

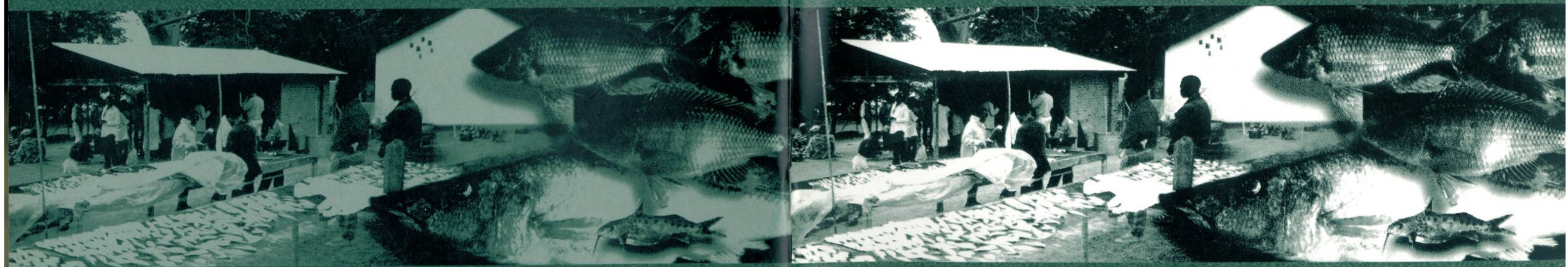
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ODA

Overseas Development Administration

Renewable Natural Resources Profile

Malawi



NRI

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OVERSEAS DEVELOPMENT ADMINISTRATION

Malawi

Renewable Natural Resources Profile

Natural Resources Institute

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ACRONYMS

ADDs	Agricultural Development Divisions
ADMARC	Agricultural Development and Marketing Corporation
EIU	Economist Intelligence Unit
FAO	Food and Agriculture Organisation of the United Nations
FRIM	Forestry Research Institute of Malawi
ICLARM	International Centre for Living Aquatic Resources Management
IMF	International Monetary Fund
KFCTA	Kasungu Flue-Cured Tobacco Authority
MDI	Malawi Dairy Industries
MEPC	Malawi Export Promotion Council
NGO	non-governmental organisation
NRI	Natural Resources Institute
NSCM	National Seed Company of Malawi
ODA	official development assistance
ODA	Overseas Development Administration
OECD	Organisation for Economic Co-operation and Development
PCC	Petroleum Control Commission
RNR	renewable natural resources
SACA	Smallholder Agricultural Credit Administration
SCA	Smallholder Coffee Authority
SFFRFM	Smallholder Farmers Fertiliser Revolving Fund of Malawi
SSA	Smallholder Sugar Authority
STA	Smallholder Tea Authority
TNA	Tree Nut Authority
TRF	Tea Research Foundation
TRIM	Tobacco Research Institute of Malawi
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development

INTRODUCTION

This profile of the renewable natural resources (RNR) sector of Malawi has been compiled by the Natural Resources Institute (NRI) for the Overseas Development Administration. It brings together material from a wide range of published and unpublished sources into a comprehensive account of the physical and socio-economic characteristics of Malawi's RNR sector and its future development potential. Views expressed are the responsibility of the authors alone and are not necessarily those of NRI.

The profile is arranged so as to provide an easily accessible and assimilable source of information on the RNR sector of this country. The Key Facts and Summary of RNR Potential sections are intended both to summarise key information and issues, and highlight developmental opportunities, constraints and the potential for addressing these. These aspects are covered in greater depth in later sections which provide comprehensive physical, social-economic and technical data and information which are particularly relevant to the areas under consideration. Although an attempt has been made to present information in as logical a manner as possible, owing to the inherent complexity of this exercise, some omissions and inaccuracies will be inevitable. However, as this compendium is intended to be updated on a regular basis, any such problems may be accommodated in later editions.

The principal authors of the profile are Keith Davies (land resources specialist) and Caroline O'Reilly (socio-economist). Basic data were also contributed by Barry Blake (fisheries biologist) and Mike Pritchard (economist).

KEY FACTS

RESOURCES

Total area	c. 118 673 km ²
Land	94 465 km ²
Water bodies ¹	24 208 km ²
Lake Malawi ²	
Total area	29 600 km ²
Catchment	96 918 km ²
Total volume	8400 km ³
Total annual renewable water resources	9.0 km ³ (870 m ³ per capita)
Annual withdrawals fresh-water resources (1970-92) ³	
Total	0.2 km ³
Per capita	20 m ³
Rainfall	<750->1100 mm in Rift Valley Zone to 1000->1500 (3000+ in pockets) in Mountain Zone
Land use ⁴	
Arable	16 700 km ²
Permanent crops	300 km ²
Permanent pasture	18 400 km ²
Forest and woodland	37 000 km ²
Other	21 680 km ²
Protected areas	
National parks	5 covering 6972 km ²
Game reserves	4 covering 3614 km ²
Forest reserves	69 covering 7813 km ²

Source: Various including FAO (1995); World Resources Institute (1994)

Note: ¹Discharge of major rivers is given in Appendix 1. ²Approx. 71% in Malawi. ³Data refer to any year from 1970 to 1992. ⁴FAO estimates for 1993.

AGRICULTURE

Main crops ¹ (1994)	Area (ha)	Production (t)
Rice	23 000 ³	42 000 ³
Maize	1 129 000	1 040 000
Sorghum	54 000	17 000
Millet	24 000	10 000
Wheat	2 000 ²	1 000 ³
Beans	146 000 ²	81 000 ²
Groundnuts (in shell)	50 000 ²	31 000 ²
Cassava	75 000 ²	200 000 ²
Potatoes	94 000 ²	350 000 ²
Sunflower seed	11 000 ²	9 000 ²
Seed cotton	38 000	30 000 ²
Cottonseed	n/a	20 000 ²
Vegetables (and melons)	n/a	265 000
Fruit (excluding melons)	n/a	507 000 ²
Sugar cane	19 000 ²	2 000 000 ² (raw sugar 203 000)
Tea	19 000 ²	42 000 ²
Coffee	5 000 ²	5 000 ³
Tobacco	113 000 ³	99 000 ³

Source: FAO (1995)

Note: ¹Smallholder sector crops—main food crops: maize, pulses, cassava, sweet potato, millet, sorghum; main cash crops: tobacco, maize, cotton, coffee, groundnuts, rice. Estates sector crops—tobacco, maize, tea, sugar, coffee, macadamia nuts. ²Estimate. ³Unofficial figure. There are some discrepancies between these figures and Ministry of Agriculture data for 1992/93 in Appendix 2.

LIVESTOCK

1994 estimates	Number	No. slaughtered/production	
Cattle	980 000	88 000 head	18 000 t
Sheep	196 000	49 000 head	1 000 t
Goats	890 000	267 000 head	3 000 t
Pigs	245 000	196 000 head	10 000 t
Asses	2 000	—	—
Chickens	9 000 000		10 000 t
Dairy cow	92 000		42 000 t milk
Hides and skins			
Cattle hides			1 760 t
Sheepskins			103 t
Goatskins			561 t

Source: FAO (1995)

FISHERIES

Total lake/river catch (1992)	69 500 t
Aquaculture production (1991)	223 t (includes 3 t crustacea)
Area under aquaculture (1987)	72 ha
Total no. fishermen (1993)	10 000 (estimates vary) plus 20 000 ancillary workers
No. inland vessels (1993)	12 000
No. industrial vessels (1987)	16
Average catch (1988–90)	84 300 t
Imports (1988–90)	404 t
Exports (1988–90)	275 t
Supply per capita (1988–90)	9.3 kg/year

Source: Government of Malawi (1993); FAO (1993)

FORESTRY

Montane forest	3 730 km ²
Moist deciduous forest	29 480 km ²
Dry deciduous forest	1 660 km ²
Plantations	1 800 km ²

Source: Hardcastle (1994)

MINERALS¹

Coal	16 000 000 t
Glass sands	25 000 000 t
Limestone	20 000 000 t
Ceramic clays	15 000 000 t
Vermiculite	1 600 000 t
Bauxite	28 000 000 t
Strontianite/monazite	>11 000 000 t
Graphite	35 000 t
Phosphates	985 000 t
Pyrite/pyrrhotite	40 000 000 t
Kyanite	14 000 t

Source: Government of Malawi (1987)

Note: ¹Proven reserves not production figures. Principal minerals currently exploited are coal and lime—41 200 t of coal were produced in 1989, and 3100 t of lime were produced in 1987—there is small-scale production of rubies and sapphires, and trial mining of gypsum began in 1990.

ECONOMY

GNP per capita (1992)	US\$ 210
GDP from agriculture (1992)	28%
Labour force in agriculture	87%
Main trading routes	During war in Mozambique, trade routes severely disrupted; trade routed through Zambia to Durban. Since peace accord, Tete corridor reopened; rail access to ports of Beira and Nacala improved. Northern corridor through Tanzania to Dar es Salaam (lake/road/rail).

Source: World Bank (1994); UNDP (1994); UN/GOM (1993); Chilowa (1993); EIU (1994)

DEMOGRAPHY

Population (mid-1992) ¹	9.1 million
Average annual population growth rate (1980–92)	3.2%
Urbanisation (1992)	12%
Population distribution	Southern Region (50% of population): density 125 persons/km ² Central Region (38% of population): density 87 persons/km ² Northern Region (11% of population): density 34 persons/km ²

Source: World Bank (1994)

Note: ¹Estimate for 1991, based on 1987 census, excluding more than 900 000 Mozambican refugees is 8.7 million; estimate for 1993, excluding most of 1.3 million Mozambican refugees is 9.33 million (EIU, 1993).

HEALTH AND EDUCATION

Under-5 mortality (1992)	226 per 1000 live births
Access to safe water (1988–91) ¹	56%
Adult literacy rate	45% (estimate)

Source: UNICEF (1994); UNDP (1994)

Note: ¹Data relate to different year or period or relate to only part of the country.

KEY ENVIRONMENTAL ISSUES

Malawi's natural resources are being rapidly degraded. The degradation has two principal interrelated causes:

- **High population density and growth rate** which lead to demands on natural resources that exceed their assimilative and regenerative capacity
- **Poverty** which leads the poor to trade off long-term sustainable resource use for short-term consumption of stocks. Inefficient resource allocation resulting from inappropriate policies exacerbates the problem.

The main issues are:

- **Deforestation**—an annual loss of up to 3% of total forest cover
- **Land degradation**—loss of soil fertility and soil erosion
- **Biodiversity and wildlife resource depletion**—outside protected areas
- **Water pollution**—contamination of groundwater
- **Depletion of fish resources**—through overfishing, pollution and use of inappropriate catching techniques

KEY TRANSBOUNDARY ISSUES

- **Refugee influx** from Mozambique during civil war placed considerable strain on natural and economic resources
- **Landlocked** status means **high transport costs** and reliance on neighbouring countries for overland transport routes to sea—hence devastating economic impact of war in Mozambique, resulting in closure of most direct routes
- **Spread of water hyacinth** from Zambezi into lower Shire is threatening fish stocks and irrigation schemes
- **Tsetse infestation** in Rift Valley Zone
- **Poaching of forest resources** in both directions across the Malawi-Mozambique border

SUMMARY OF RNR POTENTIAL

Zone	Environment
Mountain Zone	Mlanje—1500–3300 m altitude, 1500 mm rainfall (3000+ in pockets). Lithosols and humic ferallitic soils.
	Rest of zone—1500–2600 m altitude, 1000–1500 mm rainfall
Plateau Zone	Shire Plateau (or Shire Highlands)—650–>1500 m altitude, 1000–>1400 mm rainfall. Latosols predominate.
	Rest of zone—750–1150 m altitude, 800–1000 mm rainfall
Rift Valley Zone	Lower Shire Valley—15–90 m altitude, <750 mm rainfall. Calcimorphic and hydromorphic soils.
	Lakeshore Plain—470–>600 m altitude, 1500–2500 mm rainfall.
	Rest of zone—90–600 m altitude, 850–1100 mm rainfall.

Land use	Fisheries	Potential
Forest, tea.		Very little scope for expanding the area planted to tea.
Forest, forest plantations, coffee. Nyika National Park.		Coffee and tree crops.
Maize, tobacco, groundnuts.		Population density limits potential.
Maize, tobacco, rice. Kasungu National Park.	Lake Chilwa and Lake Chiuta.	Diversification, general improvements in crop and livestock husbandry.
Cotton, groundnuts. Lengwe National Park.		Semi-arid zone, limited potential.
Rice.	Shire River.	Rice yields could be considerably improved. Aquaculture has good potential.
Cotton, rice, groundnuts. Liwonde National Park, Lake Malawi National Park.	Lake Malawi, Lake Malombe, Shire River.	Development of irrigation, but costs need careful study.

AGRO-CLIMATIC DATA

Zone	Area	Altitude (m)	Mean annual temperature (°C)	Mean annual rainfall (mm)
Mountain Zone	Mlanje	1500–3300	<15	>1500 (3000+ in pockets)
	Rest of zone	1500–2600	15–18	1000–1500
Plateau Zone	Shire Plateau (or Shire Highlands)	650–>1500	15–22	1000–>1400
	Rest of zone	750–1150	18–22	800–1000
Rift Valley Zone	Lower Shire Valley	15–90	>24	<750
	Lakeshore Plain	470–>600	22–24	1500–2500
	Rest of zone	90–600	22–24	850–1100

Malawi experiences three climatic seasons: the hot season which precedes the rains, with thunderstorms in late October and November; the rainy season which lasts until April or May in the south but ends in March in the rest of the country; and the dry season which occupies the rest of the year.

Rainfall is derived mainly from three different sets of conditions; three types of precipitation are associated with these conditions. Convective thunderstorms are a common phenomenon in all parts of the country during the hot season and the early period of the rainy season. Heavy monsoon-type rain is associated with the inter-tropical convergence zone, when up to 125 mm—or more—of rainfall a day can fall over a period of two or three days. In the dry season, the south-east Trade Wind becomes established, and orographic rain can fall over the southern and northern Lakeshore areas. This also produces frequent mists over the highland areas of Mlanje, Cholo, the Vipya and Nyika.

Rainfall totals can vary greatly from year to year. In the driest years the rainfall can be less than 50% of the average and in the wettest years it can be more than 160%. The variable and broken topography also produces large variations in average rainfall within relatively short distances. Physiographic conditions lead to the development of areas of high precipitation over the south and south-eastern slopes of highland areas, and to the development of comparative rain-shadows to the north and west of escarpment and highland areas. The mean annual rainfall on the south-eastern slopes of Mlanje Mountain and the Cholo Highlands ranges from 1250 mm to 3300 mm, whereas immediately to the west in the Shire valley it is only about 750 mm. The Shire Valley, the south-west Lakeshore, the Central Province plain, the Mzimba plain to the west of the Vipya and the areas to the north-west of the Nyika, all lie within partial rain-shadows.

Recent work on the climate of Sub-Saharan Africa, comparing the period 1931–60 with 1961–90, has suggested that there may have been a reduction of about 5% in total rainfall in the tropical margins of southern Africa. Possible causes for this reduction can be grouped into three broad areas: those related to

land cover changes; those related to changes in the global ocean circulation and associated with patterns of sea-surface temperatures; and those related to the changing composition of the global atmosphere.

The quasi-periodicity of southern African rainfall over about an 18-year cycle is well documented, and recent work has suggested that this also may be related to local sea-surface anomalies around the south African coast. According to the 18-year cycle theory, the 1990s should experience wetter-than-average conditions. The fact that the 1991/92 drought in Malawi was one of the most severe for over 50 years, however, serves as a warning that there are other influences, operating over different time-scales, that can also influence climatic conditions. This drought was believed to have been caused largely by the 1991 *El Niño* event. Rainfall distribution patterns can be seen in Map 4.

RENEWABLE NATURAL RESOURCES: REGIONAL VARIATION AND UTILISATION

Malawi is a small landlocked country in south-eastern Africa, bordered by Mozambique to the east and south, Tanzania to the north and Zambia to the west. Almost 20% of the country is covered by Lake Malawi (71% of which lies in Malawi), the third largest lake in Africa. The shores around the lake are some of the most fertile in Africa. Malawi lies within the East African Rift System and has an average elevation of 1200 m; most of the country is composed of high plateaux. The Nyika Plateau in the north reaches 2600 m and Mount Milanje in the south rises to over 3000 m. The Shire River flows from the southern end of Lake Malawi to join the Zambezi River in Mozambique.

Malawi can be divided into a total of 55 natural regions (see Young and Brown, 1962; Brown and Young, 1965; Stobbs, 1971) defined as areas in which the physical environment possesses the same major features, and in which individual environmental factors have a more limited range of variation than in agro-ecological zones. These regions provide a basic frame of reference for agricultural planning. However, for this profile which considers the whole RNR sector, classification of the country into more generalised units is sufficient and, on this basis, Malawi can be divided into three broad land resource zones which reflect the physiography, climate and land use of the country.

- Mountain Zone
- Plateau Zone
- Rift Valley Zone

The boundaries of the zones are shown on Map 1. On a map of this scale the boundaries are, of necessity, generalised and minor occurrences, in particular of the mountain zone, cannot be shown. Population densities and administrative regions are shown in Map 2, relief and communications in Map 3 and rainfall is shown in Map 4.

MOUNTAIN ZONE

The mountain zone consists of areas where the altitude exceeds 1500 m and the climate, in particular low temperature, is the dominant environmental influence. The main areas of Malawi where these conditions exist are:

- Nyika Plateau
- Vipya Plateau
- Mlanje Massif
- Zomba Massif
- Mchinji Ridge
- Nichisi Hill
- Dzalanyama Range
- Dedza and Chongoni Mountains
- Ncheu Plateau
- Ruwenya Hills
- Misuku Hills
- Upper Lufira Hills

Physical environment

The Mountain Zone has a climatic regime that is cooler and wetter than that of the surrounding Plateau Zone. Mean annual rainfall generally exceeds 1000 mm; on the Vipya Plateau and Mlanje Massif, it exceeds 1500 mm and on the south-eastern or windward slopes of Mlanje it can exceed 3000 mm. The dry season is generally much less pronounced; in the very high rainfall areas of the Southern Region it is virtually non-existent. Mean annual temperatures are generally in the range 15–18°C. Light frosts occur occasionally.

The massifs and high plateaux which make up much of the highland zone of Malawi consist of remnants of late Jurassic and early to mid-Cretaceous erosion surfaces. On steep slopes lithosols, shallow stony soils, predominate but on the plateaux the relatively low temperatures produce humic ferallitic soils, with a characteristically high organic matter content in the topsoil.

Land use and vegetation

Both montane evergreen forest and montane grassland communities are found in the zone. Pure grasslands are uncommon, except on the Nyika Plateau. Elsewhere on the plateaux, the usual pattern is of forest relics in the valleys and in isolated stands with mixed grasslands and scrublands in between. This probably represents a fire climax which has replaced the original forest. Much of what remains of the forest is now protected. On slopes below about 1800 m *Brachystegia-Julbernardia* woodland communities dominate.

A substantial part of the zone is forest reserve. Where land is cultivated, the range of crops grown reflects the altitude. Coffee, wheat, potatoes and other vegetables are all grown. In the high-rainfall areas of the Southern Region, dry-season rainfall is just sufficient to allow successful tea production. On the Vipya Plateau there are large areas of forest plantations. Much of the Nyika is occupied by the Nyika National Park.

Potential

The zone is best suited to the maintenance of forest reserves or the establishment of forest plantations. The maintenance of forest cover in the highland areas is important: it provides an important and economical barrier to soil erosion, is an important source of fuel and plays an essential role in watershed protection. In parts of the zone population pressure is leading to encroachment by smallholder farmers. This is particularly a problem in the Southern Region at Mount Mlanje and Zomba Mountain, where several important sites of endemic plants and biological diversity are being degraded as a result of the encroachment.

The most important crop in the zone is tea which is grown in the Mlanje and Cholo areas. The potential for increasing production is limited; most of the suitable land is already planted to tea and tea yields in Malawi are amongst the highest in the world. Coffee is grown in the zone in the Northern Region—here there is potential for increasing yields both through enlarging the area planted and by improving the level of crop husbandry.

PLATEAU ZONE

About 75% of Malawi's land area is in the Plateau Zone. It lies between 650 m and >1500 m and forms part of the extensive area of plateau land that occupies a substantial part of central and southern Africa. The zone includes Lakes Chilwa and Chiuta, and the Vwaza marsh; it encompasses the main agricultural production areas of the country and includes the areas of greatest population concentration. There are a number of steep and hilly areas, and a few broad valleys. The most intensively used parts of the zone are the plains, of which the main areas are:

- Lilongwe/Kasungu Plain
- Chilwa/Palombe Plain
- Shire Plateau (or Shire Highlands)
- Mzimba/Luwewe Plain
- Chitipa Plain

Physical environment

The zone experiences a tropical continental climate and a rainy season lasting four to five months. The rains begin in late October/November with a period of intense thunderstorms. For most of the zone the rainy season ends in March and mean annual rainfall is between 800 mm and 1000 mm. The Shire

Plateau is significantly wetter—here the rains last until April or May and mean annual rainfall usually exceeds 1400 mm.

Rainfall totals can vary greatly from year to year. There is a tendency for a period of dry years to be followed by a period of wet years, and some evidence of a regular 18-year cycle has been detected. There were several drought years in the 1980s and the 1991/92 drought was one of the worst for over 50 years.

Most of the areas of plains in the zone have gently undulating landforms. The plateau is more dissected in the Shire Highlands/Plateau around Blantyre/Zomba where the slopes are generally steeper. Latosols, strongly leached acid soils, cover most of the zone. In the Chilwa/Palombe Plain more fertile calcimorphic alluvial soils occur. Seasonally waterlogged hydromorphic soils are found locally throughout the zone in *dambos* (see below); they also occur more extensively around Lake Chilwa and the Vwaza marsh.

Lake Chilwa has a catchment of about 2600 km²; it has no outlet and is saline. It dries up periodically but, in years of normal rainfall, water depth varies between 1.2 m and 4.3 m; raised beaches are evidence of its progressive recession. Lake Chiuta is connected to Lake Amaramba, in Mozambique. In the dry season, water flows from Lake Chiuta into Lake Amaramba but, during the rains, the water level in Lake Amaramba rises faster than in Lake Chiuta and the flow is reversed. In geologically recent times, Lake Chilwa was connected to Lake Chiuta; they are now separated by a 15-m high sand bar.

Land use and vegetation

The most widespread vegetation type in Malawi—and dominant in most of the Plateau Zone—is open *Brachystegia-Julbernardia* woodland. This distinctive vegetation community once occupied all the infertile, leached plateau land up to about 1800 m. In isolated areas of more fertile soils, broad-leaved deciduous woodland communities occur. These are dominated by species of *Combretum*, *Acacia* and *Piliostigma*. Throughout the zone broad grass-covered *dambos*, waterlogged during the rains, form a regular network of drainage depressions.

The Plateau Zone is the most important and most heavily populated of the agricultural regions of Malawi; most of the arable land is already under cultivation. Land use is particularly intense on the Shire Plateau, parts of the Chilwa/Palombe Plain and on the Lilongwe Plain. Here the proportion of the land under fallow is very low and soil fertility is steadily declining. Farming systems are based on rainfed arable crop production. Maize is the dominant staple and occupies about 80% of cultivated land in the smallholder sector and over 40% in the estate sector. Tobacco is the main cash crop, occupying about 40% of the cropped area on estates. In recent years, maize has become an increasingly important cash crop for smallholders. Groundnuts, pulses and coffee are also significant cash crops.

Tsetse infestation is not a widespread problem in the zone and livestock numbers are growing; the numbers of pigs and smallstock are also increasing rapidly. Almost all the livestock are owned by smallholders. The main livestock products are beef and hides; there is a small dairy industry centred in Blantyre and Lilongwe. Fishing is an important activity for people living around Lake Chilwa.

Potential

In the Southern Region and much of the Central Region there is little or no potential for increasing agricultural production by extending the area of plateau land under cultivation; most of the suitable arable land is already cultivated, along with significant areas of steep land that is not suitable for cultivation. Only in parts of the Northern Province are there any reserves of uncultivated arable land in the zone but the areas involved are very small.

Increased agricultural production will have to come from improved crop and livestock husbandry practices and diversification into more profitable enterprises. To enable smallholders to invest in improved seed and fertiliser they will have to grow money-making cash crops. Allowing smallholder farmers to grow burley tobacco would be the easiest way of achieving this, but would need to be accompanied by extension advice to protect national crop hygiene. Improvements in overall access to

inputs and credit facilities are two other key elements in enabling smallholders to make more productive use of their land.

Most of the main urban areas in Malawi are within the zone and demand for dairy products, pigs, poultry and horticultural products is increasing.

RIFT VALLEY ZONE

The Rift Valley trough, which traverses the country from north to south, is the southern part of the East African Rift Valley system. It is the most distinctive physiographic feature of Malawi. The valley floor which ranges in elevation from more than 600 m to less than 40 m is divided into three distinct areas:

- Lower Shire Valley
- Lakeshore Plain
- Lake Malawi

Physical environment

The Rift Valley Zone is hotter than the rest of Malawi—it is also generally drier. The Lower Shire Valley, with a mean annual rainfall of less than 750 mm, is the driest part of the country. The northern parts of the Lakeshore Plain, on the other hand, are some of the wettest parts of the country. The Lakeshore Plain to the east of the Vipya Plateau and the area north of Karonga have a mean annual rainfall of between 1500 mm and 2500 mm. The Karonga area, in particular, feeds a number of large rivers that drain into Lake Malawi and is of considerable importance to the hydrology of the lake.

There are two large lakes in the zone—Lake Malombe and Lake Malawi—Lake Malawi is the world's ninth largest in area (29 600 km²) and the fifth largest in volume (8400 km³). Seasonal and periodic fluctuations in lake levels are characteristic of the hydrology in Malawi. Since 1896, when records began, the level of lake Malawi has varied from 468 m to over 474 m; annual variation averages just over 1 m. Lake Malombe is a shallow lake that probably formed part of Lake Malawi in the geologically recent past. The Shire River flows out of the southern end of Lake Malawi and through Lake Malombe. In 1915, when Lake Malombe reached its lowest recorded level, all dry-season flow in the Shire River ceased and did not resume until 1935.

Landforms in the Rift Valley floor are generally flat to gently undulating depositional plains and alluvial terraces. The soils are usually more fertile than those on the plateau with calcimorphic alluvial soils and hydromorphic soils predominating.

Land use and vegetation

A variety of woodland vegetation communities and man-induced thickets occur, reflecting the wide variation in rainfall and soils found in the zone. In the southern parts of the Lakeshore Plains and in the Shire Valley, almost pure stands of *Colophospermum mopane* woodland are found. Large areas of swamp grassland also occur around Lake Malombe and in the Elephant Marsh in the lower Shire valley.

Maize, bulrush millet, cassava and rice are the main staple crops grown. Cotton, rice, sugar cane and groundnuts are grown as cash crops. The lower Shire is a semi-arid area where conditions are marginal for rainfed maize production.

Most of the relatively small area of land in Malawi under irrigation is in this zone. Irrigation is practised on some sugar estates in the Shire Valley, in the Dwangwa River Delta north of Nkhotakota, and for rice production along the lakeshore.

Relatively little of Malawi is tsetse-infested but many of the areas that are infested are in the Rift Valley. Livestock numbers in the zone are relatively low.

The south-east arm of Lake Malawi, the upper Shire River and Lake Malombe are the most heavily exploited fishing areas of the country. In the lower Shire River, the rapid spread of water hyacinth is threatening fish stocks, and also fish farming and irrigation schemes in the area.

Potential

In the Southern and Central Regions all the available arable land is being cultivated, fallow periods are being shortened and cultivation is being extended into marginal land unsuitable for agriculture. Only in the Northern Region is there any limited potential for increasing agricultural production by extending the area under cultivation. Some potential exists for increasing production by improving crop and livestock husbandry practices, and through diversification into more profitable enterprises.

There is considerable potential for increasing the area of irrigated land, though the costs involved are only justified if the crop produced is exported. The average yields of irrigated rice obtained by smallholder farmers do not justify the cost of irrigation although there is potential for introducing wheat as an irrigated crop in rotation with rice. Cotton is potentially a profitable smallholder crop, but levels of husbandry need improving.

FISHERIES

Recent estimates indicate that fish provides between 60% and 70% of animal protein in Malawi with a per capita consumption of over 9 kg/year. Estimates of the numbers of fishermen vary markedly; the 1993 frame survey (Government of Malawi, 1993) showed almost 10 000 fishermen plus over 28 000 assistants working nearly 12 000 craft in the major Malawian water bodies. The population dependent on fishing activities is in the region of 270 000 (Campbell, 1994).

Fish production has increased by about 25% per year since 1962. The rapid increase in catches, however, was recorded in the late 1960s and early 1970s. Since then annual catches have fluctuated between 60 000 and 84 000 t; the catch in 1992 and 1993 was roughly 70 000 t/year (Government of Malawi, 1993). There are five key sources of fish in Malawi: Lakes Malawi, Chilwa, Malombe and Chiuta, and the River Shire system. Lake Malawi alone produces around 50% of the national catch.

The inshore pelagic and inshore demersal fisheries of Lake Malawi are pursued by artisanal fishermen. The pelagic fishery includes the most important fisheries of the lake: *usipa* (*Engraulicypris sardella*) and *utaka* (*Haplochromis* spp.). Amongst the inshore demersal species, *chambo* (*Oreochromis* spp.), *Lethrinops* spp., *Bagrus meridionalis* and *Clarias gariepinus* are particularly important. In the other major water bodies *chambo*, *Barbus* spp. and *Clarias* spp. dominate. Artisanal fishermen use gill-nets, seines (*chilimila*), beach-seines, scoop-nets, cast-nets, hooks and traps.

In 1987 12 pair trawlers and four ring-netters operated on Lake Malawi employing 120–140 fishermen. In the period 1987–92 the industrial fishery contributed between 12% and 16% of the Lake Malawi catch, comprising mainly *Haplochromis* spp., tilapias and *usipa*.

Aquaculture production is currently estimated at just over 200 t/year (Government of Malawi, 1994). The majority of production is in the southern region and is of two types: private, sometimes intensive, aquaculture on estates, and small-scale pond culture by individual farmers. Trout (*Salmo gairdnerii*) and bass (*Micropterus salmoides*) were introduced into Malawi in the early 1900s, but the current estate emphasis is on tilapias such as *Tilapia rendalli* and *Oreochromis shiranus*. The same tilapias are cultured by small-scale farmers with some carp and *Clarias gariepinus*. The area under aquaculture is said to be 72 ha and the value of aquaculture production is around US\$ 231 000.

National catches appear fairly stable, and considerable international effort is being invested in further development of the fisheries. The importance of fish in the national diet and as an employer of people is reflected in the number of external assistance programmes in this sector.

NATIONAL SOCIAL AND ECONOMIC DATA

OVERALL ECONOMIC PERFORMANCE

	Malawi	Sub-Saharan Africa
GNP per capita (1992)	US\$ 210	US\$ 530
Average annual growth in GNP (1980–92)	-0.1%	-0.8%
Average annual inflation rate (1980–92)	15.1%	15.6%
Total external debt (1992)	US\$ 1699 million	n/a
Total external debt as % of exports (1992)	191%	282%
Debt service as % of exports (1992)	23.8%	20.0%

Source: World Bank (1994)

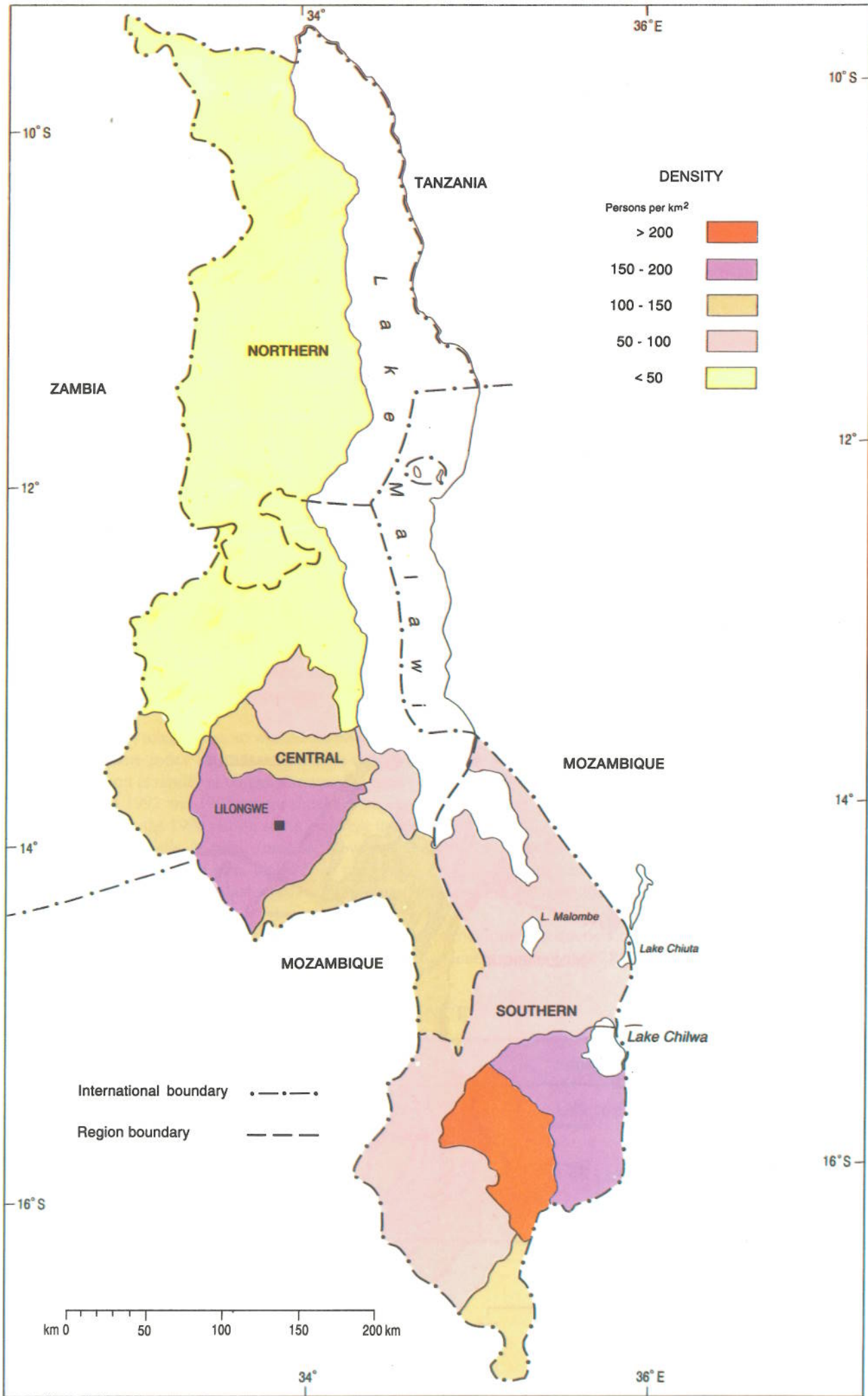
Following Independence in 1964, Malawi experienced rapid economic growth up to 1979 which was based heavily on exports of tobacco and tea from the estate sector. Annual rate of growth of GDP from 1970 to 1980 was 5.8% (World Bank, 1994) and real per capita income rose by 3% per year. In the mid-1970s however, external shocks (rise in oil prices, war in Mozambique, declining export prices) combined with internal structural weaknesses in the economy and the drought in 1979/80, led to an economic crisis and negative growth rates. Malawi embarked on a structural adjustment programme through the 1980s. Although GDP growth rates have steadily recovered (an average of 2.9% per year for 1980–92 compared to 1.8% for the region, and reaching 5% on average between 1990 and 1992), the economy remains highly vulnerable to shocks, such as changes in terms of trade and drought.

Annual agricultural GDP growth has averaged less than 2% since the early 1970s, whilst population has grown at over 3% per year. Whilst the volume of cereals imported has increased over the past two decades—from 17 000 t in 1974 to 412 000 t in 1992 (World Bank, 1994)—food still represents only a small proportion of total merchandise imports, which are dominated by capital goods and industrial inputs.

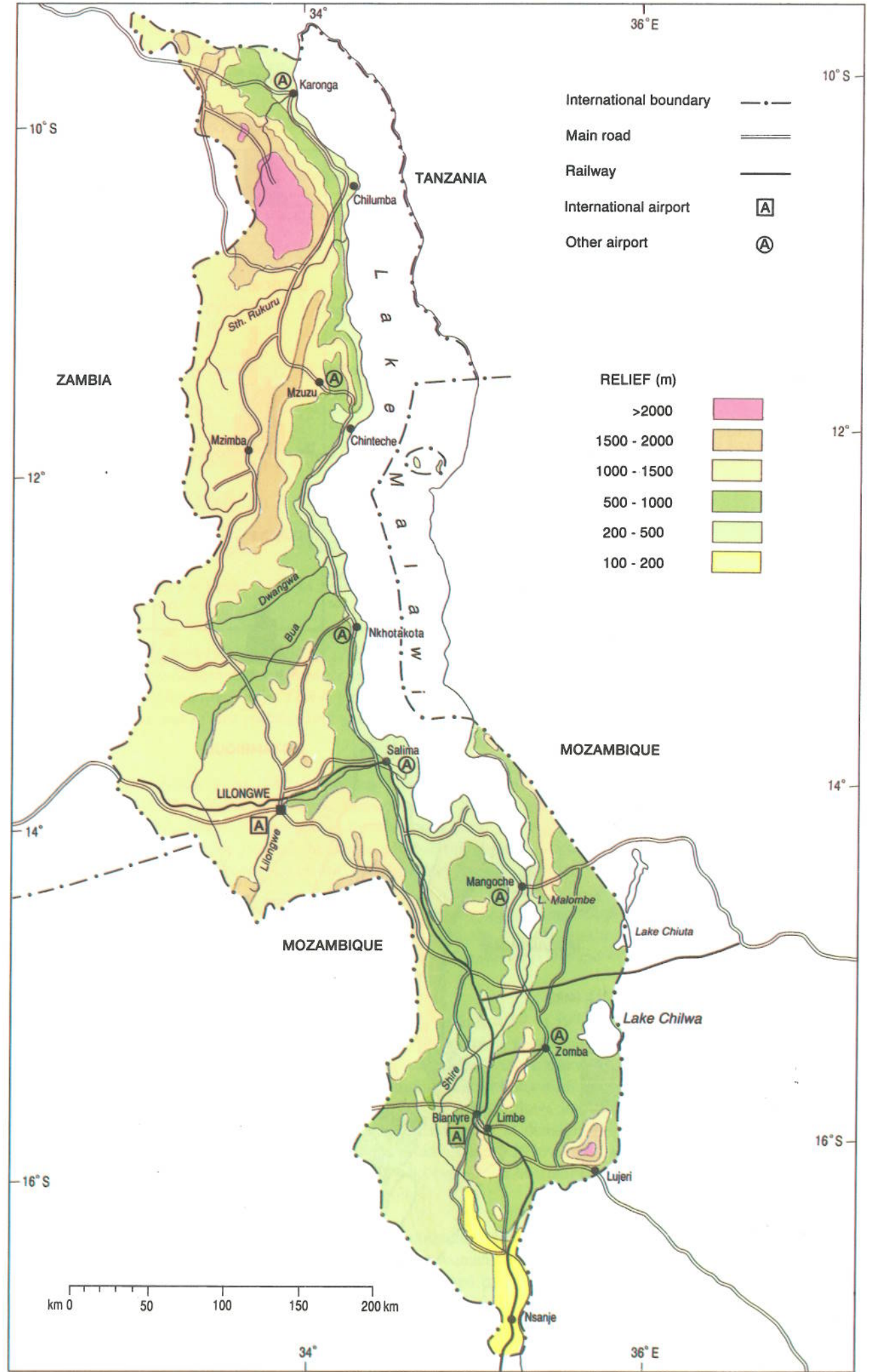
The average annual rate of inflation over the period 1980–92 was comparable to the regional average (World Bank, 1994). It reached 22% in 1992, reflecting the impact of two substantial devaluations, fell back slightly in 1993 but rose to 34.7% in 1994 (EIU, 1995).

Total external debt in 1992 was US\$ 1699 million, considerably higher than the debt of US\$ 821 in 1980 (World Bank, 1994); total external debt in 1993 and 1994 rose to US\$ 1821 and US\$ 1955 respectively (EIU, 1995). Debt service as a proportion of exports has declined since 1980 whilst the Sub-Saharan Africa average has increased; however, Malawi is still slightly above this average.

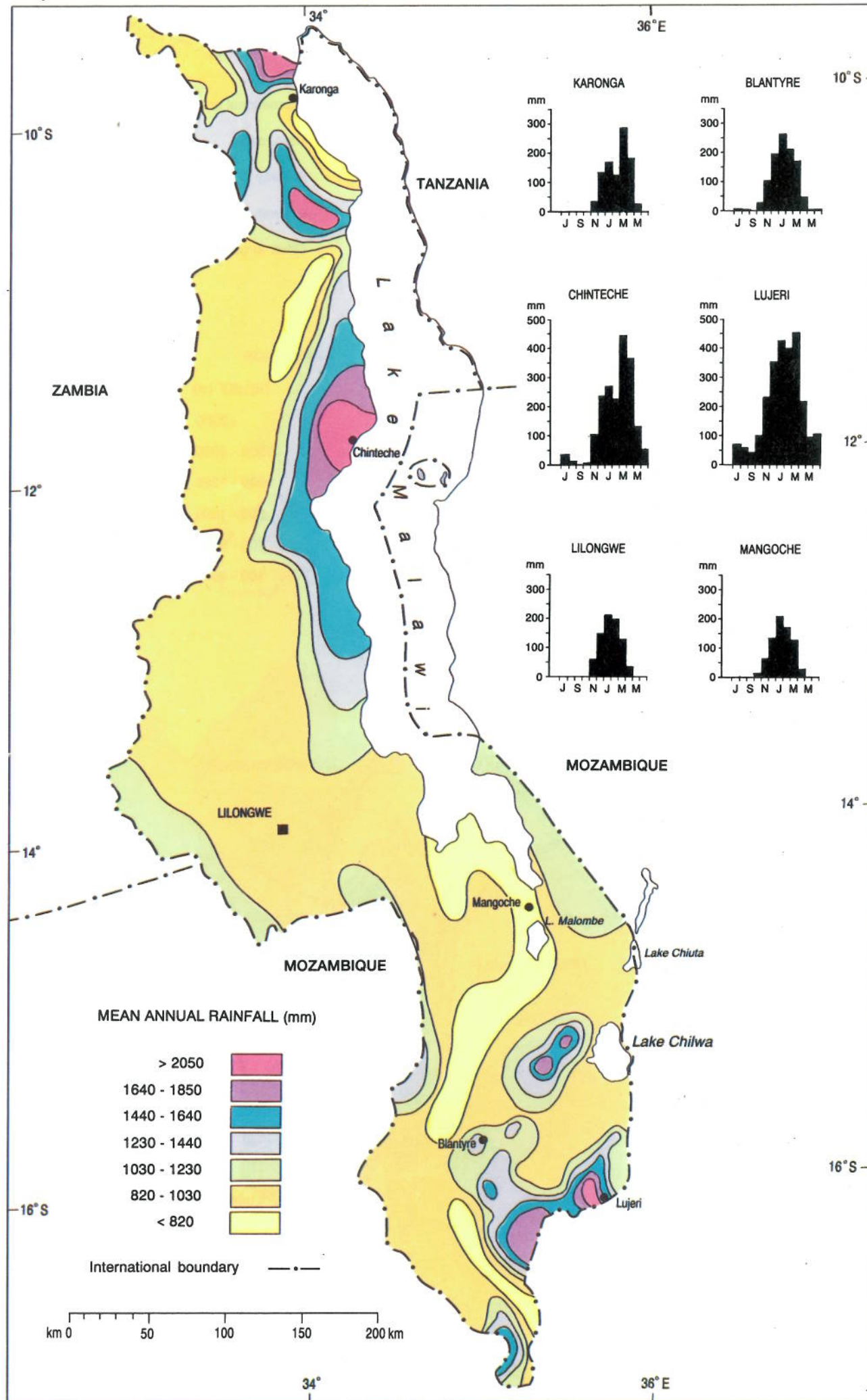
Map 2 Population and Administration in Malawi



Map 3 Relief and Communications in Malawi



Map 4 Rainfall in Malawi



Malawi's ODA receipts have increased every year since 1985 when they were at \$113 million. ODA per capita and as a percentage of GNP are both well above the regional averages.

POPULATION AND DEMOGRAPHY

	Malawi	Sub-Saharan Africa
Population (1992)	9.1 million	543 million
Projected (2000)	11 million	681 million
Average annual population growth rate (1980-92)	3.2%	3.0%
Population density (1992)	96 persons/km ²	22 ¹ persons/km ²
Urbanisation (1992)	12%	29%
Total fertility rate (1992) ²	7.6	6.4
Crude birth rate (1992)	55 per 1000	45 per 1000
Crude death rate (1992)	21 per 1000	15 per 1000
Life expectancy at birth (1992)	44 years	52 years

Source: World Bank (1994); UNICEF (1994)

Note: ¹The Sub-Saharan Africa average is based on total area, whereas the Malawi figure is calculated on the basis of land area only. ²TFR is the number of children that would be born to a woman if she were to live to the end of her childbearing years and bear children in accordance with prevailing fertility rates.

Malawi's population at the 1987 census was 7.99 million; it was estimated in mid-1993 at 9.33 million (EIU, 1994). The official estimate of annual rate of growth is now 3.3% although 3.6% is quoted elsewhere (GFA, 1993). Projections of future growth vary; the World Bank quotes an average annual growth rate of 2.5% per year for the period 1992-2000, giving a population of 11 million by the year 2000. It seems likely that population will double within the next 30 years.

With a land area of 9.4 million hectares, population density approaching 100 per km² is one of the highest in Africa. There are marked regional imbalances with the highest densities in the Southern region, particularly in the Shire Highlands. Densities per unit of arable land (around 48% of total land) are much higher still with a national average of 176 persons/km².

The level of urbanisation is still low at 12% in 1992, up from 8.5% in 1977. But rates of urban growth are high (5-15% per year for different urban centres) and point to a growing concentration of population in the future. It is projected that 30% of the population will be in urban centres by the year 2000 (UN/GOM, 1993). Internal rural-rural migration has been significant, with net outflows from the heavily populated southern highlands and from the Northern Region; and net inflows into the growth points of Central Region. External migration is no longer a significant factor in demographic trends; large outflows of labour to Zimbabwe, South Africa and Zambia dried up in the 1970s, and the sex ratio in 1987 stood at 94 males to 100 females. Most of the refugees who came from Mozambique during the war, numbering over 1 million at the peak, have now returned home.

Rapid population growth is brought about by continuing high fertility rates combined with high but falling mortality. Total fertility rate is 6.7 births per woman which is similar to the regional average of 6.1 reported by the World Bank (1994); the rates quoted by UNICEF in the table are slightly higher.

There is slight evidence of change over the past two decades when the fertility rate was 7.8 (World Bank, 1994). Child bearing begins on average by 18 or 19 years; only 7% of women in 1984 reported using any method of child spacing and only 1% a modern method, although this had increased to an estimated 7% for married women by 1992 (UN/GOM, 1993). Mortality was exceptionally high from the 1950s to the mid-1970s; life expectancy was still only 41 years in the early 1970s. The recent UN/GOM study (1993) quotes life expectancy at 48 years, considerably higher than the World Bank figure given above.

AIDS is now an important new cause of death among both adults and children; the number of HIV-positive people is generally estimated at around 10% of adults, and AIDS has already become the leading cause of death in the 20-40 years age group. It is not yet possible to forecast the future impact on population; the World Bank has made projections based on varying scenarios, and concludes that, even with the threat of an AIDS epidemic, Malawi must plan for substantial population growth, an increase of at least 50% over the next 15 years and possibly an explosion to nearly 25 million by 2020. But this will be greatly influenced by future fertility trends.

HEALTH, NUTRITION AND EDUCATION

	Malawi	Sub-Saharan Africa
Under-5 mortality (1992)	226 per 1000 live births	181 per 1000 live births
Infant mortality (1992)	143 per 1000 live births	111 per 1000 live births
Average daily calorie supply as % of requirements (1988-90)	88%	93%
Food as % of imports (1992)	8%	12%
Food import dependency ratio (1988-90) ¹	5.6%	10.2%
Prevalence of malnutrition (1980-92)		
0-4 years underweight	27%	31%
1-2 years wasted	11%	12%
2-5 years stunted	62%	49%
Access to safe water (1988-91)	56% ¹	40%
Access to health services (1985-92)	80%	48%
Adult literacy	45% (1992 estimate)	51% (1990)

(continued)

Primary school enrolment ratio (1986-91)		
Female	52% net ² (64% gross ³)	46% net (60% gross)
Male	55% net (77% gross)	54% net (76% gross)

Source: UNICEF (1994); UNDP (1994); World Bank (1994)

Note: ¹Data relate to different year or period or relate to only part of the country. ²Net indicates number enrolled in relevant age group as percentage of the population in the relevant age group for primary schooling. ³Gross indicates number enrolled regardless of age as percentage of the population in the relevant age group for primary schooling.

Infant and child mortality rates remain very high, at 143 and 226 per 1000 live births respectively, but are declining (the 1992 Demographic and Health survey indicates a CMR of 234). More than 1 in 5 children thus die before the age of five; on this indicator, Malawi ranks eighth worst in the world. The major causes of child mortality are malaria and malnutrition. Other common causes of death are pneumonia, anaemia, diarrhoea and measles (UN/GOM 1993).

The food import dependency ratio is well below the average for the region. Food aid receipts have increased dramatically over the past decade, from 5000 t in 1979/80 to an average of 225 000 t over the three-year period 1989/90-91/92 (World Bank, 1994), although showing marked fluctuations between years.

The very high prevalence of stunting in children (low height for age) indicates widespread long-term under-nutrition, producing a loss in growth potential which cannot be recovered later in life. The 1992 Demographic and Health survey found that nearly half of all children under five years were stunted (lower than the UNICEF figures given above), about half of whom were severely stunted. This is caused by inadequate household food availability, poor child feeding practices and the high incidence of infection (UN/GOM, 1993).

Access to safe water and health services is significantly higher than the regional averages; this is reflected in the declining mortality rates and increasing life expectancy referred to above. Access to safe water is considerably higher in urban areas (97%) than rural areas (50%) but these data may not reflect the situation accurately as indicated in the note to the table (UNICEF, 1994). Data are not available for rural/urban comparison for access to health services. The UNICEF report shows that 100% of the urban population (81% of the rural population) has access to adequate sanitation.

Actual adult literacy data are not available for Malawi, although the rate is estimated to be below the regional average. Primary enrolment ratio is about average for the region at 66 although secondary enrolment ratio, at 4, is way below the regional average of 18.

Overall, Malawi ranks 157 out of a total of 173 countries in the UNDP Human Development Index for 1994.

INSTITUTIONAL CONTEXT

MAIN INSTITUTIONS SERVING THE RNR SECTOR

Government Ministries/Departments

- The Ministry of Agriculture consists of:
 - Four technical departments: Agricultural Research, Agricultural Extension and Training, Animal Health and Industry, and Irrigation
 - Food and nutrition unit
 - Land resources and conservation branch
 - Smallholder credit administration

The Ministry's field services are organised into eight geographical areas or Agricultural Development Divisions (ADDs).

- The Ministry of Natural Resources has two departments:
 - Forestry
 - Fisheries

The Fisheries Department has recently undergone structural change as recommended by a World Bank Fisheries Development Project. The restructured department focuses on improving resource management, the paramount responsibilities being the protection of the existing fish resources by means of appropriate research, the collection and analysis of relevant data and the application of appropriate control mechanisms. The work of the department is divided into five programmes covering:

- Administration
- Development and extension
- Aquaculture
- Training
- Research

The development and extension activities are concentrated at local level to assist fishing communities to participate in the management of the resources available to them. Research on capture fisheries is carried out at the Monkey Bay station and aquaculture research is undertaken at the experimental fish farming station in Domasi and by the Central and North fish farming project at Mzuzu.

- The Department of Lands and Valuation and the Department of Survey have responsibility for land matters.

Data collection, processing and publication are carried out by the National Statistical Office.

Research stations/training institutions

Government-funded research (for the smallholder sector) is conducted at a network of agricultural research stations, the principal ones being Chitedze, Bvumbwe and Makoka. Forestry research is the responsibility of the Forestry Research Institute of Malawi (FRIM) in Zomba. The National Herbarium and Botanic Gardens is also based in Zomba.

Research for the estates is conducted at the Tobacco Research Institute of Malawi (TRIM) and the Tea Research Foundation (TRF), and funded by the industries. TRF and the Estate Extension Service Trust, which is funded by a cess on the tobacco crop, conduct extension for estates.

Public training institutions in the RNR sector include Bunda College of the University of Malawi; the Malawi College of Forestry; the Natural Resources College; the Fisheries College. Social science research and training is conducted at the Centre for Social Research, Zomba.

Parastatals

Parastatals concerned with the RNR sector include:

- Agricultural Development and Marketing Corporation (ADMARC)
- Malawi Dairy Industries (MDI)
- Kasungu Flue-Cured Tobacco Authority (KFCTA)
- Smallholder Tea Authority (STA)
- Smallholder Coffee Authority (SCA)
- Smallholder Sugar Authority (SSA)
- Malawi Export Promotion Council (MEPC)
- Petroleum Control Commission (PCC)
- Tree Nut Authority (TNA)
- Smallholder Farmers Fertiliser Revolving Fund of Malawi (SFFRFM)—responsible for procuring fertilisers, managing the fertiliser buffer stock and facilitating the distribution of fertiliser provided under commodity aid agreements
- Smallholder Agricultural Credit Administration (SACA)—provides credit to smallholders; it is being incorporated into the Malawi Rural Finance Company
- Malawi Mudzi Fund Trust—established to provide credit for non-farm enterprises, but also undergoing restructuring.

Private sector

A number of private companies engage in fertiliser and other input supply. The National Seed Company of Malawi (NSCM), in which Cargill International has a majority share, is the main supplier of certified hybrid tobacco and maize seed. Lever Brothers also supplies hybrid maize and sunflower seed.

Non-governmental organisations

A range of non-governmental organisations (NGOs) is active in the RNR sector. These include the Wildlife Society, the Mulanje Mountain Conservation Trust, CURE (a coalition of NGOs for environmental rehabilitation), EVARD, the Christian Services Committee.

Donors

Many bilateral and multilateral donors have RNR programmes in Malawi, including the United States Agency for International Development (USAID), Deutsche Gesellschaft für Technische Zusammenarbeit GmbH (GTZ), ODA, the European Community, the International Fund for Agricultural Development (IFAD), the World Bank, the Rockefeller Foundation, and the International Centre for Living Aquatic Resources Management (ICLARM).

REGULATORY FRAMEWORK FOR RNR MANAGEMENT

Forestry

Forest management is regulated by the Forest Act of 1984. This governs the creation and use of public forests and the management of indigenous forests. There are, however, several weaknesses in the Act. It appears to be subsidiary to other Acts where conservation and land use issues are concerned. It is ineffective in dealing with major offences in forest reserves and in dealing with pressure on reserve land

to be released for agricultural estates. Also, most of the important provisions under the Act are contained in subsidiary legislation, the Forest Rules, which are not widely known by the police and the courts. A revised Forestry Bill is currently being processed.

Wildlife

The National Parks Act was revised recently and it now consolidates a number of earlier wildlife laws. It allows for mixed use of wildlife resources and should provide a strong framework for sustainable management of wildlife resources.

Fisheries

The Fisheries Act provides for the regulation and control of fishing, the issuing of licences, and conservation of fish. All commercial fisheries are licensed and their catches are monitored. The regulations govern where and when fishing can take place, net mesh sizes, engine power and the minimum size of fish that can be landed. All artisanal fishermen are required to license their nets. Additional provisions may be needed to provide protection from pollution for hatcheries, but otherwise the Act provides an effective framework for sustainable management of fish resources.

Water resources

The Water Resources Act, the Waterworks Act, the Inland Waters Shipping Act, and the Blantyre and Lilongwe Waterworks Acts provide the legal framework for water resource management. The legislation requires strengthening to deal with the growing problem of water pollution, and to provide for more effective control of water catchment areas.

Land use planning

The recently revised Town and Country Planning Act provides a good basis for the integrated planning of land resources. It now provides for better management of countryside land use issues such as development of the Lakeshore.

Land laws

Land in Malawi is regulated by seven main laws: the Land Act, the Registered Land Act, the Land Acquisition Act, the Planning Sub-Division Control Act, the Land Survey Act, the Customary Land (Development) Act and the Local Land Boards Act. The first five of these Acts have been recently revised and they now provide a much clearer framework for land transactions and sustainable land development. The other two have not been changed in 25 years, despite significant developments in smallholder and estate land use practices. A review of these acts is now required.

KEY DEVELOPMENT ISSUES FOR THE RNR SECTOR

POVERTY AND HOUSEHOLD FOOD SECURITY

The central development issue in Malawi is the continuing poverty of a large proportion of the population, despite a wide range of development initiatives and policy reforms aiming to improve their situation. The World Bank estimates that 55% of the population live below a poverty line of US\$ 40 per capita per year, based on minimum nutritional requirements and non-food needs. A recent study by the UN/Government of Malawi quotes rural poverty at 60%, and urban poverty at 65% (UN/GOM, 1993). The *Human Development Report* (UNDP, 1994) estimates the proportion of the population living in absolute poverty during the 1980s at 82% overall, and 90% for rural areas.

The poor comprise a cross-section of the population, including smallholders farming less than 1 ha (many of whom are women), estate workers and tenants, urban dwellers and children within these households. They are characterised by inadequate food supplies, low incomes, poor health and low life expectancy, and poor education, skills and employment prospects. Within the rural poor, three main groups can be distinguished.

- Smallholders represent the bulk of the country's poor. There are an estimated 1.8 million smallholder households farming under customary land tenure. Smallholding size is one of the principal constraints, combined with low productivity of labour. It is generally held that under traditional management conditions, holdings of less than 1 ha cannot provide the household's—average size of five—food requirements from own production. Fifty-five per cent of holdings fall within this category, and female-headed households are disproportionately represented (over 70% as compared to 50% for male-headed households). The World Bank distinguishes between the 'core poor' (25% of families farming less than 0.5 ha) and the poor (35% with 0.5–1.0 ha). Both groups are food-deficit and are obliged to seek off-farm casual 'ganyu' labour; as this often coincides with peak labour demand on-farm, particularly for planting and weeding, own production is further reduced. Such households have insufficient cash to invest in available yield-increasing technologies, notably hybrid maize seed and fertiliser, and maize yields are consequently low (between around 0.9 and 1.2 t/ha). As net purchasers of maize, the poorest are adversely affected by higher producer prices accompanying structural adjustment programmes. The number of 'nearly landless' households is increasing.

A sub-group of poor smallholders is women and female-headed households. Around 70% of full-time farmers are women (1977 census) and some 25% of part-time farmers. About 30% of all rural households are headed by women, with the proportion increasing as farm size decreases. As well as farming, these women are responsible for the time- and energy-consuming tasks of child bearing and rearing, food preparation, water and fuel collection and other domestic and market activities. Female-headed households have lower crop yields and incomes per capita than male-headed households and are particularly affected by seasonal labour constraints. Women in general are less likely to receive extension advice and credit than men, although efforts have been made to redress this situation. Many women suffer from seasonal under-nutrition, especially in the pre-harvest period when workloads are also high.

- A large proportion of estate workers and tenants are living in poverty. Recent surveys reveal that around 50% of adult male permanent workers—and even more on the smaller estate—are paid less than the statutory minimum wage, and almost all children (Mkandawire *et al.*, 1990). The number of estate workers grew dramatically in the 1970s and early 1980s, whilst more recently the more rapid growth has been in the number of tenants. Most recent estimates, for 1990, are around 215 000 regular wage labourers, 267 000 casual workers, 166 000 'other' labourers, giving a total of nearly 650 000 labourers, and 126 000 tenants (Chilowa, 1993). According to the World Bank, about two-thirds of estate employees are impoverished (i.e. earn less than US\$ 40/year). Estate workers' wages since 1980 have corresponded almost exactly to the minimum wage and are way below those in any other sector (e.g. one-fifth of those in manufacturing in 1987) (Sahn and Arulpragasam, 1991).

Tenants may receive somewhat higher incomes on average than labourers but are disadvantaged in other ways, e.g. very high interest rates on credit advanced, no extra plot given for food crop production, inadequate and unreliable food rations (Sahn and Arulpragasam, 1991); poor housing conditions and long distances to amenities are also reported in a survey by Khaila *et al.* (1993). The tenant is in no position to ensure that the landlord adheres to the tenancy contract, which is often negotiated by word and not written down. This leads to a high rate of turnover, adding to management problems within the estate sector. Tenants are obliged to sell all their produce to the estate at a fixed price, although Khaila *et al.* (1993) report that, if a tenant suspects he has insufficient tobacco to pay back advances received, he may sell his tobacco elsewhere. Use of child labour is widespread, and almost all wives of male tenants participate in tobacco production as well as cultivating food crops. Tenants work mostly on tobacco estates in the Central and Northern Regions. EEST estimates that about 3 million people are supported by the estate sector and associated tobacco industry (labourers, tenants, owners, processing workers and their families): TAMA estimates 4 million.

- A third group of rural poor is the refugee population from Mozambique, many of whom have returned home following the 1992 Peace Accord and most of the remainder expected to leave by the end of 1994 (EIU, 1994). Their presence in Malawi placed a considerable additional strain on the economy, service provision and natural resources. They lived in makeshift settlements close to the border and were concentrated in southern Central Region and many areas of Southern Region—already densely settled areas. Numbers were estimated at well over 1 million at the peak of the refugee influx, although this may have been over-estimated. It seems that there was relatively little social conflict between refugees and the local population. In fact, many Malawians from the border areas actually benefited from their presence; they registered as refugees themselves so as to be eligible for free food rations.

LAND TENURE AND DECLINING HOLDING SIZE

The Malawi Land Bill of 1965 lays down the framework for current land tenure. It defines three types of land.

- Public land: land which is occupied, used or acquired by the Government, and any other land not being customary land or private land. It includes all National Parks, forest reserves and areas acquired by government for urban development and other schemes. The amount has increased significantly since Independence; in 1990 there were about 1.8 million ha of public land.
- Customary land: land held, occupied or used under customary law, excluding public land. The village headman is the custodian of land and is vested with authority to control and arbitrate over it, granting usufructory rights to residents of the village. Land cannot be sold but can pass between generation (according to local inheritance rules). The state however, retains ultimate control over the land, e.g. can convert it into private or public land. There are around 5.5–6.6 million ha of customary land.
- Private/estate land: land that is owned, held or occupied under a freehold title, a leasehold title or a certificate of claim. Leaseholds are normally granted for periods of between 21 and 99 years, and the minimum area that can be registered (as a leasehold estate) is 10 ha. Total area under estates is about 1.2 million ha.

The tenure laws define the essentially dualistic structure of Malawian agriculture: a very large smallholder sector on customary land conducting primarily subsistence production and showing slow rates of growth, and a smaller estate sector, mostly leasehold, producing export crops and historically achieving rapid growth. This distinction has become blurred in recent years with the development of a group of smallholders who have converted their land to leasehold tenure; however, they represent only a very small proportion of the total number of smallholders.

The pressure on land in the smallholder sector due to population growth has been exacerbated by the large-scale appropriation of customary (smallholder) land by the estate sector over the past 25 years.

There is a lack of reliable data on land use in Malawi and major discrepancies exist between sources. The area under customary tenure has declined from around 8.2 million ha in 1964 to 5.5 million ha in 1993, of which 4.55 million is suitable for cultivation, according to the World Bank. This does not mean that smallholders have been forced off their land, but it does imply reduced land available for future expansion (now estimated at 0.25 million ha of customary land). Average holding size has reduced from about 2 ha in 1970 to 1 ha in 1988. The situation points to a drastic need for increased productivity of land and labour in smallholder agriculture, which has not yet been achieved on a large scale. Alongside this pressure on customary land, large areas of unused land remain in the public and estate sectors. Of an estimated 1.1 million ha of unused land suitable for cultivation, over 50% is under forest and game reserves (Eschweiler, 1993).

Land distribution is skewed but data to demonstrate the degree of concentration of land occupation are hard to find. Holding size data are available for the smallholder sector but only aggregate figures can be found for estates; and there are no cross-sector comparisons readily available. Fifty-five per cent of smallholdings in 1987/88 were less than 1 ha (average size 0.55 ha) whilst only 5% of smallholdings were over 3 ha. This implies that around 10% of total cultivable area (of 5.7 million ha) or 5% of total area was occupied by over half the smallholder population (or around 930 000 holdings). Regarding the estate sector, in 1989, around 8000 estates occupied some 760 000 ha or 8% of total area. Perhaps more illuminating is the fact that in 1979, before the rapid increase in estate numbers occurred, a mere 1100 estates reportedly occupied 13% of total cultivable land. Presumably, the majority of these estates still exist and are amongst the largest. Tobacco quotas also indicate a high degree of skewness; 2% of burley growers hold 39% of the total quota whilst 94% of growers have only 52% (Barrett *et al.*, 1994, from TAMA statistics).¹

Alienation of customary land in the 1980s proceeded on a large scale, despite increasing land pressure (although there is possible evidence from remote sensing of larger areas of unutilized customary land than was previously believed, at least in some areas). Large tracts of land were granted to politicians and civil servants. Village chiefs often granted permission for conversion to leasehold without consulting residents on their need for the land, in return for some payment by the applicant (GFA, 1993). Transfer of customary land to the estate sector is now being halted, as a condition of the World Bank agricultural adjustment loan (EIU, 1993).

It should be remembered, however, that labour is frequently a constraining factor for the poorest households, such that even if they had access to greater land areas, they would not necessarily be able to exploit it without new labour-saving technology.

Although the Government has regarded the insecurity of customary tenure as "an obstruction to agricultural development", it is debatable whether this is indeed the case in Malawi. As argued by Sahn and Arulpragasam (1991), most smallholders are secure in the historically based notion that they will not lose their land; it is far from clear that conversion to private land would improve security, equity and productivity; evidence from elsewhere links privatisation to concentration of ownership; and implementation of land registration is in practice very difficult. The World Bank concurs that the property rights regime functions relatively efficiently in the smallholder and estate sectors. The inheritance systems operating under customary tenure are governed by well-articulated social rules, which mean that smallholders are generally assured of permanent access to allocated land. A pilot land titling programme carried out in the 1970s in the Lilongwe area does not appear to have had any appreciable impact on the smallholders' willingness to make long-term investment on the land.

Thus, despite the fact that smallholders can apply for leasehold, only a minority has done so. Aside from perceiving little advantage in so doing, they may be constrained by other factors: stipulations on land use which compromise their ability to grow enough maize, lack of capital or credit to pay rent and fulfil covenants, and lack of knowledge of the procedures to follow. Sub-leasing of unused estate land to smallholders is uncommon, perhaps because of concern by estate owners that they will lose control of

¹ Donor pressure may well lead to the Government abandoning the quota system, allowing market forces to determine production, with likely profound consequences for the structure of the subsector.

land they rent out (by tradition, if land is occupied for five years, the occupant can assume use-rights). Estate owners do, however, mortgage land with commercial banks in order to raise cash.

There is some evidence that informal land markets in customary land have developed, for example, land 'loans' which become permanent and sales of land being disguised as tree sales (Sahn and Arulpragasam, 1991). Common lands are often encroached upon without the consent of the chief and encroachment onto leased land is also widespread.

The land question in Malawi is one which will require attention with increasing urgency as land becomes ever scarcer in the smallholder sector.

AGRICULTURAL ISSUES

Trends in smallholder agricultural production

The consequences of land pressure are a reduction in soil fertility on cultivated lands through continuous cropping and other poor management practices, and expansion into areas marginal for cropping, leading to reduced crop yields and adverse environmental consequences. Average yields of local maize varieties have fallen between 1982/83 and 1990/91, from around 1 t/ha to less than 900 kg. The share of maize in total area has increased, to over two-thirds of cropped area. Yields of other smallholder crops have fluctuated over the past decade but show no signs of sustained increases. Overall per capita food production (including maize, millet, sorghum, rice, wheat, pulses, cassava and groundnuts) has decreased from 270 kg/year in 1970-74 to 211 kg/year in 1985-90. Per capita maize production has decreased from 204 kg to 161 kg over the same period (UN/GOM, 1993), compared to a per capita gross requirement of maize of 230 kg/year (based on a 2200 kcal average daily energy requirement).

Something of a breakthrough has been achieved with the release of new hybrid varieties of maize ('flinty' types, with acceptable processing and storage characteristics for smallholders) in the late 1980s. The area planted to hybrid maize increased from 3% of total area in 1986/87 to nearly 25% in 1992/93, but then reduced to less than 10% the following year. This is attributed to the inability of farmers to obtain seasonal credit for inputs following the large-scale defaulting on loans the previous year. Big increases in output are theoretically possible with these new varieties (which can yield 4 t/ha under smallholder conditions), but require the establishment of appropriate farmer support systems. Availability of credit is a crucial factor in allowing the uptake of hybrids, particularly if the poorer farmers who do not cultivate cash crops are to benefit.

Another recent development has been the opening of burley tobacco production to smallholders (previously restricted to estates) in 1990/91. They have been allocated a quota which has increased each year since its inception. Although only a small proportion of smallholders (about 1.5%) is as yet engaged in burley production, the absolute number is still significant (at around 30 000) and expected to increase considerably by the end of the decade. This represents a major potential injection of cash income into the smallholder economy.

Agricultural diversification

Agriculture in Malawi is heavily dependent on two crops. Maize occupies about 80% of cultivated land in the smallholder sector, and over 40% in the estate sector. Tobacco occupies about 40% of cropped land on estates, and tobacco exports account for over 70% of export earnings. Diversification is desirable, both to reduce reliance on these two crops and to increase farm incomes. The heavy reliance on tobacco for export earnings makes the Malawian economy highly vulnerable to changes in its world market price as well as to fluctuations in domestic production levels.

Generally speaking, agricultural diversification can be achieved in three ways: through the development of new farming enterprises; through improved production of existing crop/livestock enterprises; and through the processing of crop, livestock and forest products for both domestic and export markets.

Options for export diversification include macadamia and cashew nuts, fresh fruit and vegetables, herbs and spices, confectionery groundnuts, flowers, pulses, cotton, coffee, lumber products, ostriches and silkworms. For domestic markets options include more widespread use of hybrid maize, soybeans, smallstock, fish, sorghum and millet (for use as flour in low-rainfall years), fruit and vegetables and various tubers. Processing options include instant coffee, sorghum flour, starch and glues from cassava, rice dehulling and the processing of fruits, vegetables, nuts and edible oils.

There have been a number of studies on agricultural diversification in Malawi, including commodity studies on cotton, spices, horticultural products, tree nuts, fish and silkworms. However, little action has resulted. For every diversification option there are a number of constraints. Transport is a major problem: owing to its landlocked location, Malawi has always had high external transport costs. The main external trade routes through Mozambique have, in recent years, been subject to closure, disruption, delays, damage and theft. Airfreight space is limited and expensive, and storage at the airport is also a problem. Finding enterprises that can match the high gross margin possible with tobacco production is another major constraint. For most estates, diversification means complementing rather than substituting tobacco production with other enterprises, and for smallholders, one of the easiest options for raising incomes is through the expansion of burley tobacco production. Other major constraints include weak institutional support for new enterprises, limited access to credit, the difficulty in meeting strict export quality, quantity and timeliness requirements, and inadequate government support to, and co-operation with, the private sector.

Nonetheless, the entry of private traders into agricultural markets since 1987 has led to increased demand for, and production of, several high-value crops produced by smallholders (especially chillies, sunflower seeds and pulses, as well as groundnuts in years in which the government allowed this). Other recent initiatives include macadamia and cashew nuts, fresh flowers, soybeans, paprika and pyrethrum.

Growth in the estate subsector

The estate subsector has seen rapid expansion since Independence both in terms of area occupied and in contribution to GDP. Area has increased from 79 000 ha in 1970 to an estimated 1.2 million ha in 1993. An annual growth rate of nearly 6% in estate subsector GDP was achieved between 1973 and 1992, and contribution to total agricultural GDP has risen from 13% to 35%. Estates produce about 90% of agricultural exports.

Expansion of the estates in the 1970s and early 1980s was largely a response to high world prices for tobacco, assisted by the availability of cheap labour and commercial loans. Some of the negative implications of this—the alienation of customary land and the poverty status of many estate employees—are discussed elsewhere (see Land tenure page 26-28). But estates clearly provided the engine for overall economic growth during this period. Estate expansion has been concentrated in the Central Region, which now accounts for 77% of all estates. Poor infrastructure, low population and climatic factors limited development in the north, whilst population pressure in the south precluded further expansion.

Up until the 1980s, there were only some 1500 estates which were mostly large-scale commercial farms owned by corporate entities, businessmen and civil servants. More recently, the sector has undergone a structural transformation with expansion in the 1980s and 1990s being dominated by much smaller estates of less than 30 ha. Many of these are owned by 'graduated smallholders' who have converted customary use rights on their land to leasehold tenure in order to gain a licence to grow tobacco. The total number of estates is now around 26 000-30 000 and the average size of leasehold estates has decreased from 345 ha in 1970 to 50 ha in 1993. Sixty-one percent of estates are now less than 20 ha and 85% had tobacco quotas of less than 5000 kg in 1994 (Khaila *et al.*, 1993). The characteristics of these smaller estates and their owners are little different from those in the smallholder sector. In particular, estates owners/managers lack management expertise (this is said to be the case even on many larger estates) and access to information, credit and technology.

This growth has thus not been accompanied by any significant improvements in technical or operational efficiency. Production is characterised by low yields (e.g. 60% of average yields of burley tobacco in

Zimbabwe), low rates of return to capital and labour, sub-optimal quality of product and an over-dependence on tobacco, mostly flue-cured and burley. Analysts agree that production of high-quality tobacco is fundamental to Malawi maintaining or increasing its share in world markets; Malawi burley is sought after for its filling qualities. Other estate crops—tea, sugar, coffee and tree crops—account for a much smaller area and value of output than tobacco. A large amount of maize (hybrid and local varieties) is also produced on estates; in 1994, an estimated 230 000 t was produced.

A further problem is the large area of unutilised estate land; one source estimates around 70% of leasehold land to be idle (Sahn and Arulpragasam, 1991) although much lower figures of around one-third are quoted by the World Bank. A considerable portion of estate land is in any case unsuitable for cultivation (and this could account for the difference in utilisation figures). Under-use is especially true for large-scale estates (greater than 100 ha) with more than one-third of these estates cultivating less than 15% of their total land (Mkandawire *et al.*, 1990); cropping intensities are much higher on smaller estates. The under-use is due to a combination of factors, including lack of capital, slow start-up, labour shortages, low land rents, inefficient land markets and policy constraints on marketing and exporting non-tobacco crops.

Agricultural service provision

Although a great deal of investment and effort has been put into the upgrading of research, extension and credit services, it is widely considered that progress has been slow and impact very limited. The extension service of the Ministry of Agriculture reaches less than 30% of the smallholder population, and tends to focus on farmers with holdings larger than 1 ha, with little coverage of the poorest, including female-headed households. Most extension is linked to credit distribution through farmers' clubs, which limits the time available for farmers education. Messages available are not well-adapted to the realities of smallholder production or to diverse physical and socio-economic situations, and the link with research is weak. The service is also constrained by lack of recurrent funding, poor management and incentive structures and inadequate training of staff. Extension to the estate subsector is rather better, through both producer associations and the Estate Extension Service (although the latter suffers from lack of field staff and its restructuring is currently under consideration).

Agricultural research has suffered from similar constraints, and progress has been disappointing in generating appropriate smallholder technologies (apart from the important exception of hybrid flint maize, and recommendations in agroforestry, land husbandry and cultural practices).

Despite rapid increases in credit supplies to smallholders during the 1980s, less than 35% have access to formal credit, and this limits the ability of the majority to intensify and diversify production. It is reported that over 60% of smallholder loans come from informal sources. The Smallholder Agricultural Credit Administration (SACA) is being transformed into a private institution in an attempt to mobilise more funds and expand coverage to include small estates of less than 30 ha. Reform of the rural credit system is widely viewed as a crucial factor for future agricultural growth.

FORESTRY AND THE NATURAL ENVIRONMENT

Deforestation

Malawi's forests play a critical role in the economy: they provide 90% of household and industrial energy requirements, a substantial volume of timber production, and significant recreational and environmental benefits. Increasing demands on the resource have been exacerbated by the influx of Mozambican refugees, and the expansion of flue-cured tobacco estates.

Deforestation is a significant, and even alarming, problem in Malawi. There is a large gap between sustainable supply and demand for wood products at prevailing prices. Wood production was about 4.3 million m³ in 1984 and will increase to an estimated 5.3 million m³ by 1995. Over the same period, consumption will increase from 9.4 million m³ to 11.7 million m³ and the annual deficit from 5.1 million m³ to 6.4 million m³. This gap is met by the harvesting of standing stock of indigenous wood on customary land. Although the annual conversion of forest to agricultural land, in the period 1965 to

1988, averaged only about 1% overall, more than 3% of the forest is lost each year. In the Southern Region the annual rate of deforestation is now a very serious problem, and here it is anticipated that all indigenous woodlands on customary land will be cleared by 1995. Only the Northern Region will maintain a surplus of wood, with an annual stock increase estimated at 2.0 million m³/year.

Estimated wood production 1984 and 1995 (m³)

	1984	1995
Production		
Forest reserves	800 000	800 000
Estates (natural forests)	500 000	300 000
Cultivated areas	1 400 000	1 400 000
Non-cultivated areas	600 000	600 000
Plantations	200 000	1 400 000
Other	800 000	800 000
TOTAL	4 300 000	5300 000
Consumption		
Fuelwood		
Urban	1 000 000	900 000
Rural	5 100 000	7 500 000
Estate	2 000 000	600 000
Rural industry	400 000	500 000
Urban industry	100 000	100 000
Poles	700 000	900 000
Wood processing	100 000	200 000
TOTAL	9 400 000	11 700 000
<i>Total deficit</i>	<i>5 100 000</i>	<i>6 400 000</i>

Source: Government of Malawi (1987)

Almost all (97%) of Malawi's forests consist of indigenous woodlands, most dominated by *Brachystegia* and *Julbernardia* species (*miombo*). These forests have low yields but produce high-quality fuelwood and poles. Three-quarters of the indigenous woodland is on customary land. Institutional weaknesses in the Forestry Department and the revenue collection system mean that fees for commercial extraction are rarely collected, and these areas are essentially an unmanaged resource. The remainder of the indigenous woodlands is in protected areas.

Distribution of forested land (ha)

	Northern Region	Southern Region	Central Region	Malawi
Estate woodlands	34 000	82 900	31 900	148 800
Customary land	875 300	312 500	487 500	1 675 300
Forest reserves	228 570	255 590	297 200	781 360

Source: Eschweiler (1993)

Plantations account for only about 3% of forest land. There is a large government plantation on the Vipya Plateau, established to supply the pulp and paper industry, and smaller plantations near Dedza, Lilongwe, Ncheu, Mulanje and Zomba producing sawn timber. There are a number of small government, private and community plantations established to provide fuelwood and building poles.

The Government is implementing a number of programmes to encourage more efficient use of wood. Smallholder tree planting is being promoted through the development of a network of retail nurseries and supporting extension services, and more fuel-efficient household stoves, charcoal kilns and tobacco barns are being developed.

Lack of enforcement of the regulations governing indigenous wood use undermines incentives for afforestation and energy conservation. It has been estimated that only about 10% of all stumpage fees are collected. Many tobacco estates, charcoal burners and brick makers evade payment. Enforcement of the prohibition on commercial felling in heavily exploited and environmentally fragile areas is weak, as is compliance with the covenant in land leases that requires tobacco estates to maintain at least 10% of their land under forest.

About 38% of Malawi's forest area is theoretically under some form of protection. There are 69 forest reserves covering 0.78 million ha, and the establishment of a further 32 reserves, or the expansion of existing reserves, has been proposed.

Land degradation

Agricultural land is Malawi's most important natural resource but is deteriorating rapidly. Population pressure on land, exacerbated by the influx of Mozambican refugees, has led to a decrease in the average holding size to less than 1 ha, and an increase in the cultivation of steep slopes and other marginal areas. A significant and increasing rate of soil erosion, a steady decline in soil fertility, loss of soil nutrients, reduced water retention and the destruction of water catchments are the consequences. With increasing demands for arable land, less and less is available for grazing. This leads to overgrazing, further land degradation and, in the long term, may threaten the future of the smallholder livestock industry. The most serious land degradation problems are found, unsurprisingly, in the densely populated and hilly areas in all three regions.

In the smallholder subsector, the problems of land scarcity, low productivity and labour constraints combine to produce a variety of agricultural practices which threaten the land resource. These include: increased farming on steep lands, monocropping of maize and insufficient use of leguminous intercrops, short or non-existent fallows and limited crop rotation, burning crop residues rather than burying them, insufficient applications of manure, compost and mulches, cultivation near waterways, ridges poorly aligned with slopes and poorly maintained, and little or no integration of trees and grasses in cropping systems. Lack of cash or credit prevents the majority of farmers from replacing soil nutrients extracted with inorganic fertilisers.

In the estate subsector, sub-optimal land use practices include failure to follow the recommended crop rotations and to plant fallow grasses and trees; poor soil conservation measures; and failure to use mulches, compost and manure to maintain soil structure. Such problems are linked to lack of land management expertise amongst many new estate owners, dependence on poorly remunerated tenant farmers and hired labourers with high turnover rates, limited diversification, and several policy weaknesses (including low and declining real land rents which encourage under-utilisation of land and undervaluation of conservation investments; lack of enforcement of land use covenants in leases; and the 21-year lease period which may be too short to encourage long-term investment). It is proposed that land rents be increased at a rate higher than inflation to improve land utilisation and conservation investments.

Biodiversity and wildlife depletion

Malawi contains a wide diversity of biotic communities, ranging from low-lying Rift Valley woodlands to montane forest and grassland. This is associated with an unusually wide diversity of animals. Lake Malawi also has the most diverse fish fauna of any lake in the world.

Wildlife

	Total number species	Endemic species	Threatened species
Mammals	195	0	10
Birds	630	0	7
Reptiles	124	6	1
Amphibians	69	1	0
Fish	c. 600	c. 580	?

Source: World Conservation Monitoring Centre (1993)

The biotic resources of the country are under pressure. Deforestation is a significant problem in Malawi and it has serious implications for the maintenance of the wide diversity of biotic communities in the country; 56% of the original forest cover is already lost, and 60% of the wetlands. Of the 195 species of mammals in the country, 10 are under threat, as are 7 of the 630 species of birds, and 60 of the 3765 species of higher plants.

Inside protected areas, poaching and encroachment by smallholders are no longer considered to be serious problems. However, outside protected areas, several significant sites of endemic plants and biological diversity are being degraded as a result of agricultural encroachment; Mount Mulanje and the Zomba Plateau are two of the more important. Malawi maintains an unusually high proportion of protected land, despite the fact that it is one of the poorest and most densely populated countries in Africa. Keeping a large share of national land in a protected system in the face of competing alternative uses is costly in social and economic terms. To justify this, the wildlife resources need to be utilised more efficiently than they are at present. Key areas where action is necessary include improving the infrastructure in national parks, increasing the penalties for poaching, developing and increasing national awareness of environmental issues, and introducing systems that allow all the stakeholders in protected areas to benefit from tourism and other wildlife exploitation.

FISHERIES EXPLOITATION

Living aquatic resources have an important role to play in Malawi's development. Twenty per cent of the country is covered by water; Lake Malawi is the largest and most significant water body in terms of fish production (58% in 1992). The capture fisheries sector in Malawi is an important source of protein, rural income, employment, food security, import substitution and biodiversity. Much of the fish is consumed in rural areas and contributes significantly to the nutritional needs of the poorest people. Living aquatic resources contribute between 60% and 70% of the animal protein supply and the over-exploitation of the resources—with adverse effects on biodiversity and possible depletion of stocks—is of primary concern to the sustainable development of Malawi's resources. Particular care must be taken to protect Malawi's unique endemic fish fauna which represent not only a vulnerable economic resource but also a major source of biodiversity.

It has been suggested that *utaka* (*Haplochromis* spp.) resources in Lake Malawi are in danger of over-exploitation, but overall the national catches are stable. The size and depth of Lake Malawi has been a limiting factor in the exploitation of the offshore pelagic resources by traditional artisanal methods. A recent ODA study has indicated the presence of a large biomass of currently unexploited relatively deep-

water pelagic cichlids which may offer greater potential than increased focus on offshore *usipa* stocks.

WATER POLLUTION

Water contamination is a growing concern. Groundwater resources are exploited by many communities, using boreholes, springs and shallow wells; maintenance of these facilities is poor. In April 1990 it was acknowledged that, of a total of 5326 boreholes, 1714 (32%) were not functioning. Of an additional 18 095 springs and shallow wells, 13 925 (77%) were unprotected. Contamination of groundwater resources with livestock wastes is an increasing problem in densely settled areas.

Water quality deterioration is associated with health problems, particularly the spread of infective and parasitic diseases. A cholera epidemic from October 1989 to March 1990 was attributed to problems associated with the community water supply.

POLICY ENVIRONMENT

Since Independence, the Malawi Government has pursued a strategy of estate-led development. In response to the economic crisis of the late 1970s and early 1980s, the country embarked on a package of structural reforms with support from the IMF and World Bank. The economy responded positively to the initial set of reforms, but further problems were experienced in 1986, linked partly to the escalating war in Mozambique and to deterioration in the terms of trade. Further measures were introduced, based on the strategy of 'growth through poverty reduction'. The major components of the reform package were:

- restructuring of the parastatal sector
- reforming smallholder agricultural pricing and marketing
- establishing fiscal discipline
- restoring a relatively open exchange and trade regime.

Improving productivity and incomes in the smallholder agricultural sector has been a major focus of the reforms; the main relevant measures are smallholder pricing reforms, restructuring of ADMARC, the liberalisation of agricultural marketing, and the controversial Fertiliser Subsidy Removal Programme. All have experienced significant problems in implementation and are the subject of ongoing review and modification.

Smallholder pricing policy (i.e. the setting of floor prices for a range of key products) has been the Government's main instrument to try to stimulate food security and higher producer incomes. But non-price constraints (e.g. land, labour and technology) have limited the capacity of smallholders to respond. Swings in the relative profitability of food and cash crops have led to substitutions between crops rather than aggregate increases in production. And since over half of smallholders are substantially dependent on the market for wages and food, they are adversely affected by higher food prices resulting from producer price incentives.

ADMARC has been restructured, and aims to be a commercial financially self-sufficient organisation. It is still, however, required to meet certain developmental objectives (e.g. stabilising certain crop prices through acting as buyer and seller of last resort, maintaining a strategic grain reserve, distributing fertiliser at fixed prices) which are at odds with its commercial aims. This has limited its ability to operate efficiently, yet ADMARC continues to dominate markets and pricing for most smallholder produce, according to the World Bank. This is despite the fact that smallholder produce markets were liberalised in 1987, and private sector involvement in trading of domestic and export crops has since increased significantly. Traders themselves suffer from a range of constraints to expansion, including intermittent bans by Government on trading in certain crops, limited access to capital and transport, and Government's continued intervention in pricing of many commodities.

A further reform measure, the elimination of subsidies on fertilisers, was suspended in 1987 due to concerns about the impact of high fertiliser prices on national food security. The Government is,

however, still committed in principle to the phasing-out of the subsidy. Constraints on increased fertiliser use exist both on the supply side (limited capacity of the SFFRFM to import, and as yet restricted private sector involvement in its marketing, liberalised in 1993/94) and on demand (insufficient purchasing power/access to credit amongst poorer smallholders).

Other important policy areas which continue to impact on the agricultural sector are liberalisation of exchange rates; reforms in trade policy; opening of burley tobacco production to smallholders; liberalisation of production and marketing of hybrid seed; and changes in smallholder credit policy and programmes. With the recent advent of a democratically elected Government in Malawi, it is anticipated that the pace of liberalisation will accelerate further (EIU, 1994).

More generally, efforts to reduce the size of the budget deficit result in a squeeze on public expenditure which reduces funds available for essential investment and services in support of agricultural development, e.g. rural infrastructure, research, extension and credit. Nonetheless, government has given relatively high priority to agriculture (on average, 12% of the development budget allocation since 1980) and there have been large injections of external funds into rural development activities, e.g. through the National Rural Development programme and a range of research and extension initiatives. According to the World Bank, the effectiveness of the Ministry of Agriculture's investment programme has been hampered by a number of factors, including inconsistencies between policies and investments; imbalances between recurrent and capital expenditure; unco-ordinated donor assistance; weak planning and implementation capacity linked to poor incentives in the Civil Service and lack of skilled manpower; and lack of support for private sector involvement in agricultural development.

The reforms discussed above impact primarily on agricultural production and marketing in smallholder and estate subsectors, but elements of pricing policy also affect broader natural resource utilisation. Low land rents in the estate subsector have contributed to the problem of under-utilisation of land; low stumpage rates in the forestry subsector exacerbate problems of deforestation and fixed prices for wood products do not reflect real costs; and low water prices lead to inefficient use of the resource. These problems will need to be considered in future policy debate.

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APPENDIX 1

Discharge of major rivers

River	Estimated maximum flow (m ³ /s)	Estimated minimum flow (m ³ /s)
Songwe	Very high	4.25
Lufira	113.27	0.057-0.141
N Rukuru	679.6	0.085-1.13
Waye/Chiwondo Lagoon	Moderate	Nil
Nyungwe	Moderate	Nil
Wovwe	56.63	0.85-1.13
Chanange/Hara	56.63-84.95	0.143
Runyina	50.97	0.85
Limpasa	254.85	0.28-0.24
Luwenya	665.44	0.57-0.85
Dwembazi	Moderate	1.416-1.7
Dwanga	High	0.85-1.13
Bua	184.06	0.141
Kaombe	High	Very low
Linthipe/Lilongwe	962.77	Very low
Lifisi	56.63-113.26	0.42
Shire	Very high	141.58

Source: Water Information Center (1975)

APPENDIX 2

Agriculture

Main crops (1992/93)	Area (ha)	Production (t)
Maize	1 326 978	2 033 975
Rice	38 631	65 357
Sorghum	43 873	21 591
Pearl millet	13 343	8 503
Finger millet	4 432	3 108
Wheat	1 608	1 014
Beans	132 509	45 070
Pigeon peas	70 598	35 392
Soybeans	15 842	13 660
Groundnuts	61 059	31 753
Sunflowers	16 187	9 339
Cassava	75 050	216 005
Sweet potatoes	36 846	210 572
Potatoes	6 217	47 975
Virginia tobacco	18 000	26 000
Burley tobacco	79 000	110 000
Cotton	53 691	45 339
Sugar cane	18 000	1 950 000
Tea	16 000	28 000
Coffee	5 000	6 000

Source: Ministry of Agriculture (1993)