969	12,300 ⁺	2,600	3,200	7,200	25,300

Source: Agnew. 1971.

Fishing methods in Malawi are varied. Over 90 percent of Malawi's fish output is supplied by traditional fishermen who catch deep water fish with hooks or in baskets set along fish migration paths. Shallow water fish are captured by almost every artisanal method possible. Individual entrepreneurs and commercial fishing companies, both using relatively modern techniques, supply about ten percent of the annual fish output. Because of the growing scarcity of large trees for dugout canoes, the most common fishing craft, a project is beginning on Lake Malawi to make ferrous cement fishing craft that will compete with dugout canoes and plank boats (USAID 1981b).

The southern portion of the Lake Malawi (the southeast and southwest arms) is the most important part of the fishery in terms of output. There is, however, a general consensus that the harvest of the southern end of the lake has reached its maximum sustainable yield so that no incremental output should be expected from this source. Research is being proposed to enable this portion of the lake to be better managed in order to enable its sustainable yield to be increased over time.

The remaining fisheries of Malawi have also reportedly reached or nearly reached their maximum sustainable yield. Thus, any major increases in fish output from Malawi's natural fisheries will have to come mostly from the central and northern parts of Lake Malawi. The potential for expanding the catch in the other parts of the lake are as yet unknown. There is some evidence that major expansion is not possible. If this turns out to be the case fish farming in inland ponds may emerge as the most economical alternative for increasing fish production. Per capita annual fish consumption in 1973 amounted to 14.4 kg, 3.6 times as much as all other meat consumed per capita (USAID 1981b).

On Lake Malawi most fishing is done in the south because of an oxygen deficit in the northern end. Of the 200 to 250 species of fish in the lake, seven are commercially exploited. These include Tilapia, Clarias, Bagrus meridionalis, Utaka (a group of Haplochromis), Barbus paludinosus, Labeo mesops and Engralicypris sardella.

Lake Chilwa is much smaller than Lake Malawi but also of importance because of its potentially high productivity. Its productivity is due partly to shallowness and warmth but these characteristics also lead to instability. For example, maximum water depth is about 2.5 m but annual loss of water to evaporation is 1.53 m. Consequently there is considerable variation in depth from year to year and this results in changes in chemical composition. Three of the 13 species of fish in Lake Chilwa are of commercial value. These are Barbus paludinosus, Tilapia shirana chilwae, and Clarias mossambicus. As a result of the high productivity but instability, large fish kills or sharp decline in numbers occasionally occur. These are of particular interest to the Fish Division of the Ministry of Natural Resources. Tilapia, one of the most important commercial fish in Lake Chilwa, has been subject to extensive mortalities (e.g. 1966 to 1967) and has been the subject of study on the causes of its mortality (Morgan 1972).

In recent years, Tilapia shirana chilwae has been successfully reared in fish ponds and other artificial impoundments in southern Malawi. This precautionary measure, and the encouraging success of the program, have provided a valuable buffer against catastrophic mortalities of the past (Morgan 1971).

3.4.5 Parks, Reserves, and Wildlife Conservation in Malawi

Malawi has a long history of activity in wildlife preservation and game protection. But despite these efforts, wildlife has been steadily decreasing in numbers since 1859. According to Hayes (1972), Malawi may now be at a turning point after a century of declining animal populations. Malawi currently has four National Parks and three Game Reserves (IUCN 1977). A fourth game reserve is in the planning stage. Enforcement of wildlife protection within natural parks has increased to the point where wildlife is increasing. In time it is hoped that this situation will also occur in the game reserves.

Hayes (1972) believes that Malawi probably has as many wildlife sanctuaries as it can afford to set aside, and argues that emphasis should be on developing them, and at the same time, educating the people, particularly the young people, to appreciate and protect this priceless heritage.

Locations of the parks and game reserves is shown in Figure 35. Legislation dealing with national parks and reserves is summarized in Appendix II. Several laws such as the Game Act of 1954 and National Parks Act of 1969 provide comprehensive guidelines for control of wildlife and parks. A new and more comprehensive Flora and Fauna Act, in preparation in 1977 (IUCN 1977) will supercede previous legislation and provide stricter legislation of wildlife resources outside of parks.

Malawi currently has 1,042,601 ha or about 11.4 percent of its total surface area (including water surface) under protection. This area, according to IUCN (1977) includes substantial areas that may not yet have been gazetted, and one game reserve that has not been approved. Nevertheless, this is a very large proportion of the country and represents a significant step toward a long-term goal of research preservation and management. In addition to the IUCN (1977) parks and game reserve data in Appendix V, Table 3, additional data for three National Parks, Kasungu, Lengwe, and Nyika, is given in Appendix V, Table 4.

3.4.6 Governmental Agencies and Wildlife Organizations

A breakdown of the major governmental and private organizations that oversee wildlife in Malawi include the following (Trzyna and Coan 1976):

GOVERNMENTAL AGENCIES:

Ministry of Agriculture

Zomba, Malawi

Member IUCN. Subordinate units:

Commissioner for Agriculture and Fisheries

P.O. Box 303, Zomba, Malawi

Department of National Parks and Wildlife

P.O. Box 597, Lilongwe, Malawi

Ministry of Health

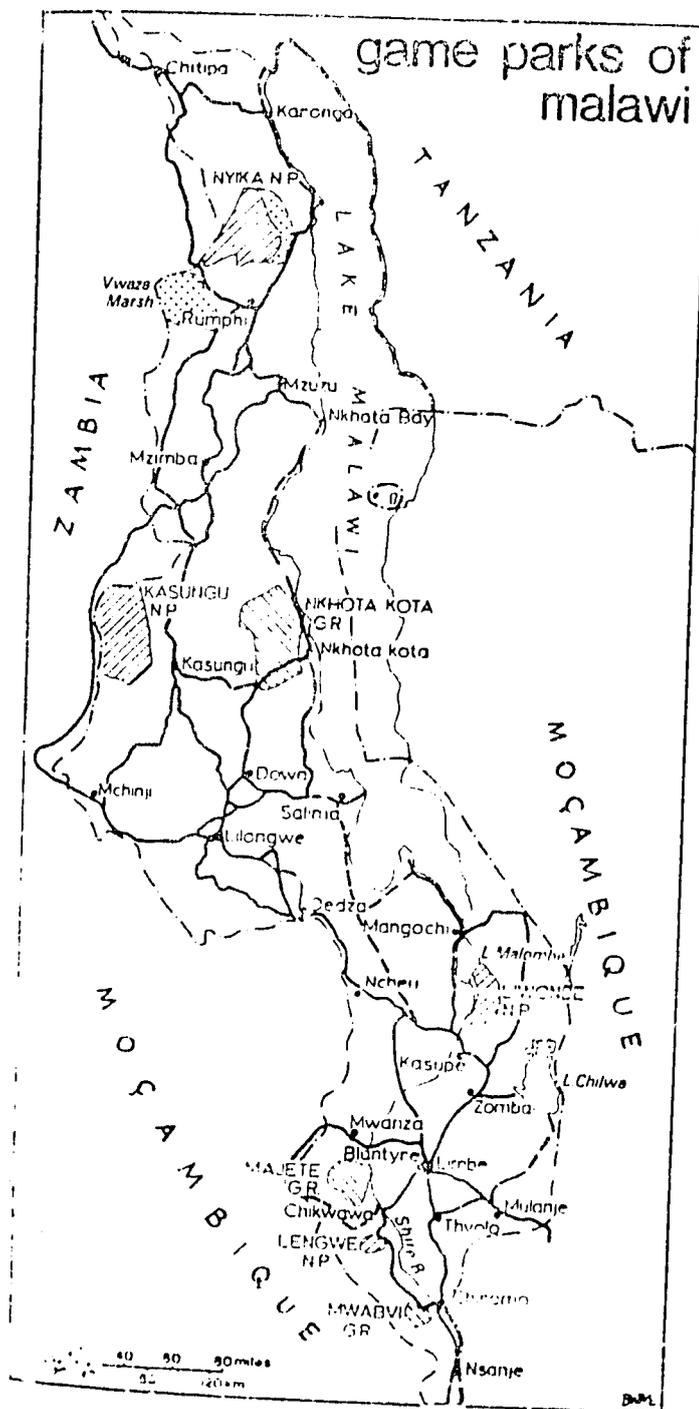
Zomba, Malawi

Ministry of Natural Resources

Geological Survey Department

P.O. Box 27, Liwonde Road, Zomba, Malawi

Water Pollution



- National Parks 
- Game Reserves 
- Proposed Game Reserves 
- Roads 
- International Boundaries 

Figure 35. Location of National Parks and Game Reserves in Malawi

Source: Hays. 1972.

OTHER ORGANIZATIONS

Lake Chilwa Coordinated Research Project
University of Malawi, P.O. Box 97, Limbe,
Malawi

Est. 1966. Studies of Lake Chilwa and the
Chilwa Plain.

National Fauna Preservation Society of Malawi
P.O. Box 135, Limbe, Malawi

University of Malawi
Chancellor College
Department of Geography and Earth Sciences
P.O. Box 280, Zomba, Malawi

Includes training programs in conservation
of national parks and wildlife.
Affiliated with IUCN.

4.0 Environmental Problems

4.1 Physical and Climatic Problems 26/

Among African nations, Malawi is fortunate in that its physiography and climate do not generally menace its environment. The country lies within a rift zone created by faulting and uplifting, and the entire region is subjected to frequent earthquakes--more than 100 per year, according to Pritchard (1979). Figure 36 shows that Malawi is in Africa's most earthquake-prone region. Nevertheless, these movements are nearly always of minor intensity and there is no record of a severe earthquake during the present century. Similarly, although parts of southern Malawi were formed by volcanic activity during the Tertiary and Quarternary periods, there are no active volcanoes in Malawi.

Climatically, too, Malawi is fortuitously situated. Rainfall, perhaps the most important climatic factor in tropical Africa (de Vos 1975), is nearly always adequate (Nelson et al. 1975). As a result, Malawi has been much less subject to drought than its neighbors. Indeed, its relative immunity from rainless periods has characterized it as one of the region's natural refuges for migrants from drought-prone areas (Webster 1978).

Nonetheless, Malawi has experienced rainfall-related problems. These have been of two types: poorly timed rainy seasons; and occasional cyclonic disturbances and consequent flooding. In rainfed agriculture such as Malawi's, the prompt arrival of the rainy season is crucial to the development of good crops. Frequently during the past fifteen years (for example, in 1968, 1969, and 1970), rains have come too early or too late. The resulting harvests of maize and other crops were reduced seriously and strained Malawi's delicate economy (Nelson et al. 1975).

Cyclones, Malawi's other climatic problem, are a nearly annual occurrence. They arise in the Indian Ocean and move west across Lake Malawi, where they pick up additional moisture, and strike Malawi with maximum force. Two particularly damaging storms--one in 1946,

²⁶Sources: Anon. 1978b.
de Vos. 1975.
Nelson et al. 1975.
Pike and Rimmington. 1965.
Webster. 1978.

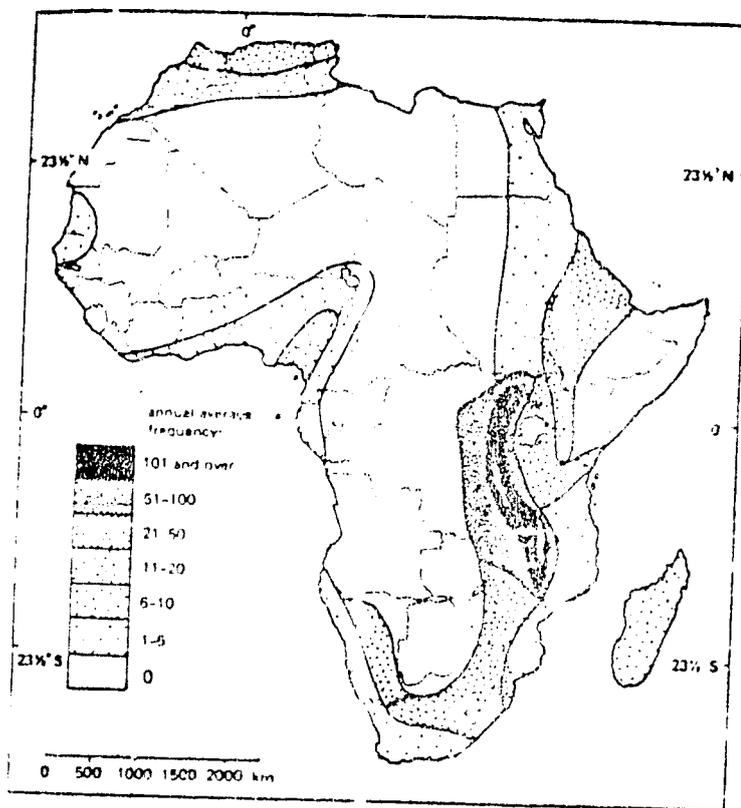


Figure 36. Frequency of Earthquakes

Source: Pritchard. 1979.

another in 1957--deposited 710 mm in 36 hours, and 560 mm in 24 hours, respectively. The second of these cyclones may have originated over Lake Malawi, a rare phenomenon, as cyclones are universally believed to form over oceans. Whenever cyclones strike, they bring high winds and heavy precipitation. These cause flooding and damage property and crops. Although cyclones are frequent, the government possesses no national plan for warning the population and evacuating endangered areas. There exists, however, a government Disaster Relief Coordinating Committee. In addition, several foreign and multinational agencies administer programs which include disaster relief components. Appendix VI, Table 2, lists some of these organizations and summarizes their activities.

4.2 Environmental Disease 27

4.2.1 General Features of Public Health

According to most health-related indicators, Malawi compares poorly with most other African countries. Section 2.2.3 has already pointed to the nation's excessive fertility rate and consequent high population growth. This elevated fertility rate contributes both directly and indirectly to public health problems. Mortality and morbidity among mothers and children are considered excessively high (Futures Group 1981). Infant mortality, for example, is approximately 150 per 1,000 live births--high even by the standards for "low-income countries." Similarly, an estimated 25 to 35 percent of children aged one to four die from malnutrition or disease (Futures Group 1981; USAID 1981a; World Bank 1981).

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- ²⁷Sources: Anon. 1978a, 1978b.
Ford. 1975.
Futures Group. 1981.
May and McLellan. 1970.
Molesworth. 1968.
Molyneux. 1979.
Nelson et al. 1975.
Stubbs. 1972e.
Tolba. 1979.
USAID. 1981a.
Van den Berghe and Lambrecht. 1963.
Williamson. 1972.
World Bank. 1981.

Compounding the problems arising from high fertility, mortality, and morbidity, in 1977 the number of physicians per population in Malawi was just one to every 40,680 inhabitants--Africa's (and the world's) fifth lowest rate and one which was 15 percent lower than in 1960 (World Bank 1981). Nursing personnel are more plentiful; each nurse serves 2,790 persons [World Bank 1981; USAID (1981a) reports one to every 3,891 persons], a better than average ratio among African nations.

Further aggravating Malawi's public health situation is the relative difficulty of obtaining safe drinking water (33 percent in 1975; World Bank 1981), and the nearly total absence of rural sewage disposal facilities (Nelson et al. 1975). And, despite a generally favorable food production base, in 1977 the average Malawian obtained only 90 percent of the recommended minimum daily caloric supply (World Bank 1981).

Together, these factors have combined to hold mean life expectancy at birth to just 47 years, a 27 percent improvement since 1960, but still Africa's eleventh lowest rate. Table 26 summarizes Malawi's health-related indicators. Figure 37 locates Malawi's health care facilities in 1969, and Figure 38 shows the prospects for such facilities over the next three decades.

4.2.2 Prevalent Diseases

As in the rest of tropical Africa, infectious diseases exact a heavy toll on Malawi's population. Among these, pneumonia, malaria, gastroenteritis, and tuberculosis--in descending order of incidence--are the principal causes of mortality. In most cases the spread of these and other infections is facilitated by inadequate drainage, impure drinking water, and other water-related problems. The moist lakeshores, river banks, and swampy areas are breeding grounds for insect and molluscan vectors, and for parasitic microorganisms.

Malaria and other parasitic infections are perhaps the most prevalent diseases in Malawi. Malaria, transmitted by a mosquito vector, exists everywhere in the country. Outbreaks are particularly common during and after the wet season, and are most pronounced along the shores

Table 26. Health-related Indicators

Statistic	Value	Source
Total population (millions), 1979	5.8	a
Average annual population, growth rate (percent), 1970-79	2.8	a
Crude birth rate per 1,000, 1979	51.0	a
Total fertility rate, 1979	7.0	a
Crude death rate per 1,000, 1979	19.0	a
Life expectancy at birth, 1979	47.0	a
Infant (0-1 year) mortality rate per 1,000 live births, 1981	150.0	b
Child (1-4 years) death rate (percent), 1979	{ 25.0	a
	{ 25-35	b
Population per physician, 1977	{ 40,680.0	a
	{ 48,198.0	c
Population per nursing person, 1977	2,790.0	a
	3,891.0	c
Population per hospital bed, 1975	546.0	c
Food consumption per capita (calories per day), 1977	2,066.0	a
	2,237.0	c
Daily per capita caloric supply, as percent of requirement, 1977	90.0	a
	97.4	c
Per capita supply of proteins (grams per day), 1974	68.4	c
Daily per capita protein supply, as percent of USDA requirement, 1974	114.0	c

- a World Bank. 1981.
b Futures Group. 1981.
c USAID. 1981a.

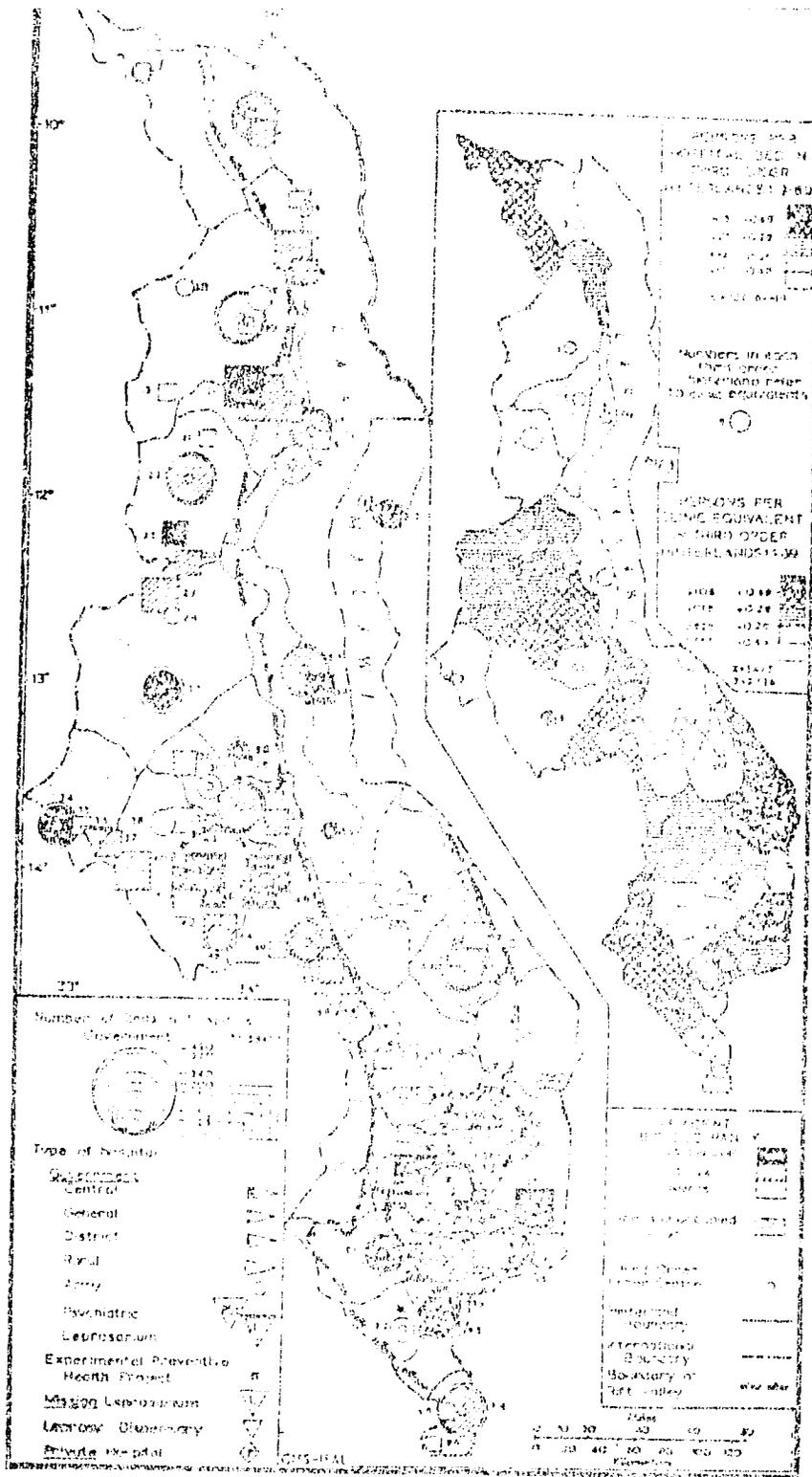


Figure 37. Health Services and Facilities, 1969

Source: Stubb., 1972e.

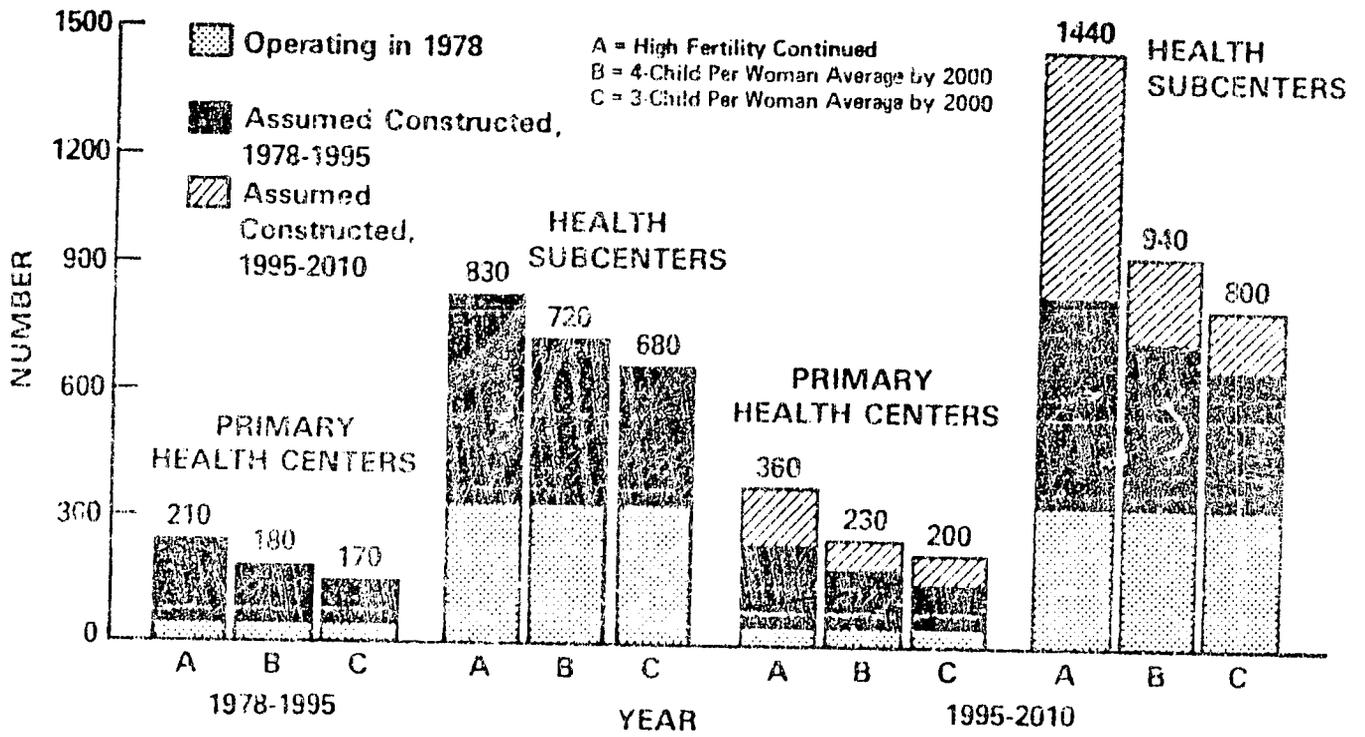


Figure 38. Existing and Projected Health Facilities

Source: Futures Group. 1981.

of Lake Malawi, Lake Chilwa, and in the Shire River Valley. In 1975 only Blantyre was essentially free of malaria. As of 1978 there were no large-scale control measures in force.

Schistosomiasis (bilharziasis) spread by waterborne snails occurs throughout the country, but is especially prevalent near stagnant or slow running waters in Dediza, Nkhota Kota, Kasuje, Nsanje, and Karonga Districts. Adequate control measures have yet to be developed or implemented.

Trypanosomiasis, or African sleeping sickness, carried by the tsetse fly (*Glossina moristans*) is not as widespread as in most neighboring countries. As Figure 15 illustrates, although Malawi is surrounded by tsetse infested areas, most of the nation's terrain is free of the vector. The disease nevertheless exists and poses a serious problem in some regions such as Chitipa and Rumphi. Other endemic parasitic infections include helminthiasis, elephantiasis, and trachoma.

Nonparasitic microorganismic infections are numerous in Malawi. Among the most serious is leprosy, which is thought to affect one in every hundred Malawians nationwide and considerably more in certain affected locales. One 5,000 sq km area in the Southern Region was studied during the mid-1960s and was found to have as many as 12,000 leprosy sufferers. With assistance from the World Health Organization (WHO), the government established the Malawi Leprosy Control Project in 1965. In spite of the efforts of the Project and of various foreign relief agencies (v. Appendix VI), leprosy remains endemic and widespread.

The other principal infectious illnesses are dysentery, perhaps the most common disorder, venereal disease, meningitis, influenza, eye diseases, and childhood diseases. Of the latter, malignancies such as lymphoma, neural tumors, and connective tissue tumors are especially prevalent. A recent study (Molyneux 1979) of the 1967 to 1976 period confirmed that 6.6 percent of all recorded malignancies in Malawi occurred in children below 15 years of age (compared with an average rate of just 2.0 percent in European countries).

4.2.3 Nutritional Deficiencies

Although no link has been established between the exceptionally high rate of childhood malignancy and undernourishment, the two factors may be related. In general, it is children between the ages of 18 and 36 months who are most vulnerable to nutritional deficiencies (Anon. 1978b). Daily caloric intake, as Table 26 has indicated, remains below internationally recommended norms. And although daily protein intake appears to be adequate (Table 26), Malawians do not generally consider meat as a regular component of their diet; insufficient meat proteins are thus ingested. Additionally, Vitamin A deficiency associated with measles, and anemia, brought on by parasitic infection, seriously affects children.

Dietary imbalance and insufficiency of certain nutrients contribute only a part of Malawi's nutritional health problem. The remaining factor is population pressure. The high fertility rate, combined with the limited amount of available cropland constrain food production and availability. Although observers believe that Malawi is capable of remaining self-sufficient in food production, agricultural techniques will need to improve in the near future. Until yields can be enhanced, undernourishment will continue to affect the population--particularly children (May and McLellan 1970).

4.3 Misuse of Land ^{28/}

The discussions in Chapters 2 and 3 have suggested that Malawi, like most of its neighbors, has experienced a number of problems relating to land use. Inefficient farming techniques, increasingly fragmented land holdings, steady deforestation, loss of topsoil, and

²⁸Sources: Agnew. 1973b.
Brietzke. 1973.
Chipeta. 1971.
de Vos. 1975.
Huntley. 1978.
McLoughlin. 1972.
Nelson et al. 1975.
Novick. 1980.
USAID. 1979a, b.

occasional overgrazing all have been cited by observers as threats to environmental stability. Unfortunately, however, specific data on these problems appear but rarely in the published literature. Perhaps on account of Malawi's small size, its relative isolation, and its laudable--and thus far moderately successful--attempts to invigorate its economy, the nation's environmental problems have not been sufficiently scrutinized.

Deforestation provides a good example of this phenomenon. It is evident from surveys that firewood shortages have led to an alarming depletion of timber resources (USAID 1981b). In 1977 supplies of fuelwood, which yields more than 90 percent of cooking and heating energy, stood at 8.8 million cubic meters; simultaneously, nearly 11 million cu m of wood for fuel and poles were required.

While fuelwood demand is expected to rise proportionally with the increase in population, the Department of Forestry predicts that the nation's maximum potential supply will drop to 4.9 million cu m by 1990 and 3.7 million cu m by the end of the century. Yet in its statistics on land use, the government has not officially acknowledged any decrease in forested area between 1961 and 1978 (FAO 1980; see also Sections 2.3.1 and 3.3.4).

In a similar manner, the literature is replete with suggestions, implications, and indications of the severity of erosion, improper farming, and excessive population pressure on available cropland. Regrettably the evidence most often remains undocumented and elusive.

All observers agree, and with good cause, that Malawi's fertility rate of 7.0 births per woman (World Bank 1981) remains inordinately high. The resulting population growth rate of 2.8 percent per year clearly threatens to upset the delicate environmental and economic equilibrium. At the same time, it is known that almost all fertile land has been cultivated. Additionally, Malawi's high divorce rate, its uxorial marriage system, and its prevailing mode of land inheritance--matrilineal 75 percent of the time--have contributed to fragmentation and subdivision of land holdings. The resulting shortage of family cropland has led farmers gradually to use grazing land, mountainous terrain, and other lands with poor soils. Frequently, these conditions have caused cultivators to abandon rotation of fallow land and cultivated land, further reducing soil fertility (McLoughlin 1972).

These factors are, of course, important ingredients in the cycle of problems associated with misuse of land.

But beyond these known premises, there has been little research into specific processes. Deforestation, as we have seen, remains not only unstudied, but unmeasured. Erosion, one of its natural consequences, according to Antoon de Vos (1975), is as severe in Malawi as anywhere in southern Africa. This process, in turn, leads to soil degradation and declining fertility (USAID 1981b). But this cycle is well known throughout the developing world. Substantiation--in the form of areal figures, rates of degradation., amount of soil lost, locations of affection regions, and quantities of decreased agricultural production--rarely accompanies these assertions. In the case of Malawi, therefore, one can only reiterate these familiar problems associated with land use.

4.4 Wildlife Conservation Problems 29

There has been a severe reduction in the number of all species of wild animals in Malawi over the last one hundred years or more. Many species now survive only in the parks and game reserves, and poaching, loss of habitat within reserves due to cultivation, and other activities by humans, have eroded wildlife numbers even further. According to early accounts Malawi was teeming with wild animals, but such statements can no longer be made.

Blame for this unfortunate deterioration has been placed at the feet of many. According to Hayes (1972) the single most important factor contributing to wildlife loss is the destruction of habitats. Regrettably, because of much larger human populations and increased cultivation of land, wildlife numbers will never return to former levels. The chief concern of the Malawian government will be to maintain the present national parks and sanctuaries, and patrol boundaries against invasion for agricultural activities and poaching. Over the longer term the government will have to undertake an active program to encourage full public support for its wildlife policy through educational programs and publicity. It is very important that the people of Malawi recognize the value of their wildlife--its ecological value and its economic value. In fact these are probably the only valid arguments for conservation of wildlife and natural resources in Malawi, or in all of Africa. In a land where the rate of human population

²⁹Sources: Hanks. 1977.
Hayes. 1972.

increase is high and land is scarce, arguments in favor of aesthetics and the concept of wilderness have little meaning. By contrast the economic value of wildlife, in terms of tourism, limited hunting, meat production, and the sale of ivory under regulated harvest, all generate revenues and employ people.

An even more important justification for a strong conservation program comes from the ecological value of wildlife. The benefits, however, are less well understood and often indirect. Because they have no direct economic value they often also receive less publicity. But, it is important to "appreciate" the ecological value from the standpoint that man and his domestic species of plants and animals are all completely dependent on the functioning of immense and complex ecological systems that involve indigenous organisms. These systems include water, carbon, oxygen, and nitrogen cycles, climatic stability and the genetic storehouse of diversity from which doubtless, new plant and animal products will be developed. In addition, the more diverse and complex ecosystems are, the more stable they are likely to be and the less likely they are to be disrupted by perturbations (Hanks 1977).

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Appendix I

Demographic and Economic Characteristics

- Table 1. Demographic Statistics
- Figure 1. Population Growth, 1960-2025, under
Different Fertility Assumptions
- Table 2. Economic Characteristics
- Table 3. Economically Active Population, 1960 and
1970
- Table 4. Employment, 1976 and 1977
- Table 5. Annual Budget, 1976-77 to 1978-79

Table 1. Demographic Statistics ^a

Statistic	Value	Source
Total population (millions), 1977	5.8	b
Population density per sq km of land, 1979	61.6	b, c
Population density per sq km of cropland, 1979	252.4	b, c
Percentage of population in urban areas, 1980	10.0	b
Urban population growth rate (percent per year), 1970-80	6.8	b
Average annual population growth rate (percent), 1970-79	2.8	b
Percentage adult literacy, 1976	25.0	b
Per capita share of GNP (US\$), 1979	200.0	b

^a Other than health-related; see Table 23 for health-related statistics.

^b World Bank. 1981.

^c FAO. 1980.

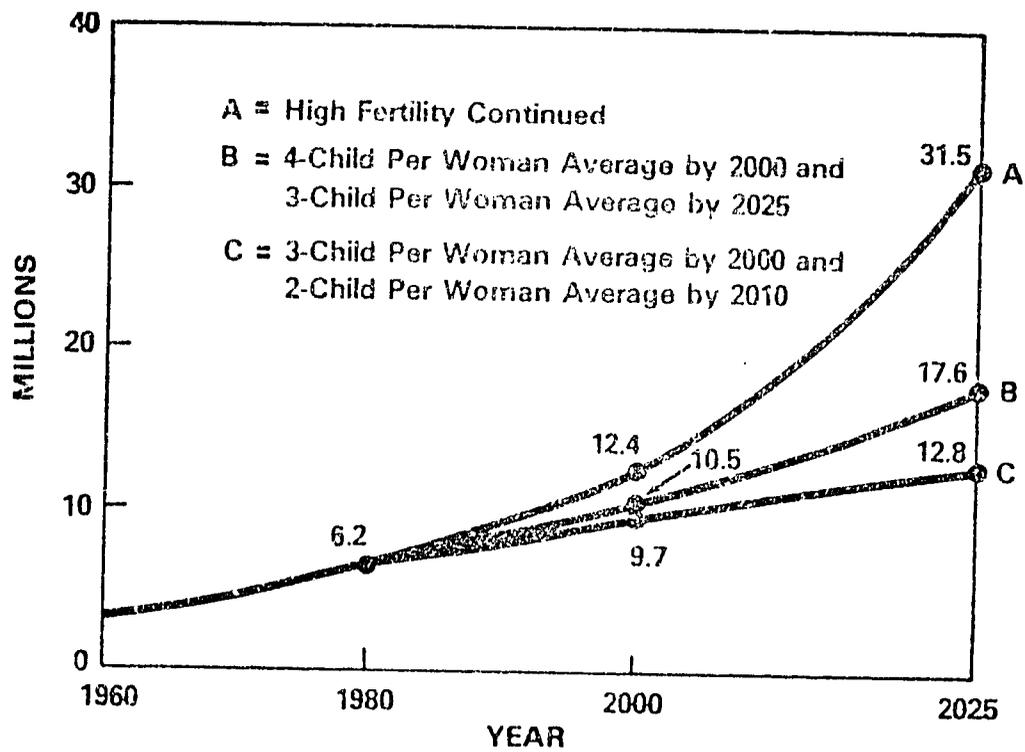


Figure 1. Population Growth, 1960 to 2025 under Different Fertility Assumptions

Source: Futures Group. 1981.

Table 2. Economic Characteristics

Gross National Product (GNP)	
Total (millions of US\$), 1979	1,160.0
Per capita (US\$), 1979	200.0
Gross Domestic Product (GDP), 1979	
Total (millions of US\$)	1,220.0
Agricultural sector, total (millions of US\$)	525.0
Agricultural sector, growth rate, 1970-79 (percent)	4.1
Industrial sector, total (millions of US\$)	244.0
Industrial sector, growth rate, 1970-79 (percent)	7.0
Manufacturing subsector, total (millions of US\$)	146.0
Manufacturing subsector, growth rate, 1970-79 (percent)	6.7
Services sector, total (millions of US\$)	451.0
Services sector, growth rate, 1970-79 (percent)	9.1
Structure of Labor Force	
Agriculture, 1979 (percent)	86
Industry, 1979 (percent)	5
Services, 1979 (percent)	9

Source: World Bank. 1981.

Table 3. Economically Active Population, 1960 and 1970

	1960			1970		
	Males	Females	Total	Males	Females	Total
Agriculture, etc.	954	634	1,588	1,095	727	1,823
Industry	42	5	47	97	8	75
Services	64	18	82	111	37	148
TOTAL	1,060	657	1,717	1,273	773	2,046

Source: Europa. 1980.

Table 4. Employment, 1976 and 1977

	1976			1977		
	Private	Government	Total	Private	Government	Total
Agriculture, forestry and fishing	95,697	5,220	103,593	111,969	21,319	133,385
Mining and quarrying	1,095	2	1,098	507	2	509
Manufacturing	34,914	1,111	36,025	59,120	1,097	31,417
Electricity and water	2,099	925	3,027	2,275	470	2,751
Building and construction	15,741	5,397	21,128	17,933	4,650	22,253
Trade, hotels and restaurants	20,714	—	20,714	17,912	185	18,207
Transport, storage and communications	10,007	2,923	12,930	11,955	3,731	15,686
Financial services	3,331	68	3,399	5,428	599	6,027
Community, social and personal services (excl. domestic services)	10,443	51,464	61,907	9,033	35,740	44,773
TOTAL	194,911	70,110	264,121	207,032	68,596	275,628

* Figures refer to employees in establishments with 20 or more persons employed, including working proprietors and unpaid family workers.

Source: Europa. 1980.

Table 5. Annual Budget, 1976-77 to 1978-79

REVENUE	1976/77	1977/78	1978/79
Income taxes	35.28	43.13	49.10
Import duties	13.12	16.05	17.00
Excise duties	4.20	4.47	5.04
Surfax	17.90	23.52	26.61
Licenses and other in- direct taxes	2.50	2.52	2.57
Current transfers	5.09	3.70	6.70
Fees, sales and recoveries	4.04	3.53	5.38
Interest and loan reim- bursement	0.45	7.02	5.59
Capital transfers	0.57	10.35	11.53
Other receipts	0.40	11.52	11.15
TOTAL	105.21	132.34	173.82

EXPENDITURE	1976/77	1977/78	1978/79
Education	14.17	18.19	20.42
Health	3.70	3.04	12.25
Housing	5.09	3.13	9.30
Natural resources	20.03	25.10	30.89
Public works and com- munications	28.34	39.03	62.90
Defence	7.03	13.58	17.32
Administration	22.00	25.37	25.08
Economic services	10.12	21.07	12.26
Public debt charges	13.00	17.27	22.29
Other services	10.53	11.08	15.75
TOTAL	149.55	184.85	254.52

Note: All figures are in millions of Malawi kwacka (K). At the 1980 exchange rate, 1 kwacka = US \$1.24.

Source: Europa. 1980.

Appendix II

Land Tenure, Reserved Land, Forestry,
and Wildlife Legislation

- Table 1. Land Tenure and Reserved Land
- Table 2. Forest Protection and Exploitation
- Table 3. Wildlife and Fisheries

Table 1. Land Tenure and Reserved Land

1. Lands Ordinance (Native Locations) (No. 5), 1904.
2. Crown Lands Ordinance, 1912. Disposal of Crown land by auction.
3. Native Tenants (Agreement) Ordinance, 1914.
4. Native Rents (Private Estates) Ordinance, 1917.
5. Native Location Ordinance, 1928.
6. Natives on Private Estates Ordinance, 1928.
7. Native Trees and Lands, 1936.
8. Native Trust Land Order in Council, 1936.
9. Acquisition of Land for Public Purposes Act. (No. 19), 1948.
10. The Town and country Planning Act. (No. 30), 1948. Includes Planning Committees and establishment of Town Planning Court. Ordinance. Subsidiary Legislation, 1966, 1968.
11. Planning (Sub-division Control) Act. (No. 11), 1958. Makes provision for the control of Sub-division of land outside Town Planning Areas. Includes establishment of Control Boards Sub-division Control Rules (under the Act.), CN No. 118, 1958.
12. Africans on Private Estates Act. (No. 12), 1962. Includes orderly development of agricultural land.
13. Natural Resources Legislation (Amdt.) Ordinance, 1963 (G.N. No. 2C).
14. Protected Places and Areas (Malawi Broadcasting Corporation) Order, 1964. (G.N. 124), 1965 (Amended 1966, 1968).
15. Control of Land (Msenjere Area) Order, 1970 (G.N. No. 267) (under the 1965 Land Act).
16. Monuments Act. (No. 44), 1955. Provision for preservation and protection of places of distinctive natural beauty: sites, building and objects of archaeological, historical interest, etc.; establishes an Advisory Committee, etc.
17. The Land Act (No. 25), 1965. Subsidiary Legislation: 1965, 1967, 1968.
18. Customary Land (Development) Act. (No. 5), 1967. Provides ascertainment of rights and interests; also better agricultural development.
19. Local Land Boards Act. (No. 7), 1967. An Act to provide for the establishment and powers of local land boards.
20. Registered Land Act. (No. 6), 1967.
21. National Parks Act (No. 33); 1969. Provides for the establishment of national parks, for the preservation therein of animals and vegetation, etc. National Parks Regulations (No. 38), 1973.

Source: Johnson and Johnson. 1977.

Table 2. Forest Protection and Exploitation

1. The Forest Act, 1942. Controls and regulates forests and forest produce. Subsidiary Legislation includes list of forest reserves.
2. The Forest Ordinance, 1942. (Cap. 119) The Forest Produce (unalienated Customary Land) Protection, control and management by District Councils (Amendment) Order (under Section 9).
3. Forest Produce (customary Land) Protection, Control and Management by the District Councils Order, (under 9 of the Forest Ordinance).
4. Forest Rules (under 4 and 13 of the Forest Ordinance protects forests). Includes list of protected trees, etc. 1942.
5. Forest (Camping in Forest Reserves) Rules (under 4 (4) (6) of the forest Ordinance. 1942.
6. Prohibition of Tapping of Palm Trees (Fort Johnston) Rules (under 4 and 5 of the Forest Ordinance). 1942.
7. Protection, Control and Management of forest produce (palms) Order, (under 9 of the Forest Ordinance) Same for Bamboos. 1942.
8. Nyasaland Forest, Chapter 119, 1942.
9. Forest Rules for various Districts, etc. 1964, 1965, 1966, 1968, Also some amendments.
10. Cotton (uprooting and destruction) Order, 1965. (GN. 188, 1965).
11. Order Under the Forest Ordinance GN 23, 1966.
12. The Plant Protection act, 1969. Provides for the eradication of pests and diseases destructive to plants to prevent the introduction and spread of pests and diseases destructive to plants, etc.

Source: Johnson and Johnson. 1977.

Table 3. Wildlife and Fisheries

- Hide and Skin Trade Act, 1955* (Rules, 1954).
- Wild Bird Protection Act, 1961*. Makes further and better provisions for protection of wild birds. Includes declaration of bird sanctuaries, controlled areas, etc. Lists of protected birds and seasons of protection.
- Wild Birds Protection (Controlled Areas) Rules under §§ 10, 24 of Wild Birds Protection (Ordinance) (Amdt.) Rules, 1964*.
- Subsidiary Legislation. Bird Sanctuaries Proclamations (under the Wild Bird Ordinance) 1928, 1925, 1938, 1949.
- Imposition of Numerical Limits Notice (under § 8, Wild Birds Protection Ordinance) Also, Declaration of Controlled Area (Under § 9, W.B.P.O.). 1964
- Scientific Animals Act*; Experiments Regulations, 1963.
- Crocodyla (Amdt.) Rules, 1963, 1965*. Crocodiles Act. (No. 12) 1968. Control and protection of crocodiles.
- Game (Amdt.) Rules, 1963*. The Game ordinance (Amendment) Act., 1964. The Game Ordinance (Cap. 137) Order (under sec. 3) Relates to declaration of M'awi National Park. The Game Ordinance (Cap. 137) Variations 1965. Notice, 1968.
- Wild Birds Protection Ordinance, Declaration of Controlled Areas, 1964*. (Cap. 138) Notice, 1968.
- Several Declarations of various Infected Areas. Govt. Notices. 1966, 1968, 1967.
- Control of Diseases of Animals Act No. 41, 1957*.
- The Game Act, 1954* - Preservation and control of game. Includes National Parks, Controlled Areas, Game Reserves, Licences to hunt game, etc. Schedules describe various game reserves, licence regulations, etc. Game Reserve (Declaration) Order, 1970 (GN No. 266).
- Several Rules prohibiting and restricting hunting in specific areas (all under § 46 of the Game Act.) 1952, 1951, 1939.
- Hippopotami (Protection) Rules, 1958. (under § 46 (b) of the Game Act.)
- The Game Act, 1953*. Makes further and better provision for the preservation and control of game. Includes establishment, regulations, etc. of National Parks, controlled areas, game reserves, also licences to hunt game, etc. Subsidiary Legislation: Declaration of Controlled Areas Notice (under § 7 of the Game Act.) Game Rules, 1954 (under § 46). Includes prohibited methods of hunting reserves, licences, etc.
- Fisheries Act No. 17, 1949*. Provides for the regulation and control of fishing, conservation of fish, licences, etc. Subsidiary Legislation: The Fisheries (Commercial Fishing) Rules; Fisheries (Aquarist Trade, Commercial Fishing) Rules, Fisheries (Shore seine Nets) Rules, Fisheries (Gill-Net Mesh) Rules; Fisheries (minimum takeable size) rules.

Source: Johnson and Johnson. 1977.

Appendix III

Natural Resources, Energy, Water,
and Hazardous Substances Legislation

- Table 1. Natural Resources and Energy
- Table 2. Water Resources
- Table 3. Hazardous Substances

The Petroleum Act (No. 111:201). An Act to regulate the storage of petroleum. Subsidiary (General) Regulations, under the Petroleum Act, 1960.

The Mining Regulations (Int) Act (No. 5), 1910. An Act to regulate the raising, mining and getting of mineral oils in Malawi. Mining Regulations, 1937, (1967) (under the Mining Act). The Mining Act, (No. 2), 1937. An act to amend and consolidate the laws as to mines and minerals. Includes prospecting, mining, use and protection of water. Subsidiary Legislation: Appointment of Commissioner, 1937; Areas excluded from prospecting, 1967; Authorization, 1938; Mining Ordinance, 1967 (1988).

Quarries Regulations, 1965 (Govt. Notice No. 184).

Explosives Regulations (Govt. Notice No. 105), 1968. Explosives Act, 1966 Commencement (GN No. 109) 1988.

Source: Johnson and Johnson. 1977.

Table 2. Water Resources

Waterworks Act, 1926. Provides for the establishment of Water-Boards and Water areas and the establishment and maintenance of waterworks in such areas.

Mud: River Waterworks Act, 1962. Provides for administration and alteration of the Mud: River water-area and Water-Board, etc.

Mud: River Waterworks (Amdt.) By-Laws. Govt. Notice No. 203, 1968 (also, 1967, 1966, 1965). Also 1950 Rate Rules, and Ordinance (Amdt.) 1965. (Order under this ordinance, 1965).

Nkhosakota District Council (Water Supplies Protection) By-Laws. GN. No. 251, 1967.

Blantyre Water Works Act. Includes prevention of pollution of gathering ground around water sources. (This is administered by the Blantyre Water Board. All other such legislation is enacted by Parliament.)

"WATER RESOURCES ACT, NO. 15 OF 1969."

ENACTED TO PROVIDE FOR THE CONTROL, CONSERVATION, APPOINTMENT AND USE OF THE WATER RESOURCES OF MALAWI, IT ESTABLISHES AND SPECIFIES THE POWERS AND DUTIES OF THE WATER RESOURCES BOARD, WHICH IS UNDER THE GENERAL SUPERVISION OF THE MINISTER OF NATURAL RESOURCES, AND IS ALSO RESPONSIBLE FOR ISSUING REGULATIONS FOR THE IMPLEMENTATION OF THE ACT, ARTICLES IN PARTS WRITTEN IN ENGLISH AND IN CHICHewa, AND FOR THE IMPLEMENTATION OF THE ACT, ACT OR OF ANY OTHER WRITTEN LAW, INTERFERES WITH OR AFFECTS THE FLOW OF OR POLLUTES OR BODIES ANY PUBLIC WATER, PENALTIES FOR SUCH OFFENSES, AND SUBJECTS TO BE APPLIED TO.

Sources: EPA. 1977.
Johnson and Johnson. 1977.

Table 3. Hazardous Substances

Noxious Weeds Act, 1935. Provides for eradication of noxious weeds subsidiary Legislation includes list of noxious weeds.

Fertilizers, Farm Feeds and Remedies Act (No. 12), 1970 (Regulations; 1970). Regulation, registration, restriction, sale and use of fertilizers, farm feeds and remedies, etc.

Radio-active Minerals Act, 1947. Regulates and controls prospecting and mining of radio-active minerals and their export, etc.

Pharmacy and Poisons Act, 1947. Makes better provision for the control of the profession of pharmacy and the trade in drugs and poisons, subsidiary Legislation: The Poisons List (1967); Poisons Rules (1942). Act amended 1965, various amendments.

Source: Johnson and Johnson. 1977.

Appendix IV

Vegetative Community Surveys

- Table 1. Grasses (Graminae), as observed in 1938
- Table 2. Wildflowers, 1975
- Table 3. Ferns, as observed in 1938
- Table 4. Some Edible Fungi, 1974

Table 1. Grasses (Graminae), as observed in 1938

Scientific Name
<u>Andropterum variegatum</u>
<u>Brachiaria brizantha</u>
<u>Digitana scalarum</u>
<u>Eragrostis aspera</u>
<u>E. weberae</u>
<u>E. castellaneana</u>
<u>Hyparrhenia cymbaria</u>
<u>H. nyassae</u>
<u>H. tamba</u>
<u>H. dissoluta</u>
<u>Melinis longicanda</u>
<u>Panicum maximum</u>
<u>Pennisetum polystachyon</u>
<u>Trychopteryx fructilosa</u>

Source: Pole Evans. 1948.

Table 2. Wildflowers, 1975

<i>Acalypha stuhlmannii</i>	<i>Casaba kirzii</i>	<i>Delphinium sp.</i>	<i>Galium stenophyllum</i>
ACANTHACEAE	CAESALPINIACEAE	<i>Desmodium repandum</i>	<i>Gardinia subcaulis</i>
<i>Achyrocline aspera</i>	CAMPANULACEAE	<i>Didymera leonotis</i>	<i>Geniosporum paludosum</i>
<i>Acidanthus equinoctialis</i>	CAPPARACEAE	<i>Dicoma anomala</i>	<i>Gentisea hispida</i>
(see <i>Gladiolus callianthus</i>)	CARYOPHYLLACEAE	<i>Dicoma sessiliflora</i>	GENTIANACEAE
<i>Acrocephalus callianthus</i>	<i>Cassia polytricha</i>	<i>Dierama pendulum</i>	GERANIACEAE
<i>Aeolanthus njassae</i>	<i>Cephalaria pungens</i>	<i>Dietes vegeta</i>	<i>Geranium nyasse</i>
<i>Aerva leucera</i>	<i>Ceratotheca sesamoides</i>	<i>Dipeadi sp.</i>	<i>Geranium vagans</i>
<i>Aeschynomene abyssinica</i>	<i>Ceropegia filipendula</i>	<i>Diplophium buehnerii</i>	<i>Gerbera ambigua</i>
<i>Aeschynomene schimperii</i>	<i>Ceropegia papillata</i>	DIPSACACEAE	<i>Gerbera viridifolia</i>
<i>Afronomea angustifolia</i>	<i>Chironia laxiflora</i>	<i>Disa concinna</i>	<i>Gerbera welwitschii</i>
<i>Agathisanthemum globosum</i>	<i>Chironia kerebii</i>	<i>Disa erubescens</i>	<i>Gerardiina angolensis</i>
<i>Albica nyikensis</i>	<i>Chlorophytum sp.</i>	<i>Disa hamatopetala</i>	GESNERACEAE
<i>Albica sp.</i>	<i>Cleome hirta</i>	<i>Disa hircicornis</i>	<i>Gladiolus atropurpureus</i>
<i>Alectra sessiflora</i>	<i>Clematis welwitschii</i>	<i>Disa ornithantha</i>	<i>Gladiolus callianthus</i>
<i>Aletris longifolia</i>	<i>Clematopsis scabrisifolia</i>	<i>Disa robusta</i>	<i>Gladiolus erectiflorus</i>
<i>Aloe buchananii</i>	<i>Clematopsis uhelensis</i>	<i>Disa saxicola</i>	<i>Gladiolus laxiflorus</i>
<i>Aloe maurii</i>	<i>Clerodendrum rotundifolium</i>	<i>Disa welwitschii</i>	<i>Gladiolus melleri</i>
<i>Aloe mzimba</i>	<i>Clerodendrum myricoides</i>	DIOSCOREACEAE	<i>Gladiolus natalensis</i>
AMARANTHACEAE	<i>Clerodendrum c. f. wildii</i>	<i>Dioscorea quartiniiana</i>	<i>Gloriosa superba</i>
<i>Amaranthus hybridus</i>	<i>Coccoloba adensis</i>	<i>Duportia dicerochila</i>	<i>Gloriosa virens</i>
AMARYLLIDACEAE	COMMELINACEAE	<i>Diosotis canescens</i>	<i>Glossostelma carsonii</i>
<i>Amphicarpa africana</i>	<i>Commelina africana</i>	<i>Diosotis debilis</i>	<i>Gnidia buchananii</i>
<i>Araucarybinum melanthioides</i>	<i>Commelina aspera</i>	<i>Diosotis melleri</i>	<i>Gnidia chrysantha</i>
<i>Asclepias cephalantha</i>	<i>Commelina diffusa</i>	<i>Diosotis zanzibariensis</i>	<i>Gnidia kraussiana</i>
<i>Asplenium hockii</i>	<i>Commelina neurophylla</i>	<i>Diosotis kilimandscharicus</i>	<i>Gonolobus boivinii</i>
<i>Asplenium welwitschii</i>	<i>Commelina zambesiaca</i>	<i>Drimia zambensis</i>	GUTTIFERAE
<i>Anisopappus latii</i>	COMPOSITAE	<i>Drosera madagascariensis</i>	<i>Habenaria gonatosiphon</i>
<i>Anomatheca grandiflora</i>	CONVOLVULACEAE	DROSERACEAE	<i>Habenaria macrostele</i>
<i>Antherotoma naudinii</i>	<i>Costus spectabilis</i>	<i>Dyschoriste hildebrandii</i>	<i>Habenaria pubipetala</i>
ARACEAE	<i>Crassocephalum rubens</i>		<i>Habenaria sp.</i>
<i>Artemesia mexicana</i>	<i>Crassula alba</i>	<i>Limilia javanica</i>	<i>Habenaria tentaculigera</i>
<i>Artemesia alata</i>	<i>Crassula argyrophylla</i>	<i>Erica johnstoniana</i>	<i>Habenaria walleri</i>
ASCLEPIADACEAE	<i>Crassula globularioides</i>	ERICACEAE	<i>Haemanthus multiflorus</i>
<i>Aster burceyanus</i>	CRASSULACEAE	ERIOCAULACEAE	<i>Hebenstretia dentata</i>
<i>Astripomoea malvaceae</i>	<i>Craterostigma lanceolatum</i>	<i>Enocaulon schimperii</i>	<i>Helichrysum brassii</i>
<i>Asystasia gangetica</i>	<i>Cinnam. pedicellatum</i>	<i>Eriosemum abyssinicum</i>	<i>Helichrysum flammeiceps</i>
<i>Athysa rosmarintolia</i>	<i>Crococmia aurea</i>	<i>Erlangea sp.</i>	<i>Helichrysum herbaceum</i>
<i>Azania garckeana</i>	<i>Crossandra greenstockii</i>	<i>Erythrocephalum zambesianum</i>	<i>Helichrysum lastii</i>
	<i>Crotalaria lachnorrhora</i>	<i>Furcraea undulata</i>	<i>Helichrysum nitens</i>
<i>Barlaria senensis</i>	<i>Crotalaria lanceolata</i>	<i>Eulophia coelogyssa</i>	<i>Helichrysum patulifolium</i>
<i>Barlaria spinulosa</i>	<i>Crotalaria pallida</i>	<i>Eulophia complanata</i>	<i>Helichrysum setosum</i>
BALSAMINACEAE	<i>Crotalaria sibirica</i>	<i>Eulophia evantha</i>	<i>Helichrysum whyteanum</i>
<i>Eccium obovatum</i>	CUCURBITACEAE	<i>Eulophia kirku</i>	<i>Limnolobos bracteosa</i>
<i>Berkheyia zeyheri</i>	<i>Cyanotis forcunda</i>	<i>Eulophia livingstoniana</i>	<i>Hesperantha petitiana</i>
<i>Bidens stepha</i>	<i>Cyanotis longifolia</i>	<i>Eulophia macrantha</i>	<i>Hewittia sublobata</i>
<i>Blaeria kuiserensis</i>	<i>Cyanotis speciosa</i>	<i>Eulophia orthoplectra</i>	<i>Hibiscus fuscus</i>
<i>Blepharis grandis</i>	<i>Cyanum adonense</i>	<i>Eulophia pavloviana</i>	<i>Hibiscus rhodanthus</i>
<i>Blophone sp.</i>	<i>Cynaglossum geometricum</i>	<i>Eulophia sp.</i>	<i>Hybanthus enneaspermus</i>
BORAGINACEAE	<i>Cynorkis kasnerana</i>	<i>Eulophia speciosa</i>	<i>Hypericophyllum scabridum</i>
<i>Borreria dibrachata</i>	<i>Cynorkis kirku</i>	<i>Eulophia thomsonii</i>	<i>Hypericum peplidifolium</i>
<i>Brachycorythus pleustophylla</i>	<i>Cyphia sp.</i>	<i>Eulophia walleri</i>	<i>Hypericum revolutum</i>
<i>Brachytelma togoense</i>	<i>Cyrtanthus breviflorus</i>	<i>Eulophia zeyheri</i>	HYPOXIDACEAE
<i>Buchnera hispida</i>	<i>Cyrtanthus welwitschii</i>	<i>Euphorbia depauperata</i>	<i>Hypoxis dregei</i>
<i>Buchnera pulchra</i>		<i>Euphorbia hirta</i>	<i>Hypoxis obtusa</i>
<i>Buchnera similis</i>		<i>Euphorbia zambesiana</i>	
<i>Bulbine abyssinica</i>	<i>Dasytachys campanulata</i>	EUPHORBIACEAE	<i>Impatiens gomphophylla</i>
<i>Bulbophyllum oxypterum</i>	<i>Datura innoxia</i>		<i>Impatiens hochstetteri</i>
CACTACEAE	<i>Delphinium dasycaulon</i>	<i>Floscopa glomerata</i>	<i>Impatiens richardsiae</i>
	<i>Delphinium leroyi</i>		

Table 2., continued

<i>Impatiens schulziana</i>	<i>Moraea</i> sp.	<i>Ruellia leptostachya</i>	TECOPHILAEACEAE
<i>Indigofera atriceps</i>	<i>Moraea textilis</i>	RANUNCULACEAE	<i>Tephrosia nyikensis</i>
<i>Indigofera dendroidea</i>	<i>Moraea thomsonii</i>	<i>Ranunculus racem</i>	<i>Thunbergia kirkiana</i>
<i>Insula glomerata</i>	<i>Mucuna poggei</i>	<i>Rhaphicarpa tubulosa</i>	<i>Thunbergia lancifolia</i>
<i>Iponomea alpina</i>	<i>Mucuna pruriens</i>	<i>Rhipsalis baccifera</i>	THYMELAEACEAE
<i>Iponomea pos-caprae</i>	<i>Murdannia simplex</i>	<i>Romulea campanuloides</i>	TILLACEAE
IRIDACEAE		ROSACEAE	<i>Trachymandra saltii</i>
<i>Isoglossa grandiflora</i>	<i>Nervilla</i> sp.	RUBIACEAE	<i>Trachycalymina cristatum</i>
	<i>Nesaea floribunda</i>	<i>Rubus ellipticus</i>	<i>Trichodesma hoodii</i>
<i>Jasminum meyeri-johannis</i>	<i>Nicandra physaloides</i>	<i>Ruellia prostrata sensu</i>	<i>Trichodesma physaloides</i>
<i>Jesticia striata</i>	NYMPHAEACEAE		<i>Trichodesma zeylanicum</i>
	<i>Nymphaea caerulea</i>	<i>Salvia coccinea</i>	<i>Trifolium simense</i>
<i>Kaempferia aethiopia</i>		<i>Satyrium anomalum</i>	<i>Tritonia laxifolia</i>
<i>Kaempferia deconi</i>	<i>Oberonia disticha</i>	<i>Satyrium atherstonei</i>	<i>Trochomeria macrocarpa</i>
<i>Kaempferia rhodesica</i>	OCHNACEAE	<i>Satyrium breve</i>	<i>Tulbaghia cameranii</i>
<i>Kaempferia rosea</i>	<i>Ochna macrocalyx</i>	<i>Satyrium bucharanii</i>	TURNERACEAE
<i>Kalanchoe lanceolata</i>	OLEACEA	<i>Satyrium neglectum</i>	
<i>Kniphofia grantii</i>	ONAGRACEAE	<i>Scabiosa austro-africana</i>	UMBELLIFERAE
<i>Kniphofia linearifolia</i>	ORCHIDACEAE	<i>Schwartzkopffia lastii</i>	<i>Utricularia livida</i>
<i>Kniphofia sp.</i>	<i>Orthosiphon allenii</i>	<i>Scilla bucharanii</i>	<i>Utricularia reflexa</i>
<i>Kniphofia splendida</i>	<i>Orthosiphon rubicundus</i>	<i>Scilla cordifolia</i>	
<i>Koeleria transvaalensis</i>	OROBANCIACEAE	<i>Scilla natalensis</i>	VELLOZIACEAE
<i>Kohoutia coccinea</i>	<i>Orobanchia minor</i>	<i>Scilla rigidifolia</i>	<i>Velloria sp. (see Xerophyta)</i>
<i>Kohoutia cuspidata</i>	<i>Osteospermum monocephalum</i>	SCROPHULARIACEAE	VERBENACEAE
	<i>Otomera elatior</i>	<i>Scutellaria paucifolia</i>	<i>Vernonia adoensis</i>
LABIATAE	OXALIDACEAE	<i>Sebaea grandis</i>	<i>Vernonia chloropappa</i>
<i>Lactuca calophylla</i>	<i>Oxalis chapmaniae</i>	<i>Sebaea longicaulis</i>	<i>Vernonia gerberiformis</i>
<i>Lactuca lasiorhiza</i>	<i>Oxalis corniculata</i>	SELAGINACEAE	<i>Vernonia petersii</i>
<i>Logania sphaerica</i>		<i>Selago thomsonii var thomsonii</i>	<i>Vernonia poskeana</i>
<i>Lochnera alata</i>	<i>Psycarpos lineolatus</i>	<i>Selago thyrsoidea</i>	<i>Vernonia superba</i>
<i>Lantana camara</i>	PAPAVERACEAE	<i>Sesamum angolense</i>	<i>Vigna pygmaea</i>
<i>Lapeirousia erythrantha</i>	PAPILIONACEAE	SOLANACEAE	<i>Vigna vexillata</i>
<i>Lapeirousia grandifolia</i>	<i>Parochetus communis</i>	<i>Solanum panduriforme</i>	<i>Viola abyssinica</i>
(see <i>Anomatitica grandiflora</i>)	<i>Pavonia columella</i>	<i>Sopubia ramosa</i>	VIOLACEAE
LENTIBULARIACEAE	<i>Pavonia patens</i>	<i>Sparmannia ricinocarpa</i>	
<i>Leucous decalenta</i>	<i>Pavonia urens</i>	<i>Sphenostylis marginata</i>	<i>Wahlenbergia virgata</i>
<i>Leuzia nyassae</i>	PEDALIACEAE	<i>Sphenostylis stenocarpa</i>	<i>Walleria mackenzii</i>
<i>Lichtfootia glomerata</i>	<i>Pelargonium luridum</i>	<i>Stathmostelma pauciflorum</i>	<i>Wormskoldia longipedunculata</i>
LILIACEAE	<i>Pentstemon schweinfurthii</i>	<i>Stathmostelma spectabile</i>	<i>Wurmbea tenuis</i>
<i>Liparis neglecta</i>	<i>Pentas geophila</i>	<i>Stenoglottis fimbriata</i>	
<i>Liparis nervosa</i>	<i>Pentas longiflora</i>	<i>Streptocarpus bucharanii</i>	<i>Xerophyta</i> sp.
<i>Lippia javanica</i>	<i>Physalis peruviana</i>	<i>Streptocarpus erubescens</i>	
<i>Lobelia blantyrnsis</i>	<i>Pimpinella huillensis</i>	<i>Streptocarpus goetzei</i>	ZINGERBERACEAE
<i>Lobelia intertexta</i>	<i>Platycoryne crocea</i>	<i>Striga asiatica</i>	
<i>Lobelia mildbruedii</i>	<i>Platycoryne mediocris</i>	<i>Striga gesnerioides</i>	
LORANTHACEAE	<i>Polycarpha eriantha</i>	<i>Striga pubiflora</i>	
<i>Loranthus albizziae</i>	<i>Polygala albida</i>	<i>Swerfia johannsdii</i>	
<i>Loranthus blantyrnsis</i>	<i>Polygala macrostigma</i>		
<i>Loranthus curviflorus</i>	<i>Polygala petitiata</i>		
<i>Lubisia octovalvis</i>	<i>Polygala virgata var. decora</i>		
LYTHRACEAE	POLYGALACEAE		
	<i>Polygonum strigosum</i>		
<i>Mezostyloma axillare</i>	<i>Polystachya johnstonii</i>		
MALVACEAE	<i>Polystachya s.p.</i>		
<i>Margarita rosea</i>	PROTEACEAE		
MELASTOMATACEAE	<i>Protea angolensis</i>		
<i>Mosselia foetida</i>	<i>Pycnostochys stuhlmannii</i>		
<i>Mosselia stellaroides</i>	<i>Pycnostochys urticifolia</i>		
<i>Moraea angusta</i>	(and variant)		
<i>Moraea schumperi</i>			

Source: Moriarty. 1975.

Table 3. Ferns, as observed in 1938

Scientific Name
<u>Asmunda regalis</u>
<u>Dryopteris thelypteris</u>
<u>Dryopteris</u> sp.
<u>Lonchitis pubescens</u>
<u>Nephrolepis cordifolia</u>
<u>Pelloea virides</u>

Table 4. Some Edible Fungi, 1974

GROUP	GENERA
Gill Fungi or Agarica	1. Agaricus 2. Amanita 3. Cantharellus 4. Lactarius 5. Leninus 6. Lepiota 7. Micropsalliota 8. Psathyrella 9. Russula 10. Termitomyces 11. Volvariella
Pore Fungi or Boletes	12. Gyroporus 13. Phacogyroporus 14. Phlebopus 15. Pulveroboletus 16. Strobilomyces 17. Suillus 18. Tubosaeta 19. Xerocomus
Other Types	20. Clavaria 21. Auricularia

Source: Williamson. 1974.

Appendix V

Wildlife Information

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|-------|----|------------------------------------------------------------------------------------------------------|
| Table | 1. | Vertebrates Listed by the IUCN |
| Table | 2. | List of Reptiles Collected by Stewart (1969) in Northern Malawi |
| Table | 3. | Annotated List of National Parks and Game Reserves |
| Table | 4. | Inventory of Natural Resources and Facilities in Kasungu, Lengwe, and Nyika National Parks in Malawi |

Table 1. Vertebrates listed by the IUCN. Mammalia (1978), Reptilia (1975)

BLACK RHINOCEROS

Diceros bicornis (Linnaeus, 1758)

Order PERISSODACTYLA Family RHINOCEROTIDAE

STATUS AND SUMMARY Vulnerable. Distribution now very sporadic in its African savanna habitats. Population thought to be anywhere between 10,000 and 30,000 with the minimum figure perhaps the more realistic. Decline attributed to poaching for its horn and habitat loss. Protected by law and occurs in national parks and reserves, although protection is often inadequate. Main conservation need is an effective ban on trade in rhino horn and particularly on its exportation to Asian countries.

DISTRIBUTION African savanna zone. Formerly widespread from South West Africa/Namibia and southwestern Cape Province north through Botswana, Rhodesia, Mozambique, Malawi, Zambia, Angola, Zaïre, Tanzania, Uganda and Kenya to Somalia, Ethiopia and the Sudan, thence westwards to the Central African Empire, northern Cameroon and Chad; also in Nigeria and further west, but no longer. In general, the species is still to be found over most of the extensive area indicated, but has been locally exterminated, with the survivors scattered in remnant populations, mostly in parks and reserves. For detailed accounts of distribution see (2, 13, 17, 20).

POPULATION Not known with any precision but probably 10,000-30,000 and everywhere depleted. The following rough estimates have been made: South Africa: 50 (14, 28); South West Africa/Namibia: 100 (28) or 'approximately 150 with more than 80 per cent in Etosha National Park' (18); Rhodesia: 1000 (28); Zambia: a 1975 report indicated the species was 'holding its own' and still common in the Lumanga Valley, where a 1973 UN/FAO survey had arrived at an estimate of 12,000 and an absolute minimum of 4000 (3); Tanzania: in the low thousands (28), 6-9000 (23), conservative estimate of 12,000 (19); Kenya: 1977/78 estimate of only 1800 (6), compared with 4500 in 1976 and 11,000 in 1968 (20), Tsavo National Park figures falling from 6000 in 1968 to 2500 in 1976 (20); Uganda: low hundreds (28), rare and possibly endangered (8); Sudan: on the verge of extinction (4), Central African Empire: at least 1000 (26); Mozambique: rare (5), in the low hundreds (28); Angola: threatened (5), in the low hundreds (28), in 1972 only reports were of probably less than 40 in the Parque Nacional do Iona and a small population in the Condo-Cubango controlled hunting areas (16); Somalia: in the tens (28); Rwanda: in the tens (28); Ethiopia: no confirmed sightings for at least five years although species may still survive in the proposed Omo National Park in Hago District (27); Cameroon: in the tens (28); Chad: about 25 (10); Zaire: possibly extinct, the Zaïrean National Institute for the Conservation of Nature having recently stated that none have been seen since 1954 (1); Malawi: threatened (5), in the tens (28); Botswana: rare (5), in the tens (28).

HABITAT AND ECOLOGY Transitional zone or ecotone between grassland and forest (24), preferably thick thorn bush or acacia scrub, but also open country and occasionally evergreen forest (28). The black rhino is a browser and lives on a variety of bushes and shrubs; it is usually inactive during the heat of the day (13, 24). The only stable social unit is the mother-child association (24). A call is produced by the female about every 2½-3½ years (24), the gestation period being approximately 15 months (9, 24).

THREATS TO SURVIVAL Poaching for its horn which is considered by many Asian peoples to have aphrodisiac properties. World demand for rhino horn has increased in the last few years and as a consequence the price has increased (13, 19). In Tanzania horn fetched U.S. \$45 per kilo in 1977 and has risen to \$250 in 1978 (15). From 1969-76, 11,900 rhino horns, representing approximately 8685 rhinos, were exported from Kenya (19, 20). Progressive deterioration and loss of habitat due to rapidly increasing human populations poses another grave threat to the rhino's future. In some areas e.g. Tsavo East National Park, habitat destruction by elephants, sometimes made worse by drought, has also been detrimental (8, 11).

CONSERVATION MEASURES TAKEN Listed in Appendix I of the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora, trade in it or its products therefore being subject to strict regulation by ratifying nations. Trade for primarily commercial purposes banned. Listed in Class B of the 1968 African Convention on the Conservation of Nature and Natural Resources, and as such may only be hunted or collected under special authorisation granted by the competent authority. Legally protected throughout its range and occurs in many national parks and reserves, but protection is often inadequate (28).

CONSERVATION MEASURES PROPOSED Effective protection against poaching. Control of trade in rhino horn. A ban on the import of rhino horn to Asian countries would be extremely beneficial to the species.

REMARKS For description of animal see (2, 7, 12, 13, 29). Groves lists 7 subspecies (12). In 1976, 74 males and 85 females were held in 70 zoo collections (41 bred in captivity) (22).

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CHEETAH

Acinonyx jubatus (Schreber, 1776)

Order CARNIVORA

Family FELIDAE

STATUS Vulnerable. Severely reduced and faces a prospect of increasing attrition and even more limited distribution as the human population expands into its favoured habitats. Even inside national parks and game reserves its prospects cannot be regarded as good.

DISTRIBUTION The African race, *A. j. jubatus*: south of the Sahara from Nigeria, Sudan and Somalia to southern Africa. At present, survives throughout much of its former range, but in much reduced numbers and seems to diminish even where protected in national parks and reserves. Its distribution is discontinuous and numbers vary from common to rare - or even absent in some areas where it was formerly common.(3) The Asiatic race, *A. j. venaticus* formerly occurred from Sind, Afghanistan and southern Russia westwards to Syria and Palestine, and thence (although some authors regard this as a separate race *A. j. hecki*) westwards across North Africa to Rio de Oro. Now known certainly only in Iran and on the Turkmen/Afghan border.(1; 4)

POPULATION The remaining African populations may total less than 15,000, within a probable range of 8000-25,000. Rough estimates of population sizes, based on informed local opinion and, for order of magnitude purposes only, indicate less than 2000 in Kenya, less than 200 in Uganda, less than 1000 in Tanzania, about 500 in Angola, less than 1000 in Zambia, 200 in Mozambique, 50 in Malawi, 2000 in Botswana, 400 in Rhodesia, 1500 in South West Africa, 700 in South Africa, less than 1000 throughout the Sahel zone, a few hundred in the savanna woodland zone of West Africa, rather more than 1000 in Sudan, around 1000 in Ethiopia, 300 or so in Somalia, and 300 or less in Zaïre. In rough terms, these figures almost certainly represent half the cheetah totals in Africa in 1960, and present figures could well be reduced by one half within another 10 years, perhaps by 1980, as a result of degradation or loss of habitat, and over-hunting, particularly by ranchers. Two animal dealers are believed to have caught 3000 cheetahs in Namibia since 1967, either for export to the world's zoos and safari parks or for translocation to other parks of Africa.(3; 5; 6) Iran: now estimated at more than 250 (E. Firouz 1974, pers. comm.)

HABITAT Open semi-arid grasslands (but seldom areas of tall grass) scrubland (occasionally quite dense) and various types of savanna woodland, in all cases essentially in association with medium or small-sized herbivores; exceptionally, forest margins but never forest itself. These habitats are being reduced by agriculture, degradation of rangelands and competition from domestic stock following upon increasing occupation by human communities. Loss and degradation of habitat and associated depletion of prey species have been the principal factors in the cheetah's decline.(3)

CONSERVATION MEASURES TAKEN Totally protected in almost every country except South Africa and Namibia, where it is still considered vermin (amending legislation pending). Ranching interests in Kenya, Tanzania, Zambia, Rhodesia and Angola, Namibia and South Africa, however, often destroy cheetah suspected of marauding livestock. The cheetah occurs in less than half the parks and reserves of Africa, and totals no more than 3000 animals in these protected areas. Moreover, when it is reduced to relict populations in isolation from each other, it becomes

singularly susceptible to disease, carnivore competition, shifts in prey community make-up, changes in vegetation configuration, and other natural limiting factors. In the main, its stability in protected areas shows a decline. Included in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973; trade in these animals between acceding nations is subject to severe restriction, trade for primarily commercial purposes is banned. The International Fur Trade Federation operated a three-year voluntary ban among its membership on the use of cheetah furs in 1971/74. The moratorium has worked moderately well in certain countries but has been widely disregarded in France, Italy, Spain, Scandinavia and Japan, where the demand for spotted fur has increased. Fully protected by law in Iran and the USSR, also in several reserves in Iran.

CONSERVATION MEASURES PROPOSED In terms of adaptability to change, the cheetah is one of the most vulnerable mammals. Conservation requirements, particularly outside parks and reserves, include more careful enforcement of protective laws and regulations, supervision of control so that only individual nuisance animals are removed when depredation occurs, control of over-grazing, and protection of wild prey species to reduce risk of predation on domestic animals. At the same time, the legitimate interests of ranchland communities in Africa should be recognized especially in those areas where pastoralists are attempting upgraded livestock husbandry and sometimes need to protect themselves in the event of undue predation.

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LEOPARD

Panthera pardus (Linnaeus, 1758)

Order CARNIVORA

Family FELIDAE

STATUS Vulnerable. Exterminated from large parts of its former range and depleted elsewhere. In some areas persecution and loss of habitat have taken a severe toll; at least five geographic races are threatened with extinction. But it is still widespread and maintaining good numbers, even increasing when not persecuted.

DISTRIBUTION Africa, and most of southern Asia from Turkey across the USSR and China to Korea, southwards to Arabia, Sri Lanka and Java. Now very local and rare in the desert areas of northern Africa and the Middle East. Much the most widespread of the felids; it is still common where prey is plentiful and protection assured, but has declined significantly and sometimes critically in about half of Africa. Exterminated from large parts of its former range in southern Africa, eastern Africa (notably Somalia and Ethiopia), and certain sectors of West Africa (especially in the coastal states). Depleted elsewhere, notably parts of Kenya, northern Tanzania, western Zambia, Ngamiland in Botswana, parts of Angola and Mozambique, also Chad, Mali and Senegal, and parts of the coastal states of West Africa.

POPULATION The leopard has had to give way to the advance of agriculture, deforestation, and depletion of its prey. In areas taken over for agriculture and stock-raising it has been either exterminated or depleted; but it is still widespread and maintaining good numbers where it persists. During the 1960's leopards were relentlessly trapped to meet a worldwide demand for their furs, and some populations were severely reduced. Efforts were made to correct this situation in several countries, notably Tanzania, Zambia and Botswana, e.g. through national predator management policies. In parts of southern Africa, the leopard is still considered vermin. (3-10) In moderately favourable habitats of the Zaire basin rain forest, it maintains a density of one to five or even three sq.km, and in optimal habitats even one to every sq.km. In the miombo woodland zone poaching pressure has varied greatly, and in large areas density rises to one animal per five sq.km. Because of tsetse fly, an dry and infertile soils, the miombo biome will be little affected by human activities except for the 10-15 per cent which constitute alluvial floodplains or "jambo" drainage systems. In South Africa thick thornbush in the Kruger Park and an abundance of impala prey permit densities of two leopard to three sq.km, possibly higher, in a few optimal localities, with an estimated minimum of 650 animals occupying the Park's 1,817,000 ha.

HABITAT Leopards inhabit a variety of biomes, from tropical rain forest, miombo woodland, savanna and rocky areas with heavy or scattered vegetation to the high, cold regions of the Himalayas, and the suburbs of Nairobi. In general, they are still widely found in all biomes of Africa south of the Sahara except for outright desert. 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.

CONSERVATION MEASURES TAKEN The leopard is widely protected as a game animal; where not protected, as in Nigeria, South Africa and Namibia, it is fully protected in parks and reserves. Where it is still not protected or where it preys on man's increasing herds of domestic stock it has been persecuted severely. International

action has been necessary to curb the drain on protected populations from illegal trapping and smuggling through these same countries into the world trade channels. The International Fur Trade Federation imposed a three-year voluntary ban on its members' use of leopard skins, from September 1971 to September 1974, which operated moderately well in the United Kingdom, marginally well in the Federal Republic of Germany and Switzerland, and scarcely at all in France, Italy, Spain, Scandinavia and Japan. In 1973, the demand for leopard skins was higher than ever before. Demand is perhaps twice as high in the principal consumer countries as five years ago, except for Japan which bought hardly any spotted furs in the late 1960's but is now buying heavily. Included in Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora, 1973; trade in these animals between acceding nations is subject to severe restriction, trade for primarily commercial purposes is banned.

CONSERVATION MEASURES PROPOSED The leopard should remain in Appendix I of the International Convention until the livestock industry in Africa and Asia is prepared to admit that the wildlife conservationists have an interest as legitimate as that of the ranching community. It should likewise be banned to the international fur trade until major producer and consumer countries indicate their readiness to accept controls to regulate a sustained-yield offtake. In Africa much severer penalties are required to deter poaching and preventive killing by livestock owners.

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NILE CROCODILE

Crocodylus niloticus Laurenti, 1768

Order CROCODYLIA

Family CROCODYLIDAE

STATUS Vulnerable. Numbers have been drastically reduced almost everywhere, largely during the last 20 years to supply leather to meet a world wide demand.

DISTRIBUTION All of Africa except the northwest and central Sahara; also Malagasy Republic but probably few in the Comores. Formerly along the south coast of the Mediterranean and east to Syria; also in the Seychelles. Now extinct in Cape Province and rare in Natal south of Tugela river, South Africa.

POPULATION Destruction of habitat, e.g. damming of rivers, draining of swamps and lakes, and other human pressures, militate against any rehabilitation of the species. All reports agree that populations can only be restored by stringent conservation measures. The total adult population in Natal is considered to be fewer than 800 animals.

HABITAT Large rivers and lakes, fresh water marshes, river mouths and estuaries, rarely in mangrove swamps.

BREEDING RATE IN WILD Extensive literature, not yet reviewed.

CONSERVATION MEASURES TAKEN In Appendix I of the Convention on International Trade in Endangered Species of Wild Fauna and Flora. Protected under class "B" by the African Conservation Convention of 1968. Protected in Uganda. However, in many African States the Nile Crocodile still has no legal protection, although it is legally protected in most National Parks and Game Reserves. Importation into the United States is prohibited under provision of the Endangered Species Act. South Africa has set up a research programme aimed at saving the species and restocking in areas where it has been exterminated.

CONSERVATION MEASURES PROPOSED Enforced protective legislation should be in operation throughout the entire geographical range. The collecting of crocodiles and their eggs should be controlled. State Game Departments should assume responsibility for controlling crocodile rearing and restocking projects. The IUCN Survival Service Commission, through its Crocodile Specialists Group, offers advice to interested Government agencies for such projects.

NUMBERS IN CAPTIVITY Still to be reviewed.

BREEDING POTENTIAL IN CAPTIVITY Rearing of Nile Crocodiles under controlled conditions has been shown to be quite feasible.

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AFRICAN WILD DOG

Lycaon pictus (Temminck, 1829)

Order CARNIVORA

Family CANIDAE

STATUS Depleted throughout its range. Vulnerable to continued persecution, shrinkage of range and reduction in numbers of natural prey.

DISTRIBUTION Throughout the savanna regions of Africa south of the Sahara, but now restricted to non-farming areas, west as far as the Ivory Coast and eastern border of Guinea then north to Mali, Niger and the southern parts of Algeria.(3)

POPULATION Depleted throughout its range. An IUCN survey in 1971 revealed a fair number outside the nature reserves in South Africa, about 140 in Kruger National Park, but none in Natal, the Orange Free State and most of the Cape Province, absent from the northern part of Namibia and depleted elsewhere; widely spread in Botswana, common in their national parks and outside; persisting only in game reserves in Rhodesia; good populations within the protected areas of Zambia but controlled outside owing to predation on the domestic animals of the increasing human population; rare in Tanzania even in national parks. Uncommon in the Ouedi Fime-Ouadi Achim faunal reserve in Chad.(4; J.E. Newby 1976, pers. comm.)

HABITAT Open or wooded savanna. Have been observed at the summit of Mt. Kilimanjaro and on Mt. Kenya above 2700 m.(2)

CONSERVATION MEASURES TAKEN They are relatively free from persecution in the large national parks and game reserves of most African states, but prejudice against them as killers still persists, and they are still sometimes killed in protected areas. They have full legal protection in Ethiopia, but enforcement is difficult owing to lack of conservation staff and problems of poor communications in remote areas.(1)

CONSERVATION MEASURES PROPOSED They should be given full protection of the law; control measures should be carefully supervised and eased wherever possible.

REMARKS They are primarily diurnal and hunt in packs of 6 to 20 - sometimes up to 40 in number. They are commonly regarded as harmful to game and domestic stock, but they play an important role in the balance of their environment.

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 3. Heester, J., and Setzer, H.K. (1971): *The mammals of Africa: an identification manual*. Smithsonian Institution Press, Washington D.C.
 4. Richter, W. von (1972): Remarks on present distribution and abundance of some South African carnivores. *J. S. Afr. Wildl. Mgmt. Assoc.* 2 (1): 9-16.

Table 2. List of reptiles collected by Stewart (1969) in northern Malawi

<i>Kinixys belliana belliana</i>	Hinged Tortoise
<i>Hemidactylus mabouia</i>	Tropical Gecko
<i>Lygodactylus angularis</i>	Angle-throated Gecko
<i>Lygodactylus capensis</i>	Cape Dwarf Gecko
<i>Agama cynogaster</i>	Tree Agama
<i>Chamaeleo dilepis</i>	Flap-necked Chameleon
<i>Chamaeleo goetzei nyikae</i>	Nyika Chameleon
<i>Brookesia nchisiensis</i>	Pitless Pygmy Chameleon
<i>Mabuya striata</i>	Two-striped Skink
<i>Mabuya varia varia</i>	Savanna Variable Skink
<i>Mabuya varia nyikae</i>	Nyika Variable Skink
<i>Riopa sundevallii</i>	Sundevall's Skink
<i>Ablepharus wahibergii</i>	Wahlberg's Snake-eyed Skink
<i>Cordylus cordylus</i>	Eastern Arboreal Girdled Lizard
<i>Gerrhosaurus flavigularis</i>	Yellow-throated Flated Lizard
<i>Chamaesaurus micropus</i>	Grassland Snake-Lizard
<i>Varanus niloticus</i>	Nile Monitor
<i>Typhlops schlegelii</i>	Common Blind Burrowing Snake
<i>Python sebae</i>	African Python
<i>Boaedon fuliginosus</i>	House Snake
<i>Mehelya nyassae</i>	Nyassa File Snake
<i>Pseudaspis cana</i>	Mole Snake
<i>Duberria lutrix</i>	Slug-eating Snake
<i>Telescopus semiannulatus</i>	Tiger Snake
<i>Psammophylax tritaeniatus</i>	Montane Grass Snake
<i>Psammophilis sibilans</i>	Sun Snake
<i>Psammophilis angolensis</i>	Angola Sun Snake
<i>Dischidodus typus</i>	Boomslang
<i>Calamelaps unicolor</i>	Purple-glossed Burrowing Snake
<i>Aparitactus capensis</i>	Centipede-eating Snake
<i>Naja nigricollis</i>	Black-necked Spitting Cobra
<i>Atractaspis bibronii</i>	Bibron's Burrowing Viper
<i>Causus defilippii</i>	Snouted Night Adder
<i>Bitis arietans</i>	Puff Adder

Table 3. Annotated List of National Parks and Game Reserves.

Source: IUCN. 1977.

MALAWI

AREA 118,484 sq. km (of which 24,406 sq. km are surface water)

POPULATION 4,039,583 (1966 census), 5,175,000 (1976 estimate)

PARKS AND RESERVES LEGISLATION The Land Act authorizes acquisition of customary land and its declaration as Public Land, which is then available for gazettelement as National Park. The Game Act (1954) prescribes a means for establishment of Game Reserves and identifies prohibited activities within these. The National Park Act (1969) provides the most comprehensive control of all other activities. No National Park may be reduced in area without a specific resolution of Parliament. A new comprehensive Flora and Fauna Act is in preparation, designed to supersede the Game Act and to make provision for stricter protection of wildlife resources outside the Parks.

PARKS AND RESERVES LEGISLATION Prior to 1973, National Parks and Game Reserves were the responsibility of the Game Division of the Department of Forestry and Game. In April 1973, as directed by the President, a separate Department of National Parks and Wildlife was established within the Ministry of Agriculture and Natural Resources and now manages four National Parks and four Game Reserves (one of the latter still at the proposal stage). It is also responsible for crop protection outside Reserves. A Principal Game Warden, responsible to the Secretary for Agriculture and Natural Resources, has three Regional Game Wardens serving under him. Each National Park is the responsibility of a Senior Game Warden. Other staff includes 15 Game Rangers and 100 Game Scouts.

ADDRESS Department of National Parks and Wildlife, P.O. Box 30131, Lilongwe 3, Malawi.

TOTAL AREA UNDER PROTECTION 1,042,601 ha (as per the following list, which includes substantial additions to areas 2.1, 2.2 and 3.1, which may not yet have been gazetted, and one Game Reserve which had not been finally approved and put on a legal footing when list was prepared).

PROTECTED AREAS

2.1	Nyika National Park	304,385 ha
2.2	Kasungu National Park	220,320 ha
2.3	Nkhosha Fata Game Reserve	175,960 ha
2.4	Vunza Marsh Game Reserve (proposed)	103,680 ha
3.1	Lungwe National Park	90,720 ha
3.2	Majete Game Reserve	64,000 ha
3.3	Liwonde National Park	58,616 ha
3.4	Mwabvi Game Reserve	25,920 ha

NAME Nyika National Park

TYPE NP BIOTIC PROVINCE 4.6.5

LEGAL PROTECTION Total

DATE ESTABLISHED 1 January 1966, under the Game Ordinance (also known as Malawi National Park).

GEOGRAPHICAL LOCATION About 480 km by road north of Lilongwe and 35 km west of Livingstonia on Lake Malawi; S 10°20'; E 33°30'

ALTITUDE 1600-2400 metres

AREA 304,185 ha (91,000 ha excluding areas of extensions, not yet gazetted).

LAND TENURE Government ownership

PHYSICAL FEATURES A roughly oval plateau with its long axis north-east to south-west, forming part of the eastern margin of the East African Rift Valley system. Four big rivers originate within the Park, which is one of the most important water catchments in the country, and drain into Lake Malawi, notably the North Rukuru river which enters the lake at Karonga. The temperature range is from below 0°C during cold months to over 21°C in the warm season. Mean annual precipitation is 1140 mm.

VEGETATION 90% of the plateau over 1800 m is covered by a short, open grassland dominated by *Loudetia simplex*, red cat grass *Themeda triandra* and *Eriotheca abyssinica*. An estimated 72-84% has relict evergreen forest, largely in valley beds and in hollows on valley slopes. Lower elevations are dominated by mixed *Brachystegia* woodland.

NOTEWORTHY FAUNA Mammals include one 'vulnerable' Red Data Book species, the leopard *Panthera pardus*, *Acinaca hyena burchellii*, warthog *Phacochoerus aethiopicus*, bushbuck *Tragelaphus scriptus*, eland *Lurotragus oryx*, grey duiker *Sylvicapra grimmia*, reedbuck *Pedicularis leucura* and reedbuck antelope *Hippotragus equinus*. Among the more unusual of the characteristic birds of the plateau are red-winged francolin *Fringilla leucinucha*, wattled crane *Grus carunculatus* and Jackson's bustard *Neotis jacksoni*.

ZONING The Park was zoned in the 1972/75 Master Plan on the basis of the five land-use categories developed by the Canadian National Parks Service: Class I special areas; Class II Natural environment areas; Class III lower category Natural environment areas; Class IV general outdoor recreation; Class V intensive use areas.

DISTURBANCES OR DEFICIENCIES The greatest threat is wild fire, originating outside and inside the Park, and the protection of the remaining forest patches from these annual burns is a critical problem.

TOURISM 120-1500 visitors annually; facilities include four chalets each with four single and six double rooms. Other 250 km of unpaved roads are for the most part passable throughout the year.

SCIENTIFIC RESEARCH A permanently established wildlife research officer.

SPECIAL SCIENTIFIC FACILITIES At present only an office with minimal equipment, reference books and specimens.

PRINCIPAL REFERENCE MATERIAL

HAYES, G. D. 1972. A Guide to Malawi's National Parks and Game Reserves. Government Printer, Zomba, Malawi, 118 pp.

LEMON, Paul C. 1964. Natural Communities of Malawi National Park (Nyika Plateau). Government Printer, Zomba, Malawi, 70 pp.

LEMON, Paul C. 1964. The Nyika Wildlife. Nyasaland Journal 17 (July): 19-41.

WYE COLLEGE, 1973. Final Report on area north of Nyika Plateau. Wye College, Malawi Project 1972, London University, 151 pp.

STAFF 16 full time and up to 250 labourers and artisans on a temporary basis.

BUDGET Equivalent of U.S. \$ 114,000 allocated by the Government for the development of the Park, in the financial year 1976/77, together with about U.S. \$ 50,000 for recurrent expenditure.

LOCAL PARK ADMINISTRATION Senior Game Warden, Private Bag Chilinda, P.O. Rompi or Principal Game Warden, Department of National Parks and Wildlife, P.O. Box 30131, Capital City, Lilongwe 2.

NAME Kasungu National Park

TYPE NP BIOTIC PROVINCE 4.6.5

LEGAL PROTECTION Total

DATE ESTABLISHED Established as a Game Reserve in 1930 and as a National Park in 1970.

GEOGRAPHICAL LOCATION West of Kasungu, about 175 km north of Lilongwe and extending towards the Zambian border: S 13°00'; E 33°10'

ALTITUDE 1000-1340 metres

AREA 220,320 ha (204,860 ha excluding approved extensions not yet gazetted)

LAND TENURE Government ownership

PHYSICAL FEATURES Relatively flat plateau embracing much of the higher catchment of the Shire River, which, together with its tributaries, is seasonal in flow but generally still has water in deeper pools during the dry months. Several prominent inselbergs break the general plateau surface. Climatically typical of Central Malawi with daily maximum often exceeding 29°C from September to May and daily minimum of 4°C-7°C from June to August. Annual rainfall averages 750 mm to 1000 mm but may vary significantly between years.

VEGETATION Open to fairly wooded country forming a mosaic of medium height 'miombo' woodland dominated by *Brachystegia* spp. and *Julbernardia globiflora*. A more varied woodland dominated by *Combretum* spp., *Acacia piliostigma* and *Terminalia* occurs along the Shire and some of its larger tributaries. A zone of moderately dense *Hyparrhenia* grassland also borders the rivers in places. The relatively infertile leached plateau areas up to 1200 m also have their own characteristic tree cover.

NOTEWORTHY FAUNA Wild dog *Lycan pictus* and cheetah *Acinonyx jubatus* are seen occasionally, the latter classified as a vulnerable species in the red data book. About 1500-2000 elephants *Loxodonta africana* are conspicuous and thought to be increasing. Black rhino *Diceros bicornis* (another 'vulnerable' species) is also seen occasionally. A wide variety of other wildlife typical of *Brachystegia* woodland includes many small mammals. Some 200 bird species have been recorded.

ZONING The entire area has been zoned using five land-use categories developed by the Canadian National Parks Service (see under Area 2.1).

DISTURBANCES OR DEFICIENCIES The eastern boundary adjoins an expanding project based on tobacco grown by smallholders. Conflicts with wildlife can be expected and a physical barrier will probably be needed in future. An additional strip of country along this border, for which application has been made, would help to mitigate the problem.

TOURISM Around 200 visitors annually. Accommodation for 36 people in a 12 tent-camp. Around 120 km of gameviewing tracks.

SCIENTIFIC RESEARCH None reported

LOCAL SCIENTIFIC FACILITIES None

PRINCIPAL REFERENCE MATERIAL

BAILEY, G.D. 1972. A guide to Malawi's National Parks and Game Reserves. Government Printer, Zomba, 118 pp.

HOSSHEAN, A.S. and HALL-MARTIN, A. 1969. Report to the Government of Malawi on a wildlife survey of Malawi. F.A.O., Rome (unpublished typescript).

SAVORY, R. and MOORE, G. 1972. A survey of the possibilities of sward improvement in Kasungu Game Park. Bunda College of Agriculture, University of Malawi.

STAFF 34 full time and up to 200 artisans and labourers on a temporary basis.

BUDGET Equivalent of U.S. \$ 78,500 allocated by the Government for development during the 1976/77 financial year, together with a similar amount for recurrent expenditure.

LOCAL PARK ADMINISTRATION Senior Game Warden, Kasungu National Park, P.O. Box 43, Kasungu or Principal Game Warden, Dept. of National Parks and Wildlife, P.O. Box 30131, Capital City, Lilongwe 3.

NAME Lengwe National Park

TYPE NP BIOTIC PROVINCE 4.6.5

LEGAL PROTECTION Total

DATE ESTABLISHED As Game Reserve in 1928, National Park in 1970.

GEOGRAPHICAL LOCATION About 80 km south of Blantyre, to the west of the Shire River: S 16°15'; E 34°45'

ALTITUDE 120-293 metres

AREA 90,720 ha (12,800 ha excluding approved extensions, not yet gazetted)

LAND TENURE Government ownership

PHYSICAL FEATURES Relatively flat region divided into three physiographic units: a gently undulating landscape sloping upwards to the watershed between the Shire and the Zambezi rivers; extensive plains of alluvial deposits; and seasonally flooded depressions known as "dambos" found along drainage lines. Daily temperatures often exceed 35°C during hot months and may occasionally be experienced throughout the year. Annual precipitation is extremely variable and its amount is not quoted.

VEGETATION Most of the Park is dominated by a combination of mopane woodland Colophonypernum mopane in the south, and 'miombo' woodland of Brachystegia and Combretum spp. in the north. The most important plant communities for wildlife are the dry deciduous thickets of Pterocarpus antunesianus and of Lecaniodiscus fraxinifolius, which form the habitat of the nyala antelope. Several sandstone ridges also occur and support a taller woodland of Pterocarpus angolensis and Acacia drepanolobium.

NOTEWORTHY FAUNA Mammals recorded include samango monkey Cercocebus mitis albogularis (or torquatus), spotted hyena Procyonictes, leopard Panthera pardus and bush pig Porcula porcus, the leopard a 'vulnerable' species according to the Red Data Book classification. The Park is one of two remaining habitats in Malawi in which the nyala antelope Tragelaphus angasi occurs. Other ungulates include bushbuck T. scriptus, greater kudu T. strepsiceros, buffalo Syncerus caffer, grey duiker Sylvicapra grimmia, and reedbuck Capreolus moschatus and impala Aepyceros melampus. A striking assemblage of lowland, tropical birds is an important element in the Park.

ZONING The Park has been zoned on the basis of the five land-use classes developed by the Canadian National Parks Service (see under Area 2.1).

DISURBANCE OR DANGERS The Park is nearly surrounded by agricultural schemes, including a major sugar production project. No buffer land exists between its boundary and these developed areas and 13 km of fencing has already had to be erected and more will be needed.

TREES No information

SCIENTIFIC RESEARCH None reported

SPECIAL SCIENTIFIC FACILITIES None

PRINCIPAL REFERENCE MATERIAL

- HABGOOD, F. 1965. The geology of the country west of the Shire River between Chikwawa and Chiromo. Geol. Survey Dept. Bull. No. 14
- HALL-MARTIN, A.J. 1970. Report on the Lengwe and Mvabwi Game Reserves in relation to land use of the Lower Shire Valley. Wildlife Research Unit, Kasongu (unpublished typescript).
- HAYES, G.D. 1972. A Guide to Malawi's National Parks and Game Reserves. Government Printer, Zomba, 118 pp.
- MOSSMAN, A.S. and HALL-MARTIN, A.J. 1969. Report to the Government of Malawi on a wildlife survey of Malawi. F.A.O., Rome (unpublished typescript).

STAFF 11 full time and up to 30 labourers and artisans on a temporary basis

BUDGET Equivalent of U.S. \$ 44,000, allocated by the Government for development of the Park in the financial year 1976/77, and a similar amount to cover recurrent expenditure.

LOCAL PARK ADMINISTRATION Senior Game Warden, Lengwe National Park, P.O. Box 25, Chikwawa or Principal Game Warden, Dept. of National Parks and Wildlife, P.O. Box 30131, Capital City, Lilongwe 3.

NAME Liwonde National Park

TYPE NP

BIOTIC PROVINCE 4.6.5

LEGAL PROTECTION Total

DATE ESTABLISHED May 1973

GEOGRAPHICAL LOCATION Upper Shire River plain and east of the river, 140 km north of Limbe: S 14°50'; E 35°20'

ALTITUDE 472-961 metres

AREA 58,616 ha

LAND TENURE Government ownership

PHYSICAL FEATURES The Park is geographically well defined, being bounded on the west by the Shire River and Lake Malombe and on the other sides by hills and ridges. The topography is a gentle slope upward from the river, broken only by two isolated groups of hills. Mean annual temperature on the plain is 13°C, with extremes of 7°C and 39°C. Annual precipitation averages 650-1150 mm.

VEGETATION There is a series of seven main vegetation types up the gradually rising slopes of the Shire River, the most widespread of which is mopane woodland *Colophospermum mopane*. The shore of Lake Malombe and the margins of the Shire have typical riverine and floodplain vegetation, intergrading with small areas of gallery forest, palm savanna of *Hyphaene ventricosa* and woodland savanna.

NOTEWORTHY FAUNA Early reports suggested an abundance of game in what is now the Park area but this is now much reduced, although nearly all species are still present. Lion *Panthera leo* are seen occasionally and moderate numbers of leopard *P. pardus*, together with elephant *Loxodonta africana*, a fairly good population of hippo *Hippopotamus amphibius*, greater kudu *Tragelaphus strepsiceros*, buffalo *Syncerus caffer*, waterbuck *Kobus ellipsiprymnus* and sable antelope *Hippotragus niger*. The leopard is classified as a vulnerable species by the Red Data Book, while the crocodile *Crocodylus niloticus*, of which few survive in the river, now rates as 'endangered'. Plans exist for reintroducing the race of wildebeest *Connochaetes taurina johnstonii*, which once used to be found in Malawi. A preliminary bird check-list includes 207 species, many of them aquatic.

ZONING This has been applied on the basis of the five land use categories developed by the Canadian National Parks Service (see Area 2.1 for details).

DISTURBANCES OR DEFICIENCIES Originally the Park only included the east bank of the Shire River, open and vulnerable to insensitive use. Steps have been taken to extend the boundary to include the entire river. Periodic closure of the Liwonde Barrage, immediately downstream of the Park, floods substantial areas for varying periods; the ecological impact of this is not yet clear.

TOURISM There are plans to open the Park, to which the public is not yet admitted, in the 1977/1978 season, on a daytime visit only basis.

SCIENTIFIC RESEARCH The Liwonde Research Project was set up in 1974 by the staff of the University of Malawi. The aim is a detailed survey of the plants and animals with description of the population dynamics of major components. Plans exist for an eventual Ecological Research and Monitoring field station.

SPECIAL SCIENTIFIC FACILITIES None to date

PRINCIPAL REFERENCE MATERIAL

- HALL-MARTIN, A.J. 1969. An ecological review of the Liwonde area, Kasupe District, and recommendations on the proposal to create a National Park in this area. Unpublished Departmental typescript.
- SWEENEY, R.C.H. 1959. A checklist of the mammals of Nyasaland. Nyasaland Society, Malawi.

STAFF 10 full time and up to 30 labourers and artisans on a temporary basis

BUDGET Equivalent of U.S. \$ 41,000 allocated by the Government for the financial year 1976/77 to the development of the Park, together with a similar amount to cover recurrent expenditure.

LOCAL PARK ADMINISTRATION Senior Game Warden, Liwonde National Park, Private Bag 18, Kasupe or Principal Game Warden, Dept. of National Parks and Wildlife, P.O. Box 30131, Capital City, Lilongwe 3.

Table 4. Inventory of Natural Resources and Facilities in Kasungu, Lengwe, and Nyika National Parks in Malawi.

Malawi Kasungu National Park Over 300 square miles; averaging about 3,300 ft above sea level. The terrain consists of gently rolling wooded hills with scattered rocky outcrops. The Dwangwa, Lingadzi, and Lifupa streams rise in the park, and their wide, grassy valleys make for easy game viewing. During the open season the area is dry and hot, with cold nights.

- 🦒 Animals are similar to those in the Luangwa valley, except for giraffe, which are absent here. So, too, are hippos, though in time they may be attracted to the dams being built within the park. Species you will see include: elephant, buffalo, zebra, hartebeest, kudu, eland, roan, sable, reed-buck, waterbuck, oribi, occasional rhino, lion, leopard, cheetah. Birds include many eagles, vultures, and carmine bee-eater.
- 🏠 At Lifupa game camp there are 12 rondavels with accommodation for 24 people; each has basic furniture, foam-rubber mattresses, bedclothing, mosquito nets, lamps, shower, basin, and wet kit each per night or K2 per adult, K1 children 2-12. There is a communal dining room with 2 refrigerators. The stores have basic dry goods and beer. The camp has a petrol pump.
- ✈️ There is an airfield for light aircraft near the camp. Nearest town is Kasungu, 30 miles away by good road; 96 miles farther away is the regional capital, Lilongwe, which has scheduled air connections. The park is also within easy reach of the Salima Lakeshore resort on Lake Nyasa.
- 🚗 Over 300 miles of good road run within the park. No foot travel is permitted. The best view is from the Black Rock summit.
- 📅 Open May 1 to December 31; best time June to October.
- 🕒 2-5 days.
- 🚗 K1.50 per car plus 25¢ per passenger. If you are carrying more than the licensed number of passengers, a double car fee is charged; if more than three times that, a party of 11 school-children in a Land Rover licensed car is treated a triple car fee is charged. Children under 2 are free but there are no cots at the camp.
- 🗨️ Always ask the guards which tracks are the best for viewing at the time of your visit; the best area changes from week to week.
- 👁️ A guard will gladly escort you to see the ancient rock paintings at Wangombe Rume hills.
- 📍 Assistant Commissioner of Forests, PO Box 65, Lilongwe/ tel: 2272.

Malawi Lengwe National Park about 50 square miles; about 2,000 ft above sea level. Much of the park is covered with large stands of dense thicket – cover for the rare and beautiful nyala antelope, here found at the northernmost end of its range in Africa. Elsewhere are open grassy glades and fairly thin deciduous forest. The nature of the country makes game viewing less easy than in other parks; but when you do see an animal it is that much more of a surprise and the circumstances that much more intimate. For many visitors this makes the park more, rather than less, rewarding.

- Nyala antelope, bushbuck, kudu, hartebeest, impala, duiker, Samango monkey, Livingstone's suni, buffalo; lion, leopard. Birds include bee eater, sunbirds, weavers, roller (especially lilac-breasted roller), parrots; ibis, marabou stork, and many other water birds; guinea fowl, francolin, fish eagle, vultures, bustard.
- At Lengwe game camp are two double-bedroomed guest houses, each with basic furniture, foam mattresses, mosquito nets, bedding, lamps, and verandahs. Ablutions are in a separate block. There is a fully-equipped kitchen and a cook's services are included in the charges. K2 per person, K1 per child between 2 and 12 (no cots provided), or K4 per room, or K8 per chalet. Servants sleep in a separate room for 10t. Car entrance fees are £1.50. Accommodation bookings confirmed in advance via United Touring Company Ltd, PO Box 176, Blantyre/tel: 30122 ext 27 and 28.
- The nearest town is Chikwawa (15 miles), where you can buy petrol and a very limited range of stores. Blantyre, the capital, serviced by scheduled international air connections, is only 31 miles farther north from Chikwawa, so the park is easily accessible to day visitors from Blantyre.
- A circular drive within the park feeds a number of crescent branches; total length of park roads is 40 miles. A short walk from the camp is a well-constructed hide (the only one in the park). It looks out over a much frequented waterhole.
- ☀ Open all year; best time June to October.
- 🕒 1-3 days.
- 🏠 As for Malawi Kasungu.
- 👮 Rangers will act as guides, free, unless other duties prevent them.
- ➔ **United Touring Company Ltd, PO Box 176, Blantyre/tel: 30122 ext 27 and 28.**

Malawi Nyika National Park 360 square miles; averaging 7,000 ft with occasional peaks rising to above 8,000 ft above sea level. The park is divided by ridge upon ridge of mountain grassland scored by deep valleys, clad here and there with evergreen forest. The views from some of the higher valley slopes are stupendous. The headwaters of three rivers – Chelinda, North Rukuru, and Runyina – are within its borders. Because of the altitude, nights can be very cold, with frosts in June to August.

- ♁ Eland, zebra, roan antelope, reedbuck, duiker, bushbuck, hyena, genet, serval, caracal, lion, leopard, cheetah. Near Chelinda camp there are three dams where there is good bird viewing. The park's most attractive species include secretary bird, wattled crane, and Stanley's bustard; other avifauna similar to Lengwe.
- ➔ At Chelinda camp 18 visitors can stay in 4 self-contained chalets, each with living room, fireplace, 2 or 3 double bedrooms, own shower and wc, fully-equipped kitchen. Room for 8 more visitors in 4 double bedrooms near the communal lounge (which has a large refrigerator). The camp has basic provisions; paraffin (kerosine), firewood, and the services of a cook are included in the basic charges, which are the same as for Malawi Lengwe.
- ✈ Nearest airport at Mzuzu, 117 miles away by surfaced road via Rumpi. There are two airfields for light aircraft near by, one at Katurubi, and one just over a mile from Chelinda camp.
- 🚗 106 miles of good road form a network that takes in most of the park. This is the only park in Malawi where you are allowed to tour on foot.
- ☀ Open all year; best time June to October.
- 🕒 3–5 days.
- 🏠 As for Malawi Kasungu.
- 🗨 Rangers will act as guides, free, unless other duties prevent them.
- 🕒 At Finigra, just outside the southern boundary, is an ancient rock shelter decorated with paintings made some 3,500 years ago. Park guards will take you to this historic monument.
- ➔ Director of Forests and Game, PO Box 182, Zomba/ tel: 797.

Appendix VI

Recent Foreign Assistance Programs

Table	1.	Foreign Assistance Projects	
Table	2.	Donor Commitments for Assistance, 1979	
Table	3.	Summary of Development Assistance Programs of U.S. Nonprofit Organizations, 1977	
Table	4.	Description of Development Assistance Programs of U.S. Nonprofit Organizations, 1977	
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Table 1. Foreign Assistance Projects, 1975 to 1978

Project(s)	Year	Nature of project(s)	Amount	Donor/sponsor
Nkula Falls II	1977	Hydroelectric plant		EEC
--	1975	General development	£11.2 million	Great Britain
17 projects	1977	General development	DM 108.1 million	West Germany
13 advisors	1978	General development	n.a.	Denmark
--	1977-78	General development	US\$ 18.7 million	Canada
--	1977	General development	n.a.	CDF (U.N.)
--	1978	General development	US\$ 175 million	World Bank
Lilongwe Land Development Programme	1968-78	Rural development	c. US\$ 24 million	IDA loans
Total assistance	1976	All projects	US\$ 258 million	All donors

Source: Arnold. 1979.

Table 2. Donor Commitments for Assistance

Donor	Major Types of Assistance	Amount (\$000)
ADF	District Water Supply Center and Road Construction	4,981.0
ADB	Lilongwe International Airport	9,085.0
British Government	General Development Grant	19,946.0
Germany	Road Construction, Hospitals, Market Centers and Electrical Power	26,956.0
CIDA	Railway Construction, Railway Equipment, Health Centers, Rural Water and NRDP	16,468.0
DANIDA	Medical Training School and Rural Water	962.4
IDA	Area Development, Road Construction and Education	18,555.0
Japan	Airport Buildings and Ancillary Equipment	6,250.0
Netherlands	Airport Equipment	1,600.0
OPEC Special Fund	Road Construction	1,894.0
SEB	Telecommunications	697.0
USAID	Road Construction	1,785.0
CDC	Sugar Project	4,792.0
CSC	Health Facilities and Rural Water	623.7
British Council	National Library Construction	12.5
EDF	Urban Water Supply, Road Construction and Rural Development	12,062.0
South Africa	National Park and Bureau of Standard	289.0
OSFAM	Agricultural Extension Facilities	22.0
Be. T Trust	University of Malawi and Hospitals Construction	216.5
IDRC	Rural Fuelwood Research	76.8
Total		121,394.0

Source: USAID, 1981a.

Table 4. Description of Development Assistance Programs
of U.S. Nonprofit Organizations, 1977

AFRICA EVANGELICAL FELLOWSHIP

P.O. Box 109, 18 Snowden Place, Glen Ridge, New Jersey 07028 -- (201) 748-9281

Address in Malawi: P.O. Box 14, Nsanje
Jaryl A. Ring, Field Director

EDUCATION: Operates a Bible College with 25 students which includes a three year course in English and Chichewa; operates one residential school for the blind which uses the standard school syllabus and has 40 children enrolled; operates nine lower primary schools with 13 teachers and 425 pupils.

MEDICINE & PUBLIC HEALTH: Operates two dispensaries at bush stations.

PERSONNEL: 9 U.S. volunteers (4 nurses, 5 teachers); 23 local (22 teachers, 1 midwife).

PROGRAM INITIATION: 1910.

COOPERATING GOVERNMENT & ORGANIZATION: Government of Malawi (blind school), Christoffel Blindemission.

(Program information received June 1977)

THE AFRICAN-AMERICAN INSTITUTE

833 United Nations Plaza, New York, New York 10017 -- (212) 949-5616

Address in Malawi: P.O. Box 30081, Blantyre
Mrs. Leona E. Chilemba, Program Representative

EDUCATION: As part of the African Graduate Fellowship Program (AFGRAD) provides a very limited number of awards to students from Malawi for graduate study in the United States.

(Program information received September 1977)

AFL-CIO (AMERICAN FEDERATION OF LABOR-CONGRESS OF INDUSTRIAL ORGANIZATIONS)

African-American Labor Center (AALC)
145 East 46th Street, New York, New York 10017 -- (212) 697-0404

Program in Malawi administered from regional office in Kenya:

P.O. Box 42316, Nairobi
Tel. 334-107
John Gould, Regional Representative

The purpose of the program in Malawi is to assist the Trades Union Congress of Malawi; (TUCM) and its affiliated trade unions to develop viable programs and effective, free, democratic and responsible organizations capable of representing the legitimate interests of workers and of contributing to the social and economic development of Malawi.

COMMUNITY DEVELOPMENT: Provides basic support and assistance to a small but growing trade union movement, and provides financial help and technical assistance for the process of leadership development within the TUCM.

EDUCATION: At the request of the TUCM, the AALC provides technical instruction and financial assistance to trade union education seminars.

PERSONNEL: U.S. short term instructors as needed, 2 local.

COOPERATING ORGANIZATION: Trades Union Congress of Malawi.

(Program information received June 1977)

AMERICAN LEPROSY MISSION, INC.
1262 Broad Street, Bloomfield, New Jersey 07003 -- (201) 338-9197

MEDICINE & PUBLIC HEALTH: Provides financial support for the leprosy control project at Likwani-Zumbo-Mankhosi, which serves an area of approximately 1,000 square miles. The center, which emphasizes outpatient treatment, includes a 20-bed hospital, temporary housing facilities for 10 patients, five subclinics and an outpatient program in surrounding areas served by cycle and landrover. ALM support contributes to medical and surgical treatment, rehabilitation, case finding surveys, provision of food and clothing and vehicle maintenance.

PROGRAM INITIATION: 1974.

FINANCIAL DATA: Expenditures for CY 1976: \$6,943
Budget for CY 1977: 5,000.

COOPERATING ORGANIZATIONS: Fama Pereo, Canada (general financial support); British Leprosy Relief Association contributes funds and serves as coordinator of the project.

(Program information received June 1977)

SISTERS OF CHARITY OF CINCINNATI
Mount St. Joseph, Ohio 45031 -- (513) 244-4200

Address in Malawi: P.O. Box 14
Muona, Charomo
Sister Ruth Jonas

EDUCATION: Provides fundamental education for children and adults in Muona.

SOCIAL WELFARE: Provides individual and family counseling and guidance and occasional assistance in meeting material needs of the local population.

PERSONNEL: 2 U.S.

PROGRAM INITIATION: 1975.

(Program information received October 1977)

DIRECT RELIEF FOUNDATION
404 East Carrillo Street, Santa Barbara, California -- (805) 966-9149
Mailing Address: P.O. Box 1319, Santa Barbara, California 93102

EQUIPMENT & MATERIAL AID: Through the Self Help to Health Program supplies donated pharmaceuticals, medical supplies and equipment to needy institutions upon request. In FY ending 9/30/76 made donations with a total value of \$9,112.

MEDICINE & PUBLIC HEALTH: Supplied a physician through the Aesculapian International Program who works in Likuni Hospital, Lilongwe.

PERSONNEL: 1 U.S. volunteer physician.

PROGRAM INITIATION: 1968.

FINANCIAL DATA: Value of medical services and donations for

FY ending 9/30/76: \$9,112 TOTAL

Medical Services - 6,000

Medical donations - 3,112.

(Program information received June 1977)

+ **MAP INTERNATIONAL**

327 Gunderson Drive, Carol Stream, Illinois -- (312) 653-6010
Mailing Address: P.O. Box 50, Wheaton, Illinois 60187

EQUIPMENT & MATERIAL AID: Makes shipments of donated medicines and hospital supplies in response to the requests of missionary doctors.

FINANCIAL DATA: In FY ending 9/30/76, sent 106 pounds of medicines and supplies with a value of \$1,092.

(Program information received September 1977)

MEDICAL MISSION SISTERS

Society of Catholic Medical Missionaries, Inc.
8400 Pine Road, Philadelphia, Pennsylvania 19111 -- (215) 742-6100

Address in Malawi: P.O. Box 387, Blantyre
Tel. 32876
Sister Yolanda Durian, District Superior

U.S. Sector provides funds and occasionally personnel in support of the African Sector which conducts the following program:

MEDICINE & PUBLIC HEALTH: Provision of preventive health care and health education with dispensaries, maternity centers, mobile clinics, and training of nurses, midwives (enrolled and state registered level), and medical assistants; teaching of homecrafts; conducting leprosy control and youth work at both Phalombe Hospital and Kasina Health Center. New out-stations are developing from the center in Kasina and local people are playing an active role in the actual work. One Sister trains ex-leprosy patients as laboratory technicians in a government leprosy project in Lilongwe. Also, a Sister assists the Private Hospital Association of Malawi (PHAM).

FUTURE PLANS: Are in process of localization, and role of Sisters is changing, becoming less defined and of a supportive nature.

PERSONNEL: 23 international (21 Netherlands including nurses, lab technicians, midwives; 1 West Germany, nurse; 1 Philippines, pharmacist).

PROGRAM INITIATION: 1958.

FINANCIAL DATA: Expenditures for FY 1976: \$ 6,000 including allocation for Maternal-Child Nutrition Project in Phalombe and Kasina.

Budget for CY 1977: \$11,000 TOTAL

Phalombe Project - \$10,000
Training of ex-leprosy patients - 1,000.

COOPERATING GOVERNMENT & ORGANIZATIONS: Government of Malawi, Ministry of Health; Archdiocese of Blantyre; Archdiocesan Medical Board; Private Hospital Association of Malawi.

(Program information received August 1977)

MEDICAL MISSIONARIES OF MARY, INC.

U.S. Foundation
1 Arlington Street, Winchester, Massachusetts 01890 -- (617) 729-3610

Address in Malawi: St. John's Hospital, Mzuzu

The U.S. branch provides financial support to the following program of the international organization:

MEDICINE & PUBLIC HEALTH: Operates St. John's Hospital, a 100-bed full medical and surgical general hospital with a nursing school, a children's section and an isolation block in Mzuzu.

PERSONNEL: 1 U.S. (hospital administrator), 14 international (European) including 4 volunteers.

PROGRAM INITIATION: 1961.

(Program information received September 1977)

+ MENNONITE CENTRAL COMMITTEE

21 South 12th Street, Akron, Pennsylvania 17501 -- (717) 859-1151

Address in Malawi: Kongva C.C.A.P., P.O. Dowa
Robert and Judy Herr

EDUCATION: Provides secondary school teachers who are assigned through the Ministry of Education. Two teachers are currently assigned in Lilongwe, two in Ekwendent and one in a girls' school in Mkhata Bay.

PERSONNEL: 5 U.S. teachers.

PROGRAM INITIATION: 1962.

FINANCIAL DATA: Expenditures for FY ending 11/30/76: \$27,523
Budget for FY ending 11/30/77: 29,000.

COOPERATING GOVERNMENT: Government of Malawi, Ministry of Education.

(Program information received June 1977)

MISSIONARY SISTERS OF OUR LADY OF AFRICA
3333 16th Street, N.W., Washington, D.C. 20011 -- (202) 882-3068

Address in Malawi: Box 212, Lilongwe
Tel. 2275
Sr. Felicia Nowak, S.A.

The U.S. Headquarters provides support and personnel to the following programs of the international organization:

EDUCATION: Operation of a secondary boarding school for 240 girls in Likuni, a junior secondary school (first 2 years of secondary school) for 60 girls in Mkhamenya. Operation of a teacher training college (2-year course for elementary school teachers) in Bembeke and sponsorship of its demonstration primary school for about 120 students. A 6-month course for married women is conducted in homecraft centers in Lilongwe, Dedza and Madisi including courses in home management, child care, sewing, cooking and hygiene. Operates a literacy school and a center to promote local crafts in Likuni.

FOOD PRODUCTION & AGRICULTURE: Provision of personnel to assist in developing agricultural projects in Likuni.

MEDICINE & PUBLIC HEALTH: Operation of a medical center in Likuni with 3 doctors, 1 dentist, X-ray and laboratory facilities, and training for nurses, midwives and lab technicians. Maintenance of health centers with bed facilities (but no resident physicians) at Mua, Ula and Mkhamenya as well as a leprosy control unit at Mua. Provision of a medical team giving health instruction and physical examinations at government-organized under-5 clinics in Likuni and Mua.

PERSONNEL: 3 U.S., 5 international, local staff and leadership.

PROGRAM INITIATION: 1911.

FINANCIAL DATA: Expenditures by the U.S. Headquarters for CY 1976: \$30,000.

COOPERATING GOVERNMENT: Government of Malawi.

(Program information received June 1977)

NATIONAL BAPTIST CONVENTION, U.S.A., INC.
Foreign Mission Board
701 South 19th Street, Philadelphia, Pennsylvania 19146 -- (215) 735-7868

Supports the programs of the African Baptist Assembly of Malawi, Ltd. including:

EDUCATION: Operation of one elementary and one secondary school in Chiradzalu.

MEDICINE & PUBLIC HEALTH: Operation of two small hospitals (one for men, one for women) in Chiradzalu.

PROGRAM INITIATION: 1900.

(Program information received September 1977)

NEAR EAST FOUNDATION
54 East 64th Street, New York, New York 10021 -- (212) 834-3500

Address in Malawi: Bunda College of Agriculture
P.O. Box 219, Lilongwe
Dr. James I. McNitt

FOOD PRODUCTION & AGRICULTURE: Assist in developing small livestock projects and programs to encourage small farm holders to adopt the recommended technology which will contribute to the production and consumption of additional protein.

PERSONNEL: 1 U.S. (animal husbandry specialist).

PROGRAM INITIATION: 1970.

FINANCIAL DATA: Expenditures for FY ending 6/30/77: \$30,800
Budget for FY ending 6/30/78: 9,500.

COOPERATING GOVERNMENT: Government of Malawi.

(Program information received June 1977)

OPTICW, INC.
3502 Hancock Street, P.O. Box 81122, San Diego, California 92138 -- (714) 599-1531

MEDICINE & PUBLIC HEALTH: Recruits volunteer medical professionals for short-term and long-term assignments with requesting institutions. Short-term volunteers often pay their own travel expenses with room and board usually provided by the requesting institutions. For long-term placements, the institution usually provides salary, housing and/or travel expenses. In CY 1976 placed a general surgeon with the Private Hospital Association of Malawi, Blantyre.

(Program information received September 1977)

ST. PATRICK'S MISSIONARY SOCIETY, U.S. Province
70 Edgewater Road, Cliffside Park, New Jersey 07010 -- (201) 943-6575

Address in Malawi: St. John's, Mzambazi
P.O. Eutini
Rev. James Anthony Byrne, Regional Representative

The U.S. Province provides financial assistance to the following programs of St. Patrick's Missionary Society of Ireland.

EDUCATION: Operates a homecraft center in Mzimba which provides instruction in home economics and child care.

MEDICINE & PUBLIC HEALTH: Operates a mobile clinic serving the Mzimba area.

PERSONNEL: 12 international (Ireland), 70 local.

PROGRAM INITIATION: 1970.

(Program information received September 1977)

+ SEVENTH-DAY ADVENTIST WORLD SERVICE, INC.
6840 Eastern Avenue, N.W., Washington, D.C. 20012 -- (202) 723-0800

Address in Malawi: P.O. Box 951, Blantyre
F. E. Wilson, Director

MEDICINE & PUBLIC HEALTH: In CY 1976 donated equipment and material such as clothing, medical and relief supplies in the amount of \$8,976 to the Malamula Hospital and Leprosarium in Makwasa.

(Program information received July 1977)

SOUTHERN BAPTIST CONVENTION
Foreign Mission Board
1806 Monument Avenue, Richmond, Virginia 23230 -- (804) 353-0151

EDUCATION: Operates a kindergarten with 45 enrolled.

FOOD PRODUCTION & AGRICULTURE: Supplies an agricultural worker in Balaka.

MEDICINE & PUBLIC HEALTH: Operates 3 clinics in the Salima area which served a total of 36,071 out-patients in 1976.

PERSONNEL: 29 U.S. (includes 1 teacher, 8 medical staff, 1 community center staff, 1 agricultural worker) local staff includes 1 teacher.

(Program information received October 1977)

UNITED METHODIST COMMITTEE ON RELIEF
475 Riverside Drive, New York, New York 10027 -- (212) 678-6161

COMMUNITY DEVELOPMENT: In CY 1976 made grant of \$20,000 to the Christian Service Committee Development Program for a program of integrated development including agriculture, health, education and urban development.

PROGRAM INITIATION: 1976.

COOPERATIVE ORGANIZATIONS: Christian Council of Malawi, UNICEF, World Council of Churches.

(Program information received June 1977)

VERONA FATHERS (SONS OF THE SACRED HEART)
2104 St. Michael Street, Cincinnati, Ohio 45206 -- (513) 921-4400

Address in Malawi: Catholic Parish
P.O. Box 42, Lilongwe
Tel. Blantyre 31905
Rev. Rodriguez B. Jaime

EDUCATION: Operate a regular 2-year training course in hygiene, cooking, sewing, child-care, etc. at the Leadership Training Center of the local church in Phalombe with 25 families attending. Domestic science courses are offered to village girls at the missions in Chimbula and Mulonga. Teach hygiene courses to 50 village girls at Nangombe while other mission staff teach crafts, cooking, etc.

MEDICINE & PUBLIC HEALTH: Cooperate with local Sisters in running a clinic/dispensary in Mulonga and give assistance to the Mission Hospital at Phalombe.

(Program information received July 1977)

WHITE FATHERS OF AFRICA
Provincial Office,
777 Belvedere Avenue, Plainfield, New Jersey 07067 -- (202) 561-3077

Address in Malawi: Muzu Technical School, P.O. Box 37, Muzu
Rev. Arthur Chisason, W.F.

COMMUNICATIONS: Provided \$5,000 for pick-up truck for Likuni Press & Publishing House.

CONSTRUCTION, HOUSING & PLANNING: In CY 1977, provided financial assistance for construction of schools including: \$11,000 for a staff house at Likuni Girls' Secondary School, \$5,000 for Likuni Primary School, \$6,000 for Center for Retreats and Sessions at Lilongwe, and \$1,500 for Junior High School Seminary for 150 students at Kasina, Dedza.

EDUCATION: Provided \$5,000 to supply transportation for the Principal of the Junior High School Seminary at Male, Lilongwe; provided \$2,500 to supply transportation for the Principal of the Junior High School Seminary at Kasina, Dedza; provided \$1,400 for film projector for Likuni, Lilongwe Boys' Secondary School. An American White Father is presently teaching in the senior section of the Catholic Major Seminary in Zomba and will possibly join the teaching staff of the University of Malawi. Two American White Fathers are on the staff of the Technical School at Muzu, which offers courses in English, mathematics, agriculture, carpentry, brick-laying and metal work. Used library books (approximately 12,000 volumes) were shipped from the U.S. at a cost of \$1,200 and were supplied to libraries of secondary schools and colleges throughout Malawi.

FOOD PRODUCTION & AGRICULTURE: An American is stationed with a team of local workers at Kachebere Major Seminary, Mchinji, a college-level school of technology for 150 Malawian students where he is in charge of maintenance and of a farm which makes the seminary practically self-sufficient with regard to foodstuffs.

INDUSTRIAL DEVELOPMENT: An American is in charge of the diocesan garage and metal shop at Likuni, Lilongwe. Together with two teams of six Malawian workers each, he provides service for the fleet of cars and trucks (roughly 50 units) for the Diocese of Lilongwe and repairs water pumps and maize mills in local institutions. The teams also provide the structural steel needed for the roofs of schools, churches and hospitals being built in the Lilongwe and Dedza Dioceses. To provide transportation so these workers could reach their work, \$6,500 was sent from the U.S.

SOCIAL WELFARE: Sent \$700 to provide transportation for a Sister doing casework and counseling in CHIMBU CHITWA, Lilongwe.

PERSONNEL: 3 U.S.; 142 International (51 Canada, 91 Europe).

PROGRAM INITIATION: 1940.

FINANCIAL DATA: Expenditures for FY ending 5/1/77: \$8,000. Additional funds from the United States have been channeled through Society headquarters in Rome for which figures are not available.

(Program information received July 1977)

Source: TAICH. 1977.

Table 5. Recent U.S. AID Projects

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*                                     PART I - PROJECT DESIGN INFORMATION                                     *
* COUNTRY/BUREAU: MALAWI                                                    PROJECT: 6120153 SUB-PROJECT: 01 *
* PROJECT TITLE: MALAWI LAKE SHORE ROAD, PHASE II (CONST)                 INITIAL FY: 66   FINAL FY: 66   *
* LOAN(L)/GRANT(G): L              APPROPRIATION SYMBOL: DL                ESTIMATED BUDGET($000): 6,848 *
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PROBLEM:

THE LAKE MALAWI REGION IS UNDERDEVELOPED DUE TO THE POOR ROADS THAT JOIN IT TO THE REST OF THE COUNTRY. ALTHOUGH THE GOVERNMENT OF MALAWI IS INVOLVED IN AN INTERNATIONAL EFFORT TO CONSTRUCT AN ALL WEATHER NORTH-SOUTH HIGHWAY ALONG THE LAKE'S WESTERN SHORE, IT REQUIRES FOREIGN (US) ASSISTANCE TO COMPLETE TWO MAJOR LINKS OF THIS ROAD.

STRATEGY:

THREE YEAR PROJECT CONSISTS OF LOAN TO GOVERNMENT OF MALAWI TO PROVIDE FOREIGN EXCHANGE FOR ROAD CONSTRUCTION. GOM PROVIDES LOCAL COSTS, AND MAY IMPLEMENT CONSTRUCTION THROUGH ITS MINISTRY OF PUBLIC WORKS.

SUMMARY:

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LOAN TO GOVERNMENT OF MALAWI WILL SUPPORT FOREIGN EXCHANGE COSTS OF MATERIALS AND SERVICES AND A PORTION OF THE LOCAL COSTS INVOLVED IN CONSTRUCTION OF TWO MAJOR ROAD LINKS (126 MILES) ALONG THE WESTERN SHORE OF LAKE MALAWI. PROJECT FORMS PART OF A LARGER SCHEME TO LINK ZOMBA IN THE SOUTH WITH THE NORTHERN PART OF THE COUNTRY VIA A LAKE SHORE ROUTE. WORLD BANK AND FEDERAL REPUBLIC OF GERMANY ARE FINANCING OTHER SEGMENTS. 90 MILE BALAKA-SALIMA ROAD WILL RUN NORTH-SOUTH, PARALLEL TO AND WEST OF THE EXISTING RAILROAD. CONSTRUCTION WILL REPLACE SUB-STANDARD SEASONAL ROAD WITH AN ENGINEERED ALL-WEATHER ROAD. CONSTRUCTION WILL BE TO MALAWI CLASS I DESIGN STANDARDS, CONSISTING OF A 38 FOOT EMBANKMENT WITH A SIX INCH GRAVEL WEARING SURFACE AND A 22 FOOT CARRIAGEWAY. ROAD WILL BE ADAPTABLE TO RESURFACING AT A LATER DATE TO PROVIDE A HARD SURFACE CARRIAGEWAY WITH TWO FIVE FOOT SHOULDERS. ROAD WILL REQUIRE 9 TWO-LANE BRIDGES OVER 20 FEET IN LENGTH. HUA MISSION-MONKEY BAY SECTION (36 MILES) WILL EXTEND FROM HUA, ON THE BALAKA-SALIMA ROAD, TO A JUNCTION 10 MILES SOUTH OF MONKEY BAY ON THE MONKEY BAY-FT JOHNSON ROAD. EXCEPT FOR A 12 MILE STRETCH, BETWEEN HUA AND SOSOLU, ROAD WILL REPLACE LOW QUALITY DISTRICT ROADS. DESIGN IS TO MALAWI CLASS III STANDARDS, CONSISTING OF A 30 FOOT EMBANKMENT WITH A SIX INCH GRAVEL WEARING SURFACE AND TWO THREE-FOOT SHOULDERS. TWO MAJOR BRIDGES WILL BE REQUIRED. CONSTRUCTION, IF BIDS FALL WITHIN COST ESTIMATES, WILL BE PERFORMED BY A QUALIFIED US FIRM. IF NO RESPONSIVE BIDS ARE RECEIVED, CONSTRUCTION BY FORCE ACCOUNT (IE, BY THE GOM'S MINISTRY OF PUBLIC WORKS, UTILIZING ITS OWN PERSONNEL) WILL BE CONSIDERED. IN THE LATTER CASE, EXTERNAL ASSISTANCE WILL BE REQUIRED TO PROVIDE EQUIPMENT, MATERIALS, AND SUPERVISORY PERSONNEL. IN ADDITION TO LINKING NORTHERN AND SOUTHERN MALAWI, PROJECT WILL HAVE THE EFFECT OF INCREASING ACCESS TO A 3200 SQUARE MILE AREA WHICH IS CURRENTLY UNDERPOPULATED AND LITTLE FARMED (ONLY 20% OF ARABLE LAND UNDER CULTIVATION). IN ADDITION, ROAD LINK TO MONKEY BAY IS EXPECTED TO BOOST TOURISM IN THAT AREA.

GOALS:

ALL REGIONS OF MALAWI UNIFIED BY A DEPENDABLE ROAD SYSTEM.

PURPOSE: EFFECTIVE TRANSPORTATION CORRIDORS ESTABLISHED ALONG WESTERN SHORE OF LAKE MALAWI.

OUTPUTS:

1.90 MILE BALAKA-SALIMA ROAD CONSTRUCTED TO MALAWI CLASS I DESIGN STANDARDS. 2.9 BRIDGES CONSTRUCTED ALONG BALAKA-SALIMA ROUTE. 3.36 MILE HUA MISSION-MONKEY BAY ROAD CONSTRUCTED TO MALAWI CLASS III DESIGN STANDARDS. 4. TWO MAJOR BRIDGES CONSTRUCTED ALONG HUA-MONKEY BAY ROUTE.

 * PART 1 - PROJECT DESIGN INFORMATION *
 * COUNTRY/BUREAU: MALAWI PROJECT: 6120201 SUB-PROJECT: 00 *
 * PROJECT TITLE: MALAWI POLYTECHNIC INITIAL FY: 80 FINAL FY: 84 *
 * LOAN/GRANT(G): G APPROPRIATION SYMBOL: EH ESTIMATED BUDGET(\$000): 7,900 *

PROBLEM: SCARCE SUPPLIES OF TECHNICALLY SKILLED LABOR IN MALAWI INHIBIT EFFORTS TO PROMOTE EQUITABLE ECONOMIC, SOCIAL AND RURAL DEVELOPMENT. AT PRESENT, THE DEMAND FOR APPROPRIATELY TRAINED ENGINEERING TALENT EXCEEDS THE COUNTRY'S INDIGENOUS SUPPLY, MAKING THE GOVERNMENT OF MALAWI AND MOST PRIVATE COMPANIES HEAVILY RELIANT ON EXPENSIVE EXPATRIATE PERSONNEL.

STRATEGY: FIVE-YEAR PROJECT CONSISTS OF A GRANT FOR PARTICIPANT TRAINING, CONSTRUCTION, COMMODITIES, AND TECHNICAL ASSISTANCE TO IMPROVE AND EXPAND THE INSTITUTIONAL CAPABILITY OF THE UNIVERSITY OF MALAWI'S POLYTECHNIC COLLEGE IN THE FIELD OF ENGINEERING. MOST COUNTRY WILL PROVIDE TECHNICAL AND FINANCIAL ASSISTANCE AND WILL ASSUME RECURRENT COSTS. OTHER DONORS INCLUDE THE BRITISH OVERSEAS DEVELOPMENT AGENCY, THE EUROPEAN DEVELOPMENT FUND, AND THE AFRICAN DEVELOPMENT FUND.

SUMMARY: GRANT IS PROVIDED TO THE GOVERNMENT OF MALAWI (GOM) TO IMPROVE AND EXPAND THE INSTITUTIONAL CAPABILITY OF THE UNIVERSITY OF MALAWI'S POLYTECHNIC COLLEGE TO PROVIDE ENGINEERING PERSONNEL FOR THE PUBLIC AND PRIVATE SECTOR. THE PROJECT WILL BE IMPLEMENTED BY THE GOM THROUGH THE UNIVERSITY OF MALAWI. THE CAPABILITY OF THE POLYTECHNIC WILL BE INCREASED SO THAT IT CAN TRAIN AND GRADUATE 400 CERTIFICATE, 75 DIPLOMA, AND 25 DEGREE HOLDERS ANNUALLY BY 1984, AND SO THAT IT CAN PROVIDE CONSULTING SERVICES TO THE ENGINEERING COMMUNITY, TO THIS END, A CONTRACTED INSTITUTION WILL PROVIDE FOUR U.S. TECHNICIANS FOR A TOTAL OF 12 PERSON-YEARS TO ASSIST THE POLYTECHNIC IN DEVELOPING ITS ENGINEERING PROGRAMS, AND 55 PERSON-YEARS OF DEGREE TRAINING IN THE UNITED STATES FOR 16 MALAWIANS WHO WILL SERVE AS INSTRUCTORS AT THE POLYTECHNIC. TWELVE OF THESE ARE CURRENTLY TUTORS AND TEACHING ASSISTANTS IN FOUR ENGINEERING DISCIPLINES AT THE POLYTECHNIC. THE OTHERS INCLUDE TWO WOMEN ON THE POLYTECHNIC STAFF WHO WILL RECEIVE M.S.-LEVEL TRAINING; A SENIOR STAFF MEMBER WHO WILL STUDY FOR A PH.D. IN HYDROLOGY; AND A COUNTERPART FOR THE PROJECT'S CAREER COUNSELLOR. USAID WILL PROVIDE FUNDS FOR THE CONSTRUCTION OF AN 18,000 SQ. FT. SCIENCE BUILDING, A 26,000 SQ. FT. LIBRARY, AND FOUR 3-BEDROOM HOUSES FOR SENIOR STAFF; AND WILL FURNISH SCIENCE AND LIBRARY EQUIPMENT AND BOOKS. THE BRITISH OVERSEAS DEVELOPMENT AGENCY AND THE EUROPEAN DEVELOPMENT FUND ARE CURRENTLY FUNDING SOME TEACHING POSITIONS AT THE POLYTECHNIC AND HAVE PROPOSED GRANTS TO FUND THE CONSTRUCTION AND RENOVATION OF ADDITIONAL BUILDINGS. THE AFRICAN DEVELOPMENT FUND ALSO PLANS TO CONTRIBUTE FUNDS FOR EQUIPMENT AND BUILDING CONSTRUCTION AND RENOVATION. THE MOST DIRECT BENEFICIARIES OF THIS PROJECT WILL BE THE INDIVIDUALS COMPLETING THE NEW TECHNICIANS AND ENGINEERS TRAINING. THE EMPLOYERS OF THESE ENGINEERING SPECIALISTS, AND THOSE REQUIRING ENGINEERING SERVICES AND RESEARCH. INDIRECT BENEFITS MAY RESULT FOR MALAWI'S ESTIMATED 5 MILLION RURAL POOR THROUGH THE PROJ. ITS (ROADS, WATER AND SEWER, IRRIGATION AND HYDRO-POWER, RURAL ELECTRIFICATION, ETC.) REQUIRING ENGINEERING SPECIALISTS.

GOAL: TO ALLEVIATE THE NATIONAL SHORTAGE OF SKILLED MANPOWER IN MALAWI.

PURPOSE: TO IMPROVE AND EXPAND THE INSTITUTIONAL CAPABILITY OF THE POLYTECHNIC TO PRODUCE MALAWIAN ENGINEERING MANPOWER FOR THE PUBLIC AND PRIVATE SECTORS.

OUTPUTS: 1. QUALIFIED STUDENTS COMPLETING PRESCRIBED COURSES. 2. QUALIFIED AND FUNCTIONAL TEACHING STAFF WITH SIGNIFICANT MALAWIAN PARTICIPATION. 3. AN EFFECTIVE AND FUNCTIONING 3 + 3 "SANDWICH" CURRICULUM PRODUCING EMPLOYABLE GRADUATES RELEVANT TO MALAWI'S NEEDS. 4. FUNCTIONAL TEACHING AND CONSULTIVE TESTING LABORATORIES.

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*                                     PART 1 - PROJECT DESIGN INFORMATION                                     *
* COUNTRY/BUREAU: MALAWI                                           PROJECT: 6120153 SUB-PROJECT: 00 *
* PROJECT TITLE: MALAWI-LAKE SHORE ROAD-PHASE I                   INITIAL FY: 66   FINAL FY: 66   *
* LOAN(L)/GRANT(G): L      APPROPRIATION SYMBOL: DL               ESTIMATED BUDGET($000): 6,846   *
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PROBLEM: MALAWI LAKE SHORE AREA, WITH POTENTIAL FOR DEVELOPMENT, HAS BEEN RETARDED BY INADEQUATE ROAD TRANSPORTATION. STRATEGY: ENGINEERING DESIGN OF 133 MILES OF ROAD FROM BALAKA TO SALIMA AND FROM GOLOHOTI TO MONKEY BAY.

SUMMARY: A US ENGINEERING FIRM WILL PREPARE FINAL DESIGNS, PLANS, SPECIFICATIONS, AND CONTRACT DOCUMENTS FOR THE TWO ROADS. DOCUMENTATION WILL BE SOUGHT FOR INTERNATIONAL BIDDING. CONTRACTOR WILL CONDUCT SOILS AND FOUNDATION INVESTIGATIONS, USING LOCAL SUB-CONTRACTOR WHERE APPROPRIATE, ALTHOUGH CONTRACT WILL NOT INCLUDE SUPERVISORY ENGINEERING SERVICES. CONTRACTOR WILL BE ELIGIBLE TO PERFORM SUCH SERVICES IF CONSTRUCTION IS UNDERTAKEN.

GOAL: LAKE SHORE AREAS OPEN FOR AGRICULTURAL DEVELOPMENT AND ROAD LINKS PROVIDED FOR ENTIRE SOUTHERN AND WESTERN SHORE OF LAKE MALAWI. I PURPOSE: PROVIDE ENGINEERING DESIGN OF THE BALAKA-SALIMA AND THE GOLOHOTI-MONKEY BAY SEGMENTS OF THE LAKE SHORE ROAD SCHEME. I

OUTPUTS: 1. LAKE SHORE ROAD SURVEYED TO DETERMINE DEVELOPMENT POTENTIAL. 2. FINAL DESIGNS, PLANS, SPECIFICATIONS AND CONTRACT DOCUMENTS PREPARED BY US ENGINEERING FIRM. 3. PROVISION MADE IN ORIGINAL DESIGN TO ADAPT BASIC CONSTRUCTION TO FUTURE NEEDS. I

 * P A R T 1 - P R O J E C T D E S I G N I N F O R M A T I O N *
 * C O U N T R Y / B U R E A U : M A L A W I *
 * P R O J E C T T I T L E : S E L F - H E L P R U R A L W A T E R S U P P L Y *
 * L O A N (I) / G R A N T (G) : 0 *
 * A P P R O P R I A T I O N S Y M B O L : H E *
 * P R O J E C T : 6 1 2 0 2 9 7 *
 * S U B - P R O J E C T : 0 0 *
 * I N I T I A L F Y : 8 0 *
 * F I N A L F Y : 8 3 *
 * E S T I M A T E D B U D G E T (\$ 0 0 0) : 6 , 0 0 0 *

PROBLEM: DESPITE ABUNDANT INDIGENOUS WATER SUPPLIES, RURAL AREAS IN MALAWI LACK ACCESS TO SAFE WATER, LEADING TO A HIGH INCIDENCE OF WATER-RELATED DISEASES. TO REMEDY THIS SITUATION, THE GOVERNMENT OF MALAWI (GOM) HAS INITIATED A PROGRAM TO ESTABLISH A PIPED WATER SYSTEM TO DELIVER WATER TO RURAL AREAS. THE GOM, HOWEVER, LACKS THE RESOURCES NEEDED TO CONSTRUCT THE SYSTEM, TO EDUCATE RURAL BENEFICIARIES IN THE LINK BETWEEN SAFE WATER AND HEALTH, AND TO INSTITUTIONALIZE AN INFORMATION SYSTEM TO MONITOR AND EVALUATE THE PROGRAM.

STRATEGY: FIVE-YEAR PROJECT CONSISTS OF A GRANT TO THE GOVERNMENT OF MALAWI (GOM) TO PROVIDE CAPITAL AND TECHNICAL ASSISTANCE TO EXPAND THE RURAL PIPED WATER SYSTEM, AS WELL AS TO CONDUCT SANITATION EDUCATION PROGRAMS FOR RURAL BENEFICIARIES AND ESTABLISH A GOM MONITORING, RESEARCH, AND EVALUATION UNIT. HOST COUNTRY WILL CONTRIBUTE PARTIAL FINANCES AND TARGET COMMUNITIES WILL SUPPLY 30% OF THE REQUIRED LABOR. OTHER DONORS INCLUDE THE PEACE CORPS.

SUMMARY: GRANT IS PROVIDED TO GOVERNMENT OF MALAWI (GOM) TO EXPAND ITS WATER SYSTEM TO PROVIDE PIPED WATER TO RURAL AREAS. THE RURAL WATER SECTION (RWS) OF THE DEPARTMENT OF LANDS, VALUATION AND WATER WILL DESIGN AND IMPLEMENT THE FIVE-YEAR PROGRAM.

AN ANTICIPATED 23 ADDITIONAL PIPED WATER SYSTEMS WILL BE INSTALLED IN RURAL AREAS. PIPED WATER WAS CHOSEN OVER OTHER WATER SUPPLY SYSTEMS AS IT CAN CONVENIENTLY BE OFFERED THROUGH MULTIPLE COMMUNAL TAPS. PIPES WILL BE MADE OF ASBESTOS CEMENT AND POLYVINYL CHLORIDE AND THEY WILL BE OF SIMPLE DESIGN IN ORDER TO AVERT MECHANICAL FAILURE. WATER WILL ORIGINATE FROM CONTAMINATION-FREE MOUNTAIN WATERSHEDS. SYSTEM CONSTRUCTION WILL BE ON A SELF-HELP, COMMUNITY BASIS. TRAINING PROGRAMS IN CONSTRUCTION, OPERATION, AND MAINTENANCE OF THE RURAL PIPED SYSTEM WILL BE PROVIDED TO 100 GOM PERSONNEL. IN ADDITION, 120 TECHNICIAN FIELD STAFF WILL BE OFFERED ON-THE-JOB TRAINING. IN ORDER TO ASSURE THE LONG-TERM EFFECTIVENESS OF THE PROJECT, THE MINISTRY OF HEALTH (MOH) WILL ASSIGN UNIVERSITY-TRAINED HEALTH ASSISTANTS TO TEACH VILLAGERS ABOUT HYGIENE AND ENVIRONMENTAL CLEANLINESS, AS WELL AS TO SCREEN THEM FOR WATER-RELATED DISEASES AND URGE THEM TO CONSTRUCT PIT LATRINES. A PUBLIC HEALTH COORDINATOR UNDER THE MOH WILL FUNCTION AS A LIAISON BETWEEN THE RWS AND DISTRICT HEALTH INSPECTORS IN ORDER TO ORGANIZE HEALTH AND SANITATION EDUCATION PROGRAMS IN PROJECT AREAS. SEVEN PEACE CORPS VOLUNTEERS WILL ASSIST IN THIS FUNCTION. FINALLY, A TRAINING AND RESEARCH UNIT WILL BE ESTABLISHED WITHIN THE RWS TO INSTITUTIONALIZE A CAPABILITY FOR PROJECT MONITORING, EVALUATION, AND RESEARCH. PROJECT IS EXPECTED TO SERVE APPROXIMATELY 202,000 MALAWIANS OR ABOUT 10% OF THE RURAL POPULATION. PRIME BENEFICIARIES WILL BE MALAWIAN WOMEN WHO ARE RESPONSIBLE FOR OBTAINING THE FAMILY'S WATER FOR DRINKING, COOKING, AND WASHING.

GOAL: TO IMPROVE THE BASIC LIVING CONDITIONS AND HEALTH OF MALAWI'S RURAL POOR POPULATION.

PURPOSE: TO ASSIST THE GOVERNMENT OF MALAWI (GOM) IN THEIR RURAL PIPED WATER PROGRAM WHICH, IN TURN, WILL PROVIDE SAFE WATER TO A SIGNIFICANT PERCENTAGE OF MALAWI'S RURAL POPULATION.

OUTPUTS: 1. RURAL PIPED WATER SUB-PROJECTS/SYSTEMS COMPLETED. 2. MALAWIANS TRAINED AT THE TECHNICIAN LEVEL IN RURAL PIPED WATER SUPPLY CONSTRUCTION, OPERATION AND MAINTENANCE AND IN BASIC HEALTH AND SANITATION EDUCATION. 3. ON-GOING MINISTRY OF HEALTH (MOH) SANITATION AND HEALTH EDUCATION PROGRAMS MORE CLOSELY COORDINATED WITH THE INTRODUCTION OF RURAL PIPED WATER SYSTEMS. 4. A TRAINING AND RESEARCH UNIT ESTABLISHED IN THE RURAL WATER SECTION (RWS), OF THE DEPARTMENT OF LANDS, VALUATION AND WATER (DLVW), WHICH WILL INSTITUTIONALIZE MONITORING, EVALUATION, AND RESEARCH.

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 PART 2 - PROJECT EVALUATION O MENTATION
 COUNTRY/BUREAU: SOUTHERN AFRICA REGION-OSARAC PROJECT: 590002E
 PROJECT TITLE: MALAWI LOWER SHIRE ROADS INITIAL FY: 72 FINAL FY: 76

DOCUMENT TYPE: FINAL REPORT
 DOCUMENT TITLE: LOAN COMPLETION REVIEW AND REPORT
 AUTHOR(S): WESTLEY, JOHN R
 GUEDET, J PAUL
 BONKOWSKI, LUCIAN A

PUBLICATION DATE: 04/10/75
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CONTRACT:
 PROJECT(S): 690002800 612015201

OTHER ID: 612-H-002, 612-H-002A
 PUBLICATION NO:

ABSTRACT: REVIEWS THE COMPLETED PHASE II LOAN TO MALAWI WHICH FINANCED CONSTRUCTION OF 2 SECONDARY HIGHWAYS
 TOTALING 126 MILES IN THE LAKESHORE AREA OF THE COUNTRY. DATES OF THE LOAN WERE 7/17/68 TO 12/1/74.
 DUE TO HIGH BID PRICES, AID AND GOM AGREED ON A FORCE ACCOUNT CONSTRUCTION OPERATION USING A
 CONSULTANT FIRM FOR ENGINEERING AND INSPECTION REQUIREMENTS AND A CONSTRUCTION MANAGEMENT TEAM FOR
 THE CONSTRUCTION SUPERVISION. THIS PROVED TO BE SUCCESSFUL, WITHIN LIMITS, FOR THE COMPLETION OF
 THE GRAVEL SURFACING PHASE OF CONSTRUCTION.
 DURING THE LAST PHASE OF THE PROJECT, FINANCING WAS PROVIDED FOR THE PURCHASE OF SPARE PARTS AND
 PROCUREMENT FEES FOR THE AID-FINANCED PROJECT CONSTRUCTION EQUIPMENT. THIS PROVIDED A STOCK OF
 SPARE PARTS TO MAINTAIN THE EQUIPMENT DURING THE ASPHALT SURFACING PHASE OF THE CONSTRUCTION. THIS
 PHASE (1972 - 1974) WAS DONE BY THE GOM ROADS DEPARTMENT, USING GOM PERSONNEL EXCLUSIVELY,
 INCLUDING SUPERVISION AND ENGINEERING CONTROL.
 GOM NOW HAS A FEEDER ROAD CONSTRUCTION PROGRAM UNDERWAY, FINANCED BY GERMANY, CONNECTING WITH THE
 LAKE SHORE ROAD.

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 * PART I - PROJECT DESIGN INFORMATION *
 * COUNTRY/BUREAU: MALAWI * PROJECT: 6120202 GUS-PROJECT: 00 *
 * PROJECT TITLE: AGRICULTURAL RESEARCH * INITIAL FY: 79 FINAL FY: 83 *
 * LOAN(1)/GRANT(G): G APPROPRIATION SYMBOL: FN * ESTIMATED BUDGET(5000): 9,000 *

PROBLEM: PRODUCTION INCREASES ON MALAWI'S SMALLHOLDER FARMS HAVE NOT KEPT PACE WITH THE COUNTRY'S POPULATION GROWTH -- A SERIOUS DIFFICULTY FOR A COUNTRY IN WHICH 85% OF THE PEOPLE DIRECTLY DEPEND ON SMALLHOLDER AGRICULTURE FOR THEIR SUBSISTENCE. IN ORDER TO INCREASE SMALLHOLDER YIELDS, RESEARCH PROGRAMS IN CROP AND LIVESTOCK VARIETIES AND FARMING SYSTEMS ARE NECESSARY. EFFORTS BY THE MALAWI DEPARTMENT OF AGRICULTURAL RESEARCH TO PROVIDE SUCH PROGRAMS ARE HAMPERED BY SHORTAGES OF TRAINED RESEARCH SPECIALISTS, EQUIPMENT, AND FACILITIES.

STRATEGY: FIVE-YEAR PROJECT CONSISTS OF GRANT TO THE GOVERNMENT OF MALAWI (GOH) FOR TRAINING, COMMODITIES, AND CONSTRUCTION TO CONDUCT RESEARCH IN CROP AND LIVESTOCK VARIETIES AND FARMING SYSTEMS USED BY THE COUNTRY'S SMALLHOLDER FARMERS. HOST COUNTRY WILL ASSIST WITH INCREMENTAL RECURRENT COSTS AND PROVIDE CONSTRUCTION AND TRAINING SUPPORT.

SUMMARY: GRANT IS PROVIDED TO THE GOVERNMENT OF MALAWI (GOH) TO IMPROVE AND EXPAND DEPARTMENT OF AGRICULTURAL RESEARCH (DAR) EFFORTS TO PROVIDE QUALITY RESEARCH PROGRAMS IN SMALLHOLDER CROP AND LIVESTOCK PRODUCTION. THE DAR WILL IMPLEMENT THE PROGRAM WITH TECHNICAL ASSISTANCE FROM USAID AND A U.S. TITLE XII INSTITUTION. HANDBOOK DEFICIENCIES WITHIN THE DAR WILL BE CORRECTED BY THE PROVISION OF U.S. GRADUATE EDUCATION TO 33 PROFESSIONAL OFFICERS (PO'S). A TOTAL OF EIGHT PH.D.'S WILL BE AWARDED IN PLANT PATHOLOGY; ANIMAL, MAIZE AND GROUNDNUT BREEDING; MAIZE AND SOIL PHYSIOLOGY; RANGE MANAGEMENT; AND ENTOMOLOGY. ANOTHER 25 PO'S WILL STUDY FOR MASTERS DEGREES IN AREAS SUCH AS ANIMAL NUTRITION, AGRICULTURAL ECONOMICS, AND SOIL AND SEED TECHNOLOGIES. IN ADDITION, THE TOTAL NUMBER OF PO'S IN THE DAR WILL BE INCREASED BY 15 TO A TOTAL OF 80. SHORT-TERM TRAINING IN RESEARCH ADMINISTRATION AND MANAGEMENT WILL BE PROVIDED TO SELECTED DAR PERSONNEL. IN-SERVICE TRAINING IN SPECIFIC RESEARCH PROGRAMS WILL BE CONDUCTED FOR 34 TECHNICAL OFFICERS AND ASSISTANTS. RESEARCH FACILITIES AND HOUSING WILL BE CONSTRUCTED AS FOLLOWS: 48 STAFF HOUSES; OFFICES; THREE LABORATORIES; SIX GREENHOUSES; TWO COLD STORAGE ROOMS; AND FOUR STOREHOUSES. IN ADDITION, RESEARCH EQUIPMENT AND 80 VEHICLES WILL BE PROVIDED TO DAR STATIONS. RESEARCH IN SEED, VEGETABLE, FRUIT, AND LIVESTOCK PRODUCTION, AND IN SOIL FERTILIZER USE WILL BE IMPROVED; NEW RESEARCH PROGRAMS IN FARMING SYSTEMS ANALYSIS, AGRICULTURAL ECONOMICS AND SMALLHOLDER-APPROPRIATE TECHNOLOGY WILL BE INTRODUCED BY THE TITLE XII TEAM. USAID WILL CONDUCT FIELD TRIALS IN 110-120 EXTENSION PLANNING AREAS (EPAS) TO REPRESENTATIVE SPOTS WILL BE SURVEYED FOR EFFECTIVENESS AND ACCEPTANCE BY SMALLHOLDERS OF RESEARCH PROGRAMS BY THE TITLE XII INSTITUTION. BY THE PROJECT'S COMPLETION DATE, EACH SPA WILL BE PRODUCING 10-20 RESEARCH PUBLICATIONS PER YEAR ON ANNUAL SMALLHOLDER YIELDS. ANNUAL MEETINGS OF EXTENSION OFFICERS, RESEARCH FIELD STAFF AND TECHNICAL PERSONNEL WILL BE HELD IN EIGHT MANAGEMENT UNITS, WITH SPECIAL EMPHASIS PLACED ON BRINGING NEW TECHNOLOGIES TO THE MALAWIAN SMALLHOLDER.

GOAL: INCREASED PRODUCTIVITY AND REAL INCOME OF SMALLHOLDERS WITHIN THE 15-20 YEAR NATIONAL RURAL DEVELOPMENT PROGRAM.

PURPOSE: STRENGTHEN CAPABILITY OF THE DEPARTMENT OF AGRICULTURAL RESEARCH (DAR) TO PROVIDE SOCIALLY ACCEPTABLE AND ECONOMICALLY SOUND RESEARCH FOR SMALLHOLDER NEEDS IN SATISFACTORY QUALITY AND QUANTITY AND IN A FORM USEABLE BY EXTENSION SERVICE.

OUTPUTS: 1. TECHNICAL ASSISTANCE (TA) TEAM AND DAR ESTABLISH SELECT NEW OPERATIONS. 2. PROFESSIONAL RESEARCHERS FUNCTIONING AT M.SC./PH.D. LEVELS. 3/4. ADEQUATE FACILITIES/HOUSING FOR EXPANDED OPERATIONS AND STAFF AND RESEARCH EQUIPMENT AND VEHICLES. 5. IMPROVED SUPPORT STAFF CAPABILITY. 6. FIELD TRIALS COMPLETED BY TA TEAM AND COUNTERPART STAFF; RESEARCH PACKAGES DEVELOPED. 7. QUALITY/QUANTITY OF RESEARCH PROGRAMS STRENGTHENED IN CROP, LIVESTOCK AND TECHNICAL AREAS RELEVANT TO SMALLHOLDERS; CORRESPONDING RESEARCH OF PROJECT TRAINEES CONDUCTED. 8. ANNUAL MEETINGS OF EXTENSION OFFICERS, FIELD RESEARCHERS, RESEARCH COORDINATOR AND TECHNICAL PERSONNEL. 9. TITLE XII INSTITUTION SURVEY OF SMALLHOLDER ACCEPTANCE OF RESEARCH.

Appendix VII

Acronyms Employed in this Report

CDF	Capitol Development Fund
EAGR	East African Geographical Review
EEC	European Economic Community
EPA	Environmental Protection Agency (U.S.)
ESCOM	Electricity Supply Commission of Malawi
FAO	Food and Agriculture Organization (U.N.)
GDP	Gross Domestic Product
IDA	International Development Agency
ITCZ	Intertropical Convergence Zone
MDC	Malawi Development Corporation
NAS	National Academy of Sciences (U.S.)
RA	Rural Africana.
SMJ	Society of Malawi Journal
UNEP	United Nations Environment Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
USGPO	U.S. Government Printing Office
WHO	World Health Organization (U.N.)
WMO	World Meteorological Organization

Appendix VIII

Selected Bibliography

1. Climate, Demography, Economy, Geography, History, and General Reference
2. Agriculture and Land Use
3. Water Resources
4. Geology, Soils, Mineral, and Energy Resources
5. Vegetative Resources and Management
6. Faunal Resources and Management
7. Public Health, Environmental Problems, and Conservation

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