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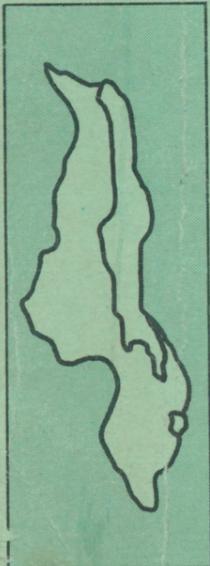
An Atlas
of the

LOWER

SHIRE

VALLEY

MALAWI



SVADP



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AN ATLAS OF THE LOWER SHIRE VALLEY MALAWI

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FOREWORD

The Shire Valley Agricultural Development Project is a major ten year development programme being carried out by the Malaŵi Government in the Lower Shire Valley, with loan assistance from the International Development Association.

It is an integrated rural development programme, incorporating a wide range of activities, and this atlas is an attempt to bring together a comprehensive series of maps depicting both the physical background of the area and development work in hand.

The atlas is designed primarily for use by Malaŵi Government personnel, but it should also be of value in school and university teaching. Much of the information contained in the plates was already available elsewhere in map or manuscript form, but such documents tended to be dispersed and often had limited distribution. It is hoped that by compiling all this information into one volume, project personnel and members of the public alike will have an improved perception of the geography of the Lower Shire Valley and the development work going on there.

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- | | |
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Thanks are given to the following non-Government individuals who gave considerable assistance in text preparation:

- M. G. C. Bouic, Estate Manager, Sugar Corporation of Malaŵi. Texts 10, 19, 20.
- L. Nesbitt, Manager, Cotton Ginners Limited. Text 19

Note

- The following abbreviations are used in the text—
- | | |
|--------|--|
| MANR | Ministry of Agriculture and Natural Resources |
| CCDP | Chikwawa Cotton Development Project |
| SVADP | Shire Valley Agricultural Development Project |
| ADMARC | Agricultural Development and Marketing Corporation |
| SUCOMA | Sugar Corporation of Malaŵi |
| ESCOM | Electricity Supply Commission of Malaŵi |
| UNDP | United Nations Development Programme |
| FAO | Food and Agricultural Organization |
| IDA | International Development Association |

Exchange Rate

At 28 January 1975 exchange rates for Malaŵi Kwacha were:

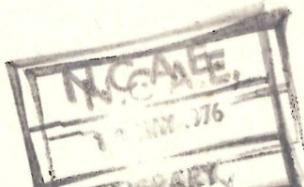
Pound Sterling £1.00=K1.98

American Dollar \$1.00=K0.84

K1.00=100 tambala (t)

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Order stand.





INTRODUCTION

Summary

The Shire Valley Agricultural Development Project is an integrated rural development project covering Chikwawa and Nsanje Districts in the Southern Region of Malaŵi. It started a five year period of development work in April 1973, and is an extension of the Chikwawa Cotton Development Project, which ran from 1968-1973 and represented Phase I of rural development in the Lower Shire Valley.

Background

The Lower Shire Valley is a potentially very productive agricultural area, but suffers a low and unreliable rainfall. Details of the physical environment are given in texts accompanying plates 2-7. During early colonial times it was a relatively neglected area, significant only as an access route to the Shire Highlands. The very high temperatures and unhealthy conditions made it an unattractive area for European settlement, thereby reducing the incentive to develop its infrastructure.

The enormous potential of the area, given adequate water control and irrigation was however recognized many years ago, and a number of major feasibility studies for large scale irrigation schemes have been conducted; from the work of Sir William Halcrow and Partners 1951-54 to the comprehensive study by Lockwood Survey Corporation of Canada 1968-1970, under the auspices of UNDP/FAO. The capital costs of implementing such schemes is, however, extremely high, and the development emphasis since Independence has been on the improvement of dryland farming complemented by small scale irrigation schemes.

Cotton has been the major cash crop of the Lower Shire Valley since the turn of the century, and it was natural that it should be the initial focus of development efforts. The techniques of controlling insect pests of cotton by knapsack spraying were perfected in Malaŵi in the early 1960's and a British aided extension scheme to introduce knapsack spraying to farmers in the Lower Shire Valley was in operation from 1965 to 1967. Despite the poor rains of these years the technique was proven as technically and economically attractive to smallholder farmers, and an approach was made to the International Development Association to assist in financing a more intensive Project to promote the rapid adoption of cotton spraying.

The Chikwawa Cotton Development Project (CCDP)

The International Development Association agreed to make a K3.0 million loan towards the cost of a major cotton extension project, and the Chikwawa Cotton Development Project commenced its five year period of operations, costing a total of K3.66 million, on 1 April, 1968. The Project initially covered the Parliamentary Constituency of Chikwawa South, but expanded slightly in 1970 for administrative convenience to cover a total area of 877 square miles, embracing about 20,000 farm families.

The key components of the Project were extension and credit, supported by borehole development, road construction and improvements in the marketing network. Housing facilities for senior and junior staff, an office complex and workshops, as well as water and electricity reticulation systems were also established at Ngabu providing the essential physical infrastructure for the launching of the Phase II Project.

Despite very unfavourable weather conditions in the final season, Phase I was successful in many of its objectives. Just over 6,000 spraying machines were sold to farmers, and by the end of the phase just over 50 per cent of all farming families either owned or borrowed a spraying machine, although the rate of insecticide application was generally below the level recommended. Sprayed yields averaged about 900 lb. compared with an estimated 300 lb. for unsprayed cotton prior to the Project, and average annual seed cotton production over the five year period was 10,571 short tons compared with 7,601 short tons for the preceding five year period; an increase of 39 per cent. The only major disappointment of the Phase I Project was the non-availability of an improved maize variety which was clearly superior to local maize under the unpredictable rainfall regime of the Lower Shire Valley.

Shire Valley Agricultural Development Project (SVADP)

An enlarged project covering the whole of the Lower Shire Valley region was a natural sequel to the successful Phase I Project in Chikwawa South. The Phase II project was first identified in May 1971, and a formal submission was made by Malaŵi Government to the International Development Association for loan finance in March 1972. A loan of K8.7 million was approved by IDA to contribute to a total estimated cost of K11.5 million. The Phase II Project covers virtually the same area as the revised Chikwawa and Nsanje Districts.

The Project is designed to increase production of cotton, maize, sorghum, groundnuts and rice; develop the livestock industry; increase fish outputs and undertake improvements to the conservation of wildlife resources. In addition, the Project includes other sectors considered as essential adjuncts to successful development of the area. Market facilities are being improved, roads developed, some land planning and conservation measures are being undertaken, rural water supplies and health facilities are being improved. An extended administration unit has been set up, and in the interests of future development, a greatly enlarged agricultural research and economic evaluation unit is carrying out a wide range of research and investigation studies.

Organisation (see plate 13)

The organisation and administration of the Project is based on that already established for the Chikwawa Cotton Development Project, through the Ministry of Agriculture and Natural Resources, with the Project Manager resident at Ngabu. The Project has taken over and added to the existing services and is co-operating with the Ministries of Health, Works and Supplies, Community Development and Local Government. Other agencies including the Agricultural Development and Marketing Corporation, the Agricultural Research Council and District Councils are involved. Full co-operation and participation at all levels between Government Organizations, various agencies, leaders and farmers, is considered essential to achieve well co-ordinated implementation.

Liaison

Liaison with other Ministries is promoted by an Inter-Ministerial/Liaison Committee which meets quarterly.

Liaison with local leaders is effected through the Lower Shire Valley Consultative Committee which meets frequently. This Committee is chaired by the Regional Minister (Southern Region) or his nominee, and includes all M.P.s and Malaŵi Congress Party leaders in the area, District Commissioners and District Council Chairmen, as well as senior representatives of various Ministries. Also present on the Committee are the Chairmen of the six Development Area Consultative Committees elected to represent the interests of the people in each Development Area. This strong and effective committee structure ensures that the local leadership is involved in the planning process and that the feeling and reactions of local people are understood and considered by Project Management.

Components

Agricultural Extension and Training

The Agricultural Extension Section is the mouthpiece of the Project and of Project recommendations to farmers. Contact with farmers is made by the Extension Development Assistants through personal visits, group meetings, demonstrations, and radio listening groups. A special service of film and puppet shows is provided by two mobile units operated by the Extension Aids Sub-section of the Project. Extension field staff can refer to a range of technical and professional staff on any special problems which they encounter.

Farmer training was largely concentrated on the Ngabu residential Training Centre during Phase I, but at the start of Phase II it was decided to give priority to intensive training at Ngabu, and to devolve responsibility for farmer training on to six area training centres. In 1975 the Ngabu centre will be upgraded to become a Farm Institute, and will expand to incorporate rural craft training.

<i>Season</i>			<i>Value to be recovered (Kwacha)</i>	<i>Percentage Recovery</i>
1968/69	..	..	39,000	98
69/70	..	..	83,000	99
70/71	..	..	132,000	98
71/72	..	..	218,000	84
72/73	..	..	130,000	77
73/74	..	..	248,000	98

Rural Development

The Project's Rural Development Section has two specific development functions in its Town Planning and Physical Surveys sub-sections. The role of Senior Rural Development Officer however is primarily one of liaison between the different organisations involved in development work in the area; in particular with the Ministry of Community Development and Social Welfare and District Councils. The stimulation of self help activities, the creation and strengthening of local institutions, and efficient liaison with the District Councils is vital if the momentum of development activities and the quality of infrastructure is to be maintained after the completion of the Project.

Credit

The provision of credit is essential to enable farmers to purchase expensive farm inputs. In Phase I the initial emphasis was on spraying machines and insecticides. Farm implements such as ploughs and ox carts were made available on medium term credit from 1971 and in Phase II the terms of reference for the credit fund expanded to include work oxen, fisheries equipment, improved seeds and fertilizer.

Credit distribution and recovery is administered through Project credit assistants who operate at every ADMARC market. Review of loan applications however is largely in the hands of Unit Loans Committees. Each committee is responsible for an ADMARC market area, and consists of elected leaders of the community. All loan applications are sent to the Loans Committee which makes recommendations to the Project Credit Service. These recommendations may be over-ruled by the Senior Credit Officer, but this rarely occurs.

Details of values of credit to be recovered in each season and percentage recoveries are shown below.

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AGRICULTURAL DEVELOPMENT AREAS

Karonga Rural Development Project

This is a World Bank (IDA) financed project, covering both Karonga and Chitipa Districts and aims at implementing the development outlined below with maximum efficiency to achieve a rapid increase in the welfare and standard of living of the people in the project area and to create as many employment opportunities as possible:

- Dryland and Irrigated crop farming
- Animal Husbandry
- Road and Lake Transport
- Improvements to Health Services

The Phase I of this Project was originally scheduled to be implemented over a five year period ending 31st March, 1977 but due to escalating costs in all spheres of project operations, it has become necessary to rephase the programme over a four year period ending 31st March, 1976.

Phase II of the project, expected to commence in April, 1976 will be designed in such a way that it will spread the benefits of the development programme over as large a number of people as possible at as low an input cost as practicable.

Kawalazi Tea Development Area

This is part of the Smallholder Tea Authority project which provides for an area of approximately 12,000 acres to be reserved for future tea development in part of Nkhata Bay District.

Limphasa Irrigation Settlement

A rice irrigation project operated under the Technical Services Integrated Project of the Department of Technical Services of the Ministry of Agriculture and Natural Resources.

West Mzimba Land Utilization Project

A pilot project designed to provide a plan for the integration of arable cropping and animal husbandry in part of the Mzimba District which can be applied elsewhere in the country.

Kasungu Flue-Cured Tobacco Growers Scheme

An old established scheme initiated by the Commonwealth Development Corporation (formerly known as the Colonial Development Corporation) and taken over by the Malaŵi Government for the training of flue-cured tobacco growers and managed by the Kasungu Flue-Cured Tobacco Authority. The scheme, financed mainly from CDC loans, is still expanding in size and scope.

Dwangwa Sugar Project

A re-assessment by the Malaŵi Government of its sugar requirements to meet both internal and export market demands has indicated that the Dwangwa delta offered the best prospects for a successful sugar project. The choice of this area takes into account the limited time available for investigations of other areas and the fact that considerable information is already available from the feasibility studies made under the British Irrigated Rice Project. The proposed sugar development project is still under discussion.

Lilongwe Land Development Programme

A World Bank (IDA) project which is in its second phase is basically a long term programme for the development of infrastructure and the improvement of smallholder agricultural production in the Programme area. The same basic aims are expected to continue into a third phase beginning in April, 1975, which will further extend the Programme Area. The proposed third phase will comprise the following:

- Land Development
- Land Reorganization and Registration
- Provision, Marketing and Storage Facilities
- Extension, Farm Input Supply and Credit Services
- Livestock Development
- Health Services

Central Region Lakeshore Development Project

This project started in 1968, financed from German Aid, for the development of cotton and other crops. Associated with the second phase which started in April, 1973 and due to be completed in 1976 were animal husbandry, a rural trade school, an experimental irrigated rice scheme and a health and community development programme. A further project which will incorporate the Bwanje Valley Area is being contemplated for financing from other sources.

Thyolo/Mulanje Tea Area

If world tea prices justify the expense, irrigation could greatly increase the production of the tea area of the Thyolo/Mulanje districts. Detailed hydrological studies to provide the necessary data have recently been completed.

Phalombe Plain Development Project

Financed from U.K. development loan, the project is designed to start the intensification of agricultural development in the district, particularly in the areas now becoming settled as a result of the provision of domestic water supplies with a view to the establishment of an intensive crop development effort in the future.

Sugar Corporation of Malaŵi (SUCOMA)

This is a commercial sugar plantation established in the Shire Valley Area in 1966, the production from which is already providing all the needs of the domestic market in Malaŵi and a small surplus for export.

Shire Valley Agricultural Development Project

The subject of this Atlas.

National Rural Development Programme

The IDA Sectoral Mission, which visited Malaŵi in 1973, recommended that a National Rural Development Programme be established, with a rolling timetable which would cover the country over a period of twenty years. The basic principle is to shift emphasis from the monolithic Major Project approach, concentrating on certain areas of high potential, to a rolling programme of area development which would, over a period of years, modernize the agricultural economy of the whole country. The needs of each area will differ and planning will proceed on a pragmatic basis, so that investment will be related closely to essential improvements.

The programme which commenced in mid-1974 with savings of K50,000 from Phase II of the Lilongwe Land Development Programme aims initially at strengthening the staffing position in the Ministry of Agriculture and Natural Resources to cope with future work-load envisaged in the Programme.

METEOROLOGY

The climate of the Lower Shire Valley is characterised by two well defined seasons: a dry season from May to October and a rainy season from November to April. The climate is conditioned by interplay between the subtropical ridges of high pressure and the Equatorial low pressure belt (Inter Tropical Convergence Zone). The subtropical ridge controls the weather over Malawi during the dry season (May–October). The associated South-East Trade Winds are stable and there is consequently very little precipitation. From October to April the weather over Malawi and the Shire Valley in particular is controlled by the Equatorial Trough, which moves from the Equator to Latitude 20°S and back again. This system brings in unstable air which causes convectional rainfall. Convectional rainfall is particularly significant in the Lower Shire Valley, but orographic factors are also important.

Temperature

Temperatures fall to their lowest in June, when the mean minimum and maximum for the Valley are 56°F (13.4°C) and 81°F (27.4°C) respectively. Temperatures rise rapidly through September to a mean monthly maximum of 99°F (37.5°C) in October. Daily maxima of 105°F (40.9°C) are quite common at this time. The mean maximum reduces slightly with the onset of the rains, but diurnal variation becomes less and the highest mean monthly minimum is 73°F (23°C) in February. (See Figure 1).

The temperatures of the Lower Shire Valley are the highest in Malawi, and given adequate rainfall this promotes rapid crop growth. Cotton in the Lower Shire Valley reaches maturity in 145 days, compared with 184 days in the upland areas (3,000 ft./914 m). Sugar cane comes to maturity in eleven months compared with 18–21 months in the highlands of Kenya. However, the valley floor experiences a considerably wider diurnal temperature range in winter than the Lake Malawi littoral and relatively low night temperatures retard the development of the winter rice crop, making it difficult to complete a successful double cropping regime.

The high temperatures of the area can be most uncomfortable and make field work especially tiring. The highest temperatures occur at the time of garden preparation, and help to explain the generally poor standard of land preparation. The average length of working day is considerably shorter than in the rest of Malawi because of the high temperatures.

The high temperatures also mean very high evaporation rates, rising from 4.2 in. (107 mm) for June to 10.8 in. (274 mm) for October, giving an annual total of 78.5 in. (1,994 mm). Such high evaporation considerably diminishes the value of the limited rainfall available.

Rainfall

Average annual rainfall is about 32 in. (813 mm) in the northern part of the Valley and about 28 in. (711 mm) in the centre, around Ngabu. About 85 per cent of total rainfall occurs from mid-November to late March. There appears to be a steady increase in rainfall following the topographic gradient from the Shire River to the Western Hills, though the absence of rain gauges in the hills, except at Lulwe and Chididi, makes it difficult to quantify the hill rainfall. Lulwe has a ten-year average of 38.49 in. (978 mm) and Chididi of 51.84 in. (1,317 mm). It is likely that most of the Western Hill area receives 35–40 in. (889–1,016 mm) probably rising to 45 in. (1,143 mm) in the Gaga area. The East Bank is significantly wetter than the West Bank (Masenjere ten-year average 36.76 in./934 mm) and crop failures due to drought are much more unusual in this area. It can be misleading to present rainfall averages for different time periods, and the annual averages given in Table 1 have therefore been presented for the ten-year period 1964/65 to 1973/74 (July–June totals) with longer period averages for comparison where available.

The isohyets (lines of equal rainfall) depicted on the plate opposite are based on the ten-year records shown in Table 1, with reference to some five-year records where appropriate. The limitation on data availability means that these lines should be regarded as indicative and not authoritative.

The seasonal distribution of rainfall is shown in Table 2 and Figure 2. There are very occasional convectional storms in October and early November, but the onset of the main rains associated with the I.T.C.Z. varies from mid-November to late December. December (6.84 in. 174 mm) and January (7.36 in. 187 mm) are the wettest months, though a further 8.78 in. (223 mm) falls in February and March (mean monthly data for Ngabu Mission over 10 years). However, there is often a dry spell of two to three weeks at the end of February which retards crop growth and induces boll shedding. From April to July light rains occur sporadically. These rains are related to the *chiperoni* rains of the Shire Highlands which are caused by intrusions of moist maritime air from the Indian Ocean. These late rains are positively harmful to most crops, causing boll rot and discolouration in cotton, and in extreme cases (1973/74) causing premature germination of grain on the cob.

The following information on planting rains is quoted from Mpata¹:

	Mean date of planting rains	Date with 80 per cent probability of planting rains
Chikwawa	Dec. 6	Dec. 15
Nkadana	Dec. 5	Dec. 17
Ngabu Mission	Nov. 30	Dec. 10
Masenjere	Nov. 29	Dec. 14
Sankhulani	Dec. 1	Dec. 14

The rainfall is the lowest and most unreliable in Malawi and there is considerable risk involved in dryland farming. Planting rains are particularly unpredictable, and cotton often has to be planted two or three times because of dry spells in December. Partial failure of grain crops is not uncommon, and although maize is the preferred staple, sorghum and bulrush millet predominate in Nsanje South because of their greater drought resistance.

Using pentade analysis, a technique which assesses rainfall effectiveness on the basis of five-day periods which are adjudged wet or dry according to certain criteria, Johnson² has shown that the Lower Shire rainfall recording stations have the most unreliable rainfall in the country. In Figure 3 the percentage probability of rainfall is shown for each pentade. There are only 10 pentades in the rainy season (average season length is 22 pentades) which have over 67 per cent probability of being classified as rainy.

Rainfall Records

There is now a comprehensive network of rainfall recording stations covering the whole Lower Shire Valley, the majority of which are operated by the agricultural extension staff of SVADP. This close network permits an appreciation of the localized pattern of distribution and provides invaluable data with which to interpret fluctuations in agricultural production. These stations are integral to the long term crop/weather relationship study which the Project is undertaking at 32 sites throughout the Valley. This study aims to quantify the relationship between rainfall, soil moisture and crop yields.

Rain gauges in the Valley are controlled by several different organizations. Meteorological Services of the Department of Civil Aviation control full meteorological stations at Makhanga and Ngabu, whilst a full meteorological station is maintained at Nchalo by the SUCOMA Sugar Estate. A further meteorological station is to be established at Kasinthula Research Station.

A number of the older stations were established by the Water Resources Division of the Ministry of Agriculture and Natural Resources; these are Nkadana, Maganga, Masenjere and Sankhulani.

The oldest station is Chikwawa Town whose records go back, with minor breaks, to 1900. Records for Nsanje Town run continuously from 1911, but unfortunately there is a break in recording from 1961/62 to 1967/68. Records for Makhanga Research Station run from 1938/39, whilst records were maintained at nearby Chiromo from 1908–1918.

References

- ¹ MPATA, S.B. Dates of Planting Rains, Variability and Probabilities in Malawi. Meteorological Notes, Series A, No. 1 September 1973
- ² JOHNSON, D.T. Crop Production in Phase with the Climate. April 1973.

TABLE 1 Average Annual Rainfall (in.)

	10 Year Average 1964/65–1973/74	Longer Term Average
Maganga	32.25	33.11 (20 years)
Chikwawa	31.74	31.92 (27 years)
Nkadana	30.20	32.43 (20 years)
SUCOMA/Alumenda	27.30	25.62 (15 years)
Ndakwera	25.61	25.96 (17 years)
Ngabu Mission	27.74	28.44 (15 years)
Masenjere F.R.	36.76	37.39 (20 years)
Sankhulani	32.76	30.94 (20 years)
Makhanga	29.84	30.67 (29 years)
Chididi	51.84	60.73 (42 years)
Lulwe	38.49	40.94 (19 years)

TABLE 2 Mean Monthly and Annual Rainfall (in.)

STATION	Per-iod (yrs.)	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	Total
Chikwawa	27	0.62	0.48	0.20	0.47	2.73	6.44	8.51	5.80	3.55	1.74	0.72	0.66	31.92
Ngabu Mission	15	0.41	0.30	0.09	0.38	2.02	6.84	7.36	4.86	3.92	1.35	0.46	0.45	28.44
Makhanga	30	0.53	0.35	0.16	0.64	3.01	6.30	7.23	4.97	3.99	1.35	0.61	0.63	29.76
Nsanje	45*	0.47	0.40	0.30	0.76	3.48	6.40	7.35	5.73	5.27	1.86	0.66	0.66	33.34

*From 1916/17–1960/61. All other records are averaged to 1973/74.

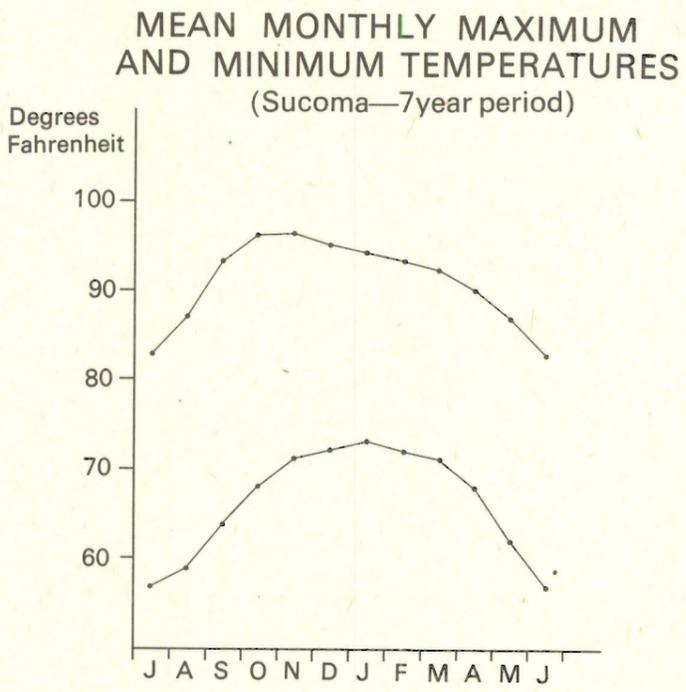


Fig.1

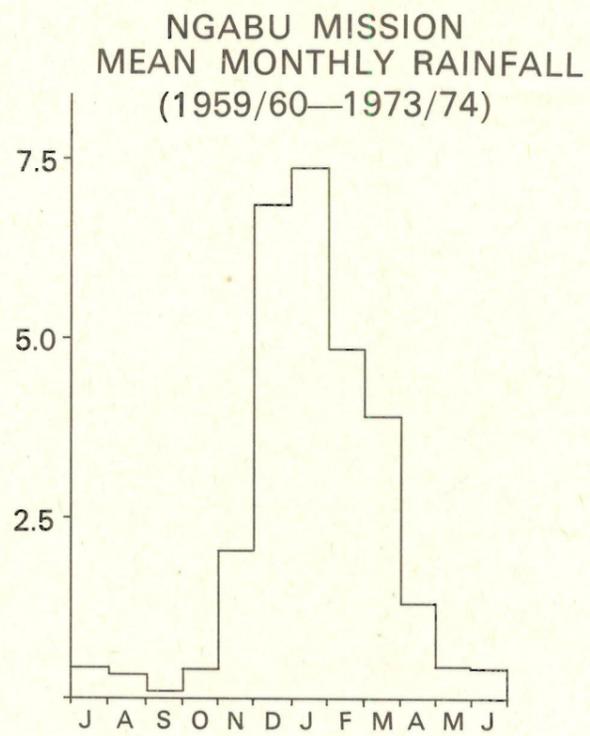


Fig. 2

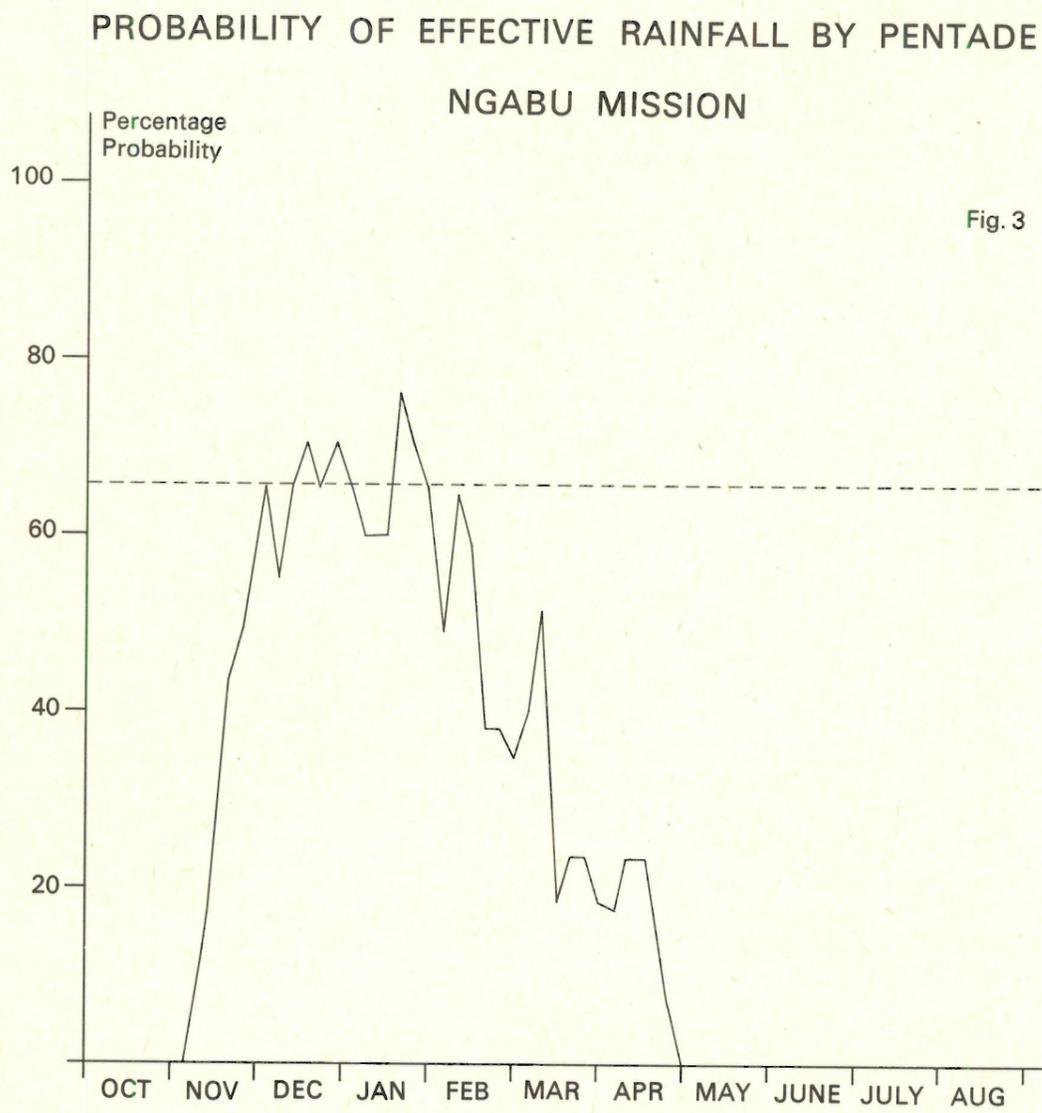
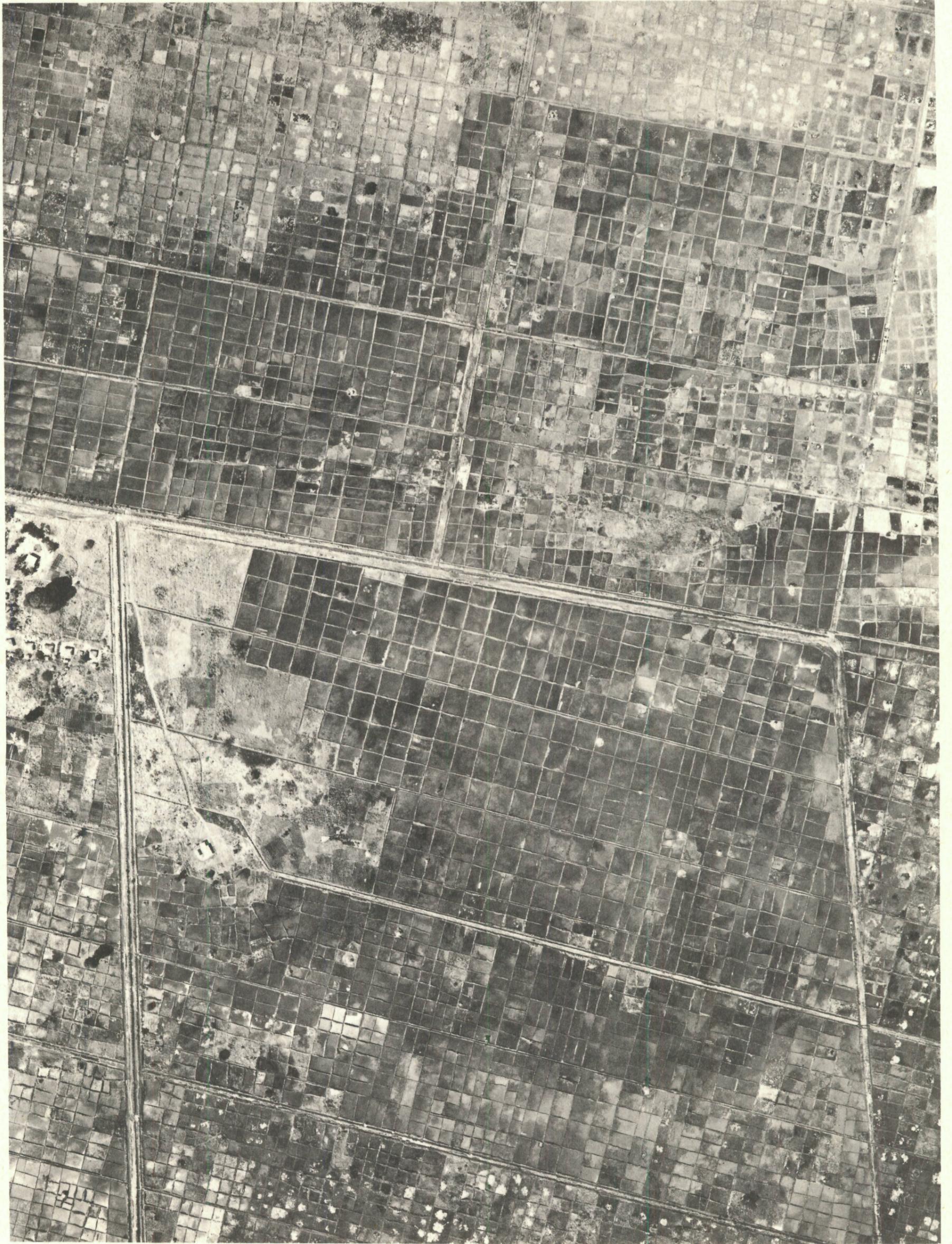


Fig. 3

Source JOHNSON, D.T. Crop Production in Phase with the Climate.



Mlolo Rice Scheme

GEOLOGY

Most of the area is underlain by gneisses and granulites of the Basement Complex or by sedimentary and volcanic rocks of Karroo age. Over large areas on the floor of the Shire Valley these rocks are obscured by colluvium and river alluvium.

The Basement Complex rocks are of high grade and can be assigned to either the amphibolite or the granulite facies. Quartzofeldspathic hornblende-biotite gneisses occur in the north and south of the area, associated in the latter with biotite-nepheline gneisses. The hornblende and pyroxene gneisses north of Nsanje enclose some lenses of anorthosite. The charnockitic gneisses and granulites which make up the Thyolo Highlands extend down to the eastern margin of the present area.

The lowest beds of the Karroo succession are the Coal Shales, which outcrop over a fairly large area around the headwaters of the Nkombedzi wa Fodya River, west of Tomali, and a small area south-west of Bangula. They consist of grey and black mudstones, carbonaceous shales with thin coal bands, and interbedded grits and sandstones, all showing considerable lateral variation. Overlying these beds is a sequence about 10,000 feet (3050 m) thick of sandstones, shales, mudstones, marls and limestones, surmounted by grits and sandstones.

The deposition of these sediments was followed by a period of vulcanicity of late Karroo age. Basalt lava flows outcrop south and west of Ngabu, and minor intrusions of dolerite are found throughout the Karroo sediments and the Basement Complex.

The Karroo rocks were succeeded in southern Malawi by the emplacement of the alkaline igneous rocks of the Chilwa Alkaline Province. This Province is represented in the present area by the Salambidwe Complex, which consists mostly of syenite and is intruded into the Karroo sediments at the northern end of their outcrop.

The Lupata Series unconformably overlies the Karroo sediments and lavas north-west of Ngabu and are thought to be of Cretaceous age. They consist of a succession of conglomerates, sandstones, shales and marls, often fairly calcareous.

Unconsolidated superficial deposits are widespread in the Shire Valley. River alluvium, mainly sand and silt, is found on the banks of the Shire and other large rivers. Most of the valley infilling is of the nature of pediment deposits resulting from downhill movement of masses of debris carried by gravity, rainwash and stream action in the course of pediplanation. South of Chiromo bedrock may lie at depths of less than 200 feet (61 m), but further north the superficial deposits may locally exceed 500 feet (152 m) in thickness.

Faulting has been very severe in the area, mostly associated with the development of the Rift Valley. The eastern margin of the Rift is represented principally by the Thyolo Fault, which follows the western boundary of the charnockitic granulites north of Ledza and the Project boundary to the south of Ledza. West of the Shire River the Karroo rocks are downfaulted against the Basement Complex along the Mwanza Fault, extending northwest from Tomali, and the Namalambo Fault south of Bangula. The Karroo is cut by numerous minor faults, as well as a few larger ones, the Coal Shales being much disturbed by the movements.

Mineral Deposits

Coal occurs in the Coal Shales west of Tomali (the Sumbukombedzi Coalfield) and south-west of Bangula (the Chiromo Coalfield). Both areas have been examined in some detail, but the prevalence of faulting and crushing, the presence of dolerite sills, the high ash content of most of the coal, and the lateral variation in the seams has made their exploitation appear unattractive. However, seams of useable coal have been reported in both coalfields.

The titanium minerals, rutile and ilmenite are associated with the anorthosites north of Nsanje. The minerals are concentrated in alluvial outwashes from the anorthosites, but the deposits are subject to rapid variations in grade.

Agates derived from the Karroo basalts are widely distributed in the soils south and west of Ngabu, from which they are extracted for use as ornamental stones. Red, grey and brown varieties have been found, of which the red stones are most in demand. The production is mainly for export.

Many bands of limestones are present in the Basement Complex, but they are relatively rich in magnesia and generally of variable quality. Vein calcite has been used for lime burning at Makoko, southwest of Nsanje, and similar veins occur in the Chikwawa-Chiromo area. Dolomitic limestones in the Karroo south-west of Tomali could be used for direct application to agricultural, land though only small quantities have so far been found.

Other minor mineral occurrences include corundum in the nepheline syenites near Nsanje and copper and lead south of Nsanje, all of which have been worked on a small scale. Mica and graphite have been recorded in the Nsanje Hills, and gypsum in a borehole near Chiromo.

Groundwater

The principal aquifers in the area are in the unconsolidated deposits of the valley floor, though good supplies are also obtained from weathered basalts south-west of Ngabu. The aquifers in the alluvial sands and gravels range in thickness from five feet (1.52 m) to more than 100 feet (30.5 m), and seem to be in hydraulic continuity even though there is considerable lateral variation. The heterogeneous nature of the deposits may give rise locally to more than one aquifer and piezometric surface. Non-flowing, leaky confined conditions occur over most of the valley. The hydraulic gradient is low, particularly towards the marshes in the centre of the area.

There are 260 boreholes in the unconsolidated sediments, mainly along the west bank of the Shire River. Their average yield is 750 gallons per hour (3,400 lts), the highest yields being found generally in thick, well-sorted deposits of sand and gravel. The best prospects for high abstraction rates appear to be offered by the alluvial fan deposits of the east bank of the Shire River and the sediments south of Nsanje.

At the sides of the valley the dissolved salts in the groundwater are predominantly calcium bicarbonate, with a low total solids content. Down-gradient, underlying most of the valley floor, the water contains sodium bicarbonate as the main dissolved salt. In a few areas, mainly on the west bank, the groundwater has a high content of total dissolved solids, principally sodium chloride; this is thought to be mainly due to low permeability, low recharge and the presence of highly soluble minerals.

Shire Valley Agricultural Development Project

GEOLOGY



SOILS

The distribution of soils in the Lower Shire Valley is influenced by three main factors, namely topography, geology and climate.

Topographically the region is dominated by the steep wall of the Thyolo Escarpment on the eastern flank of the Rift Valley. To the west is a range of lower and more gently sloping hills, whilst to the north, the valley floor is constricted and rises more steeply amongst the moderately dissected hills of the Middle Shire. The Rift Valley floor has been filled in by alluvial deposits derived from the adjacent valley sides, and by material transported by the Shire, Mwanza and Ruo rivers.

The geology of the uplands surrounding the valley has significantly affected the nature of the materials laid down in different parts. The western wall between the Mwanza River and Bangula is composed of sandstones and other sedimentary rocks of Karroo and Cretaceous age, and there is a large area of basalt of similar age around Ngabu. The western wall south of Bangula, the eastern wall, and the higher ground north of Chikwawa, consist of Basement Complex gneisses.

The comparatively hot, dry climate, with rainfall of 30-40 in. (762-1,016 mm) per annum has resulted in a comparatively low rate of weathering, and the accumulation of salts in low-lying areas.

The soils of the valley can be placed into the following broad groups—

- A The floodplain and swamps of the Shire river (Group 3).
- B The floodplains, alluvial terraces and drift deposits flanking the Shire floodplain (Groups 1 and 2).
- C The upland soils of the valley walls and the Middle Shire (Group 4).

A. The Floodplain and Swamps of the Shire River.

The Shire is the dominant feature of the valley floor. Its flood plain is half to one mile wide in the northern part of the valley, and spreads out south of the Mwanza confluence to form the Elephant Marsh. The marsh is constricted at Chiromo by the alluvial fans of the Ruo and Thangadzi rivers, but spreads out again to the south to form the Ndinge Marsh.

The floodplain is composed of complex, stratified alluvium with a high proportion of sandy soils. Much of the floodplain is inundated annually, and certain depressions as well as the bulk of the Elephant and Ndinge Marshes are flooded throughout the year. Most of the floodplain, and higher lying areas in the marshes are cultivated intensively during the dry season. Some salinity occurs in the slackwater areas with fine textured soils, and around the edges of the floodplain and marshes.

B. The Floodplains Alluvial Terraces and Drift Deposits flanking the Shire Floodplain.

These deposits show considerable variation according to the parent material from which they are derived. The two main groups are the Makande Plain around Ngabu (Group 1), and the Drift Plain comprising the remaining valley floor deposits (Group 2).

Group 1: The Makande Plain. This plain lies on the broad, gently sloping west flank of the valley between the Namikalango and Lalanje rivers, and is composed of deposits derived largely from the basalt hills to the west. The medium to fine textured alluvial soils along the stream lines contain a very high proportion of weatherable minerals, and they weather rapidly to form the vertisols which are the dominant feature of the plain. Successive cycles of erosion and deposition have resulted in the present landscape of gently sloping ridges with lithomorphic vertisols (1a) and floodplains and outwash fans with stratified alluvial soils and topomorphic vertisols (1c).

The clay fraction of these soils is dominated by montmorillonite and they are highly fertile, with a noticeably more friable topsoil than soils in other areas. For these reasons the Makande Plain is intensively cultivated, and some areas have grown cotton continuously for many years with no apparent decline in yields. However, the vertisols in particular are very susceptible to erosion as the topsoil tends to slake on wetting into small, easily transported aggregates. The size of these aggregates becomes smaller in successive years under cultivation, thus increasing the erosion hazard.

Saline and sodic patches occur in the vertisols, particularly close to the edge of the Elephant Marsh, in areas where saline groundwater rises close to the surface.

Group 2: The Drift Plain. The comparatively narrow eastern flank of the valley consists of a series of small outwash fans with complex, often sandy soils where numerous small streams emerge from the escarpment, and low lying areas with heavy, poorly drained soils

between the fans and flanking the Shire floodplain and swamps. This pattern is repeated to the west of the Shire River south of Bangula.

In addition the Ruo River has built up a large alluvial fan at the southern end of the Elephant Marsh, and the Mwanza River has an extensive floodplain occupying a separate arm of the Rift Valley. Old alluvial terraces of the Shire River lie to the west and south of Chikwawa.

These alluvial deposits are derived mainly from Basement Complex gneisses, with some material in the Mwanza floodplain derived from Karroo sedimentary rocks. The soils are commonly micaceous, and the clay fraction is mainly illitic with increasing proportions of montmorillonite in the more recent deposits and the clays occupying poorly drained areas; notably Kasinthula dambo and the interfan troughs along the eastern flank of the valley.

The older terraces are characterised by some evidence of weathering, with brown or reddish brown colours, and slightly or moderately acid soil reaction.

Soil structure is not usually pronounced except in the heavy clays, and the soil surface, particularly of the older alluvial soils of the Shire terraces, is prone to structural deterioration and capping under cultivation.

Between the Nkombedzi wa Fodya and Namikalango rivers the soils are derived mainly from calcareous sandstones, marls, and mudstones of Karroo and Cretaceous Age. These soils are medium to fine textured, and include significant areas of topomorphic vertisols, particularly in the southeast where they merge into the basalt-derived vertisols of the Makande Plain. Sandy soils along former stream channels often stand out as low ridges.

The clay fraction of the sandy and medium textured soils is dominated by illite with montmorillonite becoming important in the vertisols. Structure is not pronounced except in the vertisols, and the medium textured soils are often compact, with significant amounts of exchangeable sodium contributing to poor internal drainage conditions. The older alluvial deposits show signs of soil development, with slightly to moderately acid topsoils and some evidence of clay accumulation in the upper subsoil. Lime accumulations are found in the subsoils of most fine textured soils and vertisols. Strongly saline and sodic conditions occur in some low lying areas, notably south of the junction of the Phwadzi and Nkombedzi rivers.

Between the Lalanje River and Bangula the valley floor materials are again derived from Karroo sandstones. Here the dominant feature is the Thangadzi alluvial fan, with mainly coarse textured alluvial deposits.

C. The Upland Soils of the Valley Walls and the Middle Shire.

The escarpments to the east of the valley, and to the west, south of Bangula, are mainly rocky with only shallow soils (4a, lithosols) due to their extreme steepness. The basalt and sand stone hills to the west of the valley are also rocky with little or no soil cover. However, there are some areas of more gently sloping basalt hills around Ngabu, on which shallow lithomorphic vertisols (1b) have developed in places.

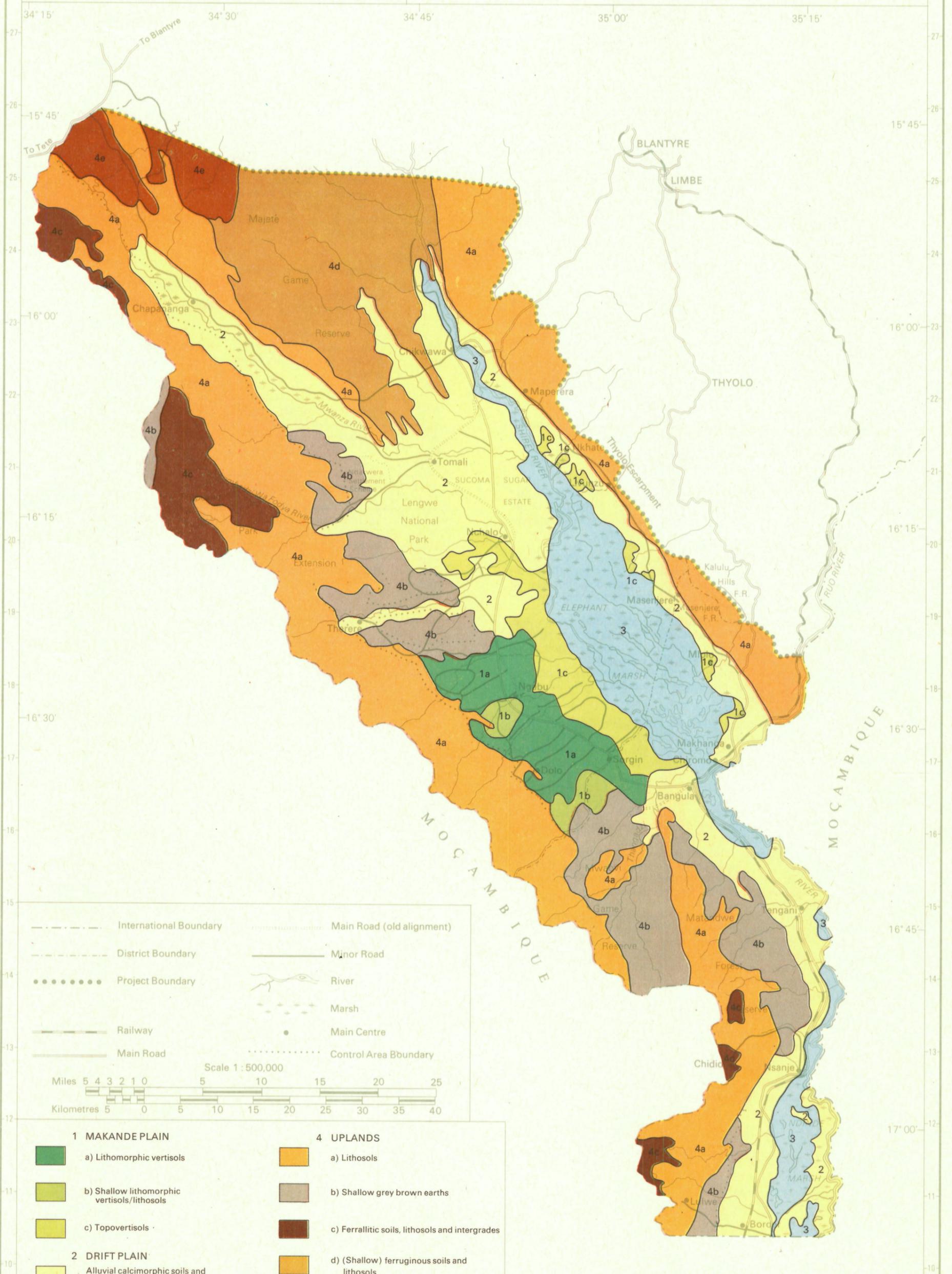
Further north the Lupata sandstones, with moderately undulating topography, give rise to generally sandy slightly weathered grey brown earths (4b). More strongly weathered ferrallitic soils (4c) occur on the gently undulating plains on the watershed west of the Mwanza, and also in small areas on the hill crests west of Nsanje. The soils of the Middle Shire uplands are mainly lithosols and shallow, moderately weathered ferruginous soils (4d).

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Shire Valley Agricultural Development Project

SOILS



LAND CAPABILITY CLASSIFICATION

Introduction

The characteristics on which this map is based are those of slope and soil properties. Reference was made to the 'Manual of Land Use Planning' (Land Husbandry Branch, M.A.N.R. 1971) for the appropriate classification into land capability classes, but it should be noted that further division into sub-classes has been carried out according to salient soil properties such as depth, stoniness or drainage. These properties constitute limiting factors to suitable land use and the subdivisions have provided the basis for differentiating between arable and non-arable land. The main sources of information used to delineate the boundaries were soil studies prepared by Malaŵi Government and the Map of Natural Areas for the Southern Region of Malaŵi. Land over 12 per cent slope was assessed using a slope/angle interpretation of 1:50,000 base maps. The extent of such land is probably greater than that shown since this method is not adequate for rough broken land with hillocks less than 50 feet (15.2 m) high.

The purpose of a land capability classification is to group various land types so as to show their most intensive safe level of use. A class of land may then be used for any lower intensity than the maximum permitted, but never more intensively than this maximum. The system developed by Land Husbandry Branch classifies land on the basis of erosion hazard, since over most of Malaŵi rain-induced soil erosion is the main factor limiting land productivity. Land Capability Classes which are found in the Lower Shire Valley have the following levels of erosion hazard:

- WET (W) Nil—Depositional area.
 B—Non-Arable (BN) } Severe; annual cropping must be excluded.
 A—Non-Arable (AN) }
 C—Arable (CA) Moderately severe.
 B—Arable (BA) Slight to moderate.
 A—Arable (AA) Slight or nil.

Description of Land Capability Map Units

- WET (W): Hydromorphic soils in and around the Elephant and Ndiinde Marshes, characterized by prolonged severe wetness. Limiting factors are temporary or permanent flooding.
- B—NON ARABLE (BN)**
- BN1: Relatively unproductive land having such a severe permanent hazard of erosion due to soil type (lithosols) and slope that, except for less hazardous pockets, all areas should be kept under permanent cover. Includes slopes greater than 12 per cent.
- BN2: Soils other than lithosols including slopes greater than 12 per cent. Although the soils may be deeper and more fertile than in BN1, slope is the limiting factor which precludes any form of arable cultivation.
- BN3: Shallow stony lithosols on slopes less than 12 per cent which require protection from erosion by a non-arable form of land use.
- A—NON ARABLE (AN)**
- AN1: Soils (including lithosols) which are derived from grits, calcareous shales and sandstones. The main limiting factor is impeded drainage, caused by high percentages of silt and montmorillonite clay which restricts soil permeability in all horizons.
- AN2: Soils (including lithosols) which have reached an advanced stage of weathering, with free draining top soil of coarse sand texture overlying an imperfectly drained sub-soil. Restricted permeability of the sub-soil is the main limiting factor.
- AN3: Ferruginous soils and latosols formed from metamorphic rock. The processes of weathering and leaching are relatively weakly developed, giving rise to moderately shallow soils which need protection.
- C—ARABLE (CA)**
- CA1: Soils of very low fertility due to strong leaching, with few weatherable minerals remaining in the sub-soil.
- CA2: Fertile soils derived from basalt, but with a heavy texture and poor structure. Because of this, and the presence of lithosols, erosion will occur without careful land use management.
- B—ARABLE (BA)**
- BA1: Highly fertile self-mulching Black Cotton Soils (Vertisols) containing montmorillonite clay and a very low humus content. Soils are characterized by a very weak structure which breaks down completely under the action of rainfall. Sub-soil panning is a characteristic limiting factor. Sheet erosion under continuous arable cropping is assisted by gully erosion which is often initiated in gilgai depressions.

BA2: Fertile, alluvial plains of the Mwanza Valley. The main limiting factor is seasonal flooding in many areas.

AA/BA2: Generally extremely fertile, well drained, stable-structured soils, but flooding in the drainage lines may occur in the wet season.

The following table shows the extent and maximum intensity of land use of each land capability unit. Two thirds of the area (excluding wet-land) is classified as non-arable, distributed in the eastern and western escarpments and in the Middle Shire Uplands. Note that there is an area of land on the Thyolo Escarpment which was not classified and is not included in the table below. Most of this land is BN class.

Land Capability Sub-Classes	Maximum Intensity of Land Use	Acres Area (Hectares)		%
		Acres	Hectares	
	Specialised—Fishing, duck-shooting, bird sanctuaries	150,000	(60,710)	10.0
BN1 and BN3	Protection (and Production) Forestry low intensity cattle grazing	570,000	(230,680)	37.5
BN3		8,000	(3,240)	
BN2	Protection Forestry	17,000	(6,880)	1.0
AN1 and AN3	Production Forestry	150,000	(60,710)	18.0
AN3		125,000	(50,590)	
AN2	Low intensity cattle grazing	40,000	(16,190)	2.5
CA1	Low intensity farming	12,000	(4,860)	1.0
CA2	Moderate intensity farming	60,000	(24,280)	4.0
BA1 and BA2	High intensity farming	55,000	(22,260)	8.0
BA2		65,000	(26,310)	
AA/BA2	Very high intensity farming	280,000	(113,320)	18.0

Non-Arable 59 per cent
Arable 31%

A land capability map is essential for the development of any area, to enable appropriate land use planning and to identify problem areas where remedial or preventative action may be necessary. In the Lower Shire Valley, the whole of the Western Escarpment north of the Matandwe Forest Reserve has been gazetted as a Controlled Area in order to prevent further land degradation from unrestricted activities by an expanding population. The boundary was chosen to divide arable from non-arable land. On the Thyolo Escarpment widespread erosion caused by over-cultivation on steep slopes dramatically illustrates the disastrous effect of bad land use, causing social problems which can only increase unless a system of land use with a major emphasis on conservation is adopted. In the south, the Lulwe Hills are similarly over-cultivated and in localized areas, particularly near the Shire River, overgrazing and trekking by cattle is an important cause of soil erosion. A scheme is in hand to ease this problem by creating fenced access routes through the arable land to grazing areas. In the Makande Plain area the problem is one of introducing a mixed farming system in conjunction with conservation works to protect the unstable but fertile soil from erosion.

Shire Valley Agricultural Development Project

LAND CAPABILITY



(see facing page)

Natural Region	Natural Area	Altitude (ft)	Mean Annual Rainfall (in)	Soil Parent Materials	Landforms	Vegetation	Soils	Present Land Use	Area (Sq Km)	Population Density (Sq Km)	Area Under Cult. (Sq Km)	Agricultural Potential
MWANZA ESCARPMENT	a. Wankumadi valley.	1500	65-75	Basement Complex, local alluvium and recent alluvium	Long narrow valley dominated by dissected escarpment and moderate slopes of moderate relief.	Brachystegia woodland.	Stony ferruginous, sandy alluvial, and litholic. Litholic; some shallow ferruginous soils.	Sparsely cultivated.	143	0-10	9-23	Afforestation with smallholdings on alluvial terraces on some hill slopes in northern half. Forest reserve with areas of afforestation.
	b. Neno escarpment zone.	1500	70-75	Basement Complex, syenite, nepheline, and nepheline	Brake relief, with gentle to moderate and high relief, with some of moderate and high relief, becoming lower and lower towards the escarpment.	Brachystegia hill and escarpment woodland.	Litholic; some shallow ferruginous soils.	Uncultivated.	434	0-10	9-07	Forest reserve with areas of afforestation.
	c. Mwanza escarpment hills.	1350-3200	70-75	Basement Complex.	Broken escarpment with hills and gorges of moderate relief, with some of moderate and high relief, becoming lower and lower towards the escarpment.	Brachystegia hill and escarpment woodland.	Litholic; some shallow ferruginous soils.	Uncultivated.	328	0-4	9-81	Forest reserve with areas of afforestation.
	d. Neno dissected plain.	2300-3300	65-70	Basement Complex.	Moderate slopes, moderate relief, frequent small residual hills and stony areas.	Brachystegia plateau woodland.	Mainly ferruginous, medium textured, acid, low fertility, heavy soils.	Sparsely to moderate cultivation; maize, groundnuts.	116	10-20	3344	Extensive cultivation; maize, tobacco. Locally suitable for perennial crops. Intensive; maize, groundnuts, tobacco, dairy.
	e. Plateau dissected high plateau remnants.	1500-3300	70-75	Basement Complex.	Moderate slopes of high relief often associated with small hills.	Brachystegia plateau woodland.	Ferruginous, heavy soils. Many deep, moderate to heavy textured, acid soils.	Sparsely to moderate cultivation; maize, groundnuts, tobacco.	407	40-80	1219	Intensive; maize, groundnuts, tobacco, dairy.
	f. Dissected high plateau remnants.	1500-3300	65-70	Basement Complex, syenite and nepheline	Moderate slopes of high relief and steep slopes, occasional gorges.	Brachystegia plateau woodland.	Litholic, weakly ferruginous, and litholic soils.	Sparsely to moderate cultivation; maize, groundnuts, tobacco.	130	20-40	325	Semi-intensive; maize, tobacco, beans, winter wheat. Livestock rearing. Some forest reserve.
	g. Diabole hills.	2100-4700	65-70	Basement Complex.	Hills of low relief, often structurally aligned in ridges; low escarpment facing south west.	Brachystegia foothill woodland.	Litholic.	Sparsely cultivated.	124	0-10	539	Forest reserve.
	h. Chapmana hills.	200-2300	70-75+	Basement Complex.	Broken escarpment with hills of moderate and frequent gorges, occasional steps of moderate relief.	Brachystegia escarpment woodland.	Litholic, rocks, boulders.	Sparsely cultivated.	293	Nil	105	Forest reserve and afforestation.
	a. Chikwawa escarpment.	1500	Over 75	Basement Complex, syenite, nepheline, and nepheline	Flat to gently undulating plain descending to Marsh boundary.	Hill woodland, Brachystegia spp., Prosopis, acacias, etc.	Litholic and litholic soils. Medium textured, acid, moderately fertile.	Sparsely cultivated; maize, cassava.	221	10-20	2846	Afforestation with some areas of semi-intensive cultivation; maize, cassava, beans.
	b. Escarpment step.	1500	Over 75	Basement Complex, syenite, nepheline, and nepheline	Flat to gently undulating plain descending to Marsh boundary.	Escarpment woodland. Brachystegia spp.	Litholic, ferruginous, and weakly ferruginous soils.	Sparsely cultivated.	505	10-20	6553	Afforestation with some areas suitable for afforestation.
	c. Cholo escarpment.	300-1500	65-75+	Basement Complex, syenite, nepheline, and nepheline	Gently sloping S.W. facing piedmont.	Lowland woodland species: Brachystegia, Acacia, etc.	Grey brown earths of medium texture, generally fertile and well supplied with moisture on alluvial fans. Humate series.	Very heavily cultivated; cotton, maize, sorghum, rice, and other crops.	174	80-160	10757	Intensive cultivation; cotton, maize, vegetable, rice on alluvial fans.
	d. Chole-Chikwawa piedmont.	150-350	Over 75	Recent alluvium.	Flat to gently undulating plain descending to Marsh boundary.	Marsh grassland and reeds.	Hydromorphic alluvials of variable texture and fertility.	Intensive diamba cultivation; rice, maize, sorghum, tobacco, sugar, fruits and vegetables.	549	60-100 (concentrated on terraces).	530	Intensive diamba cultivation of flood free uncultivable but potentially very fertile with flood control.
e. Miamba valley.	300-700	Over 75	Recent alluvium and col. local drifts.	Gently sloping piedmont (pediments on either side of narrow alluvial plain).	Lowland savanna and chicket.	Brown earths of medium texture; Tomali series.	Moderately to heavily cultivated; cotton, maize, sorghum, rice.	740	20-80	19549	Intensive cultivation; cotton, sorghum, millet, sugar cane, rice.	
f. Nkandwe plain.	300-600	Over 75	Recent alluvium and col. local drifts.	Flat to gently undulating plain descending to Marsh boundary.	Lowland savanna and chicket.	Grey brown earths of medium texture, slightly acid to neutral. Chikwawa series.	Sparsely to moderately cultivated; cotton, maize, sorghum.	298	20-40	5514	Intensive cultivation; cotton, maize, sorghum, tobacco, sugar cane, fibre crops.	
g. Ruw overwash plain.	150-300	Over 75	Alluvial overwash deposited by flood.	Flat plain with alluvial riverine landforms.	Cultivation savanna, lowland chicket and woodland.	Grey brown earths of medium texture.	Moderately cultivated; cotton, maize, sorghum.	49	40-80	1789	Intensive cultivation; cotton, groundnuts, sorghum, millet, sugarcane, fibre crops.	
h. Nsanje piedmont.	100-400	Over 75	Stream overwash from Nsanje hills.	Gently sloping north east and east facing piedmont.	Marsh grassland and reeds.	Grey brown earths of medium texture.	Heavily cultivated; cotton, maize, sorghum.	281	40-80	13862	Intensive cultivation; cotton, groundnuts, sorghum, millet.	
i. Ndenje Marsh.	50-100	Over 75	Recent alluvium.	Perennial marsh, riverine landforms associated with Marsh boundary.	Marsh grassland and reeds.	Hydromorphic alluvials of variable texture.	Intensive diamba cultivation, Marsh fertile but uncultivable without flood control.	153	0-10	136	Intensive diamba cultivation, Marsh fertile but uncultivable without flood control.	
j. Middle Marsh.	100-100	Over 75	Recent alluvium.	Perennial marsh, riverine landforms associated with Marsh boundary.	Marsh grassland and reeds.	Hydromorphic alluvials of variable texture.	Intensive diamba cultivation, Marsh fertile but uncultivable without flood control.	11	0-10	42	Intensive diamba cultivation, Marsh fertile but uncultivable without flood control.	
LOWER SHIRE HILLS	a. Siambidwe massif.	1300-3200	65-75	Jurassic syenites and nepheline syenites.	Circular, high relief, escarpment containing plateau border with moderate slopes of high relief.	Litholic.	Litholic.	Uncultivated.	20	Nil	154	Forest reserve.
	b. Zambere periplan.	700-1400	70-75+	Periplan drifts of Basal Complex (gneiss) (sandstone and basalt).	Flat to gently undulating plain.	Mixed vegetation woodland and scrub.	Mopani.	Sparsely cultivated.	353	Nil	252	Livestock rearing.
	c. Karroo hills.	600-1200	Over 75	Recent alluvium.	Periplan marsh, riverine landforms associated with Marsh boundary.	Marsh grassland and reeds.	Shallow sandy and stony drifts, many rock areas.	Uncultivated.	789	Nil	439	Forest reserve.
	d. Lupata foothills.	400-700	Over 75	Lupata sediments, sandstone, basalt, of the Red Bank.	Gently undulating uplands with smooth contours, relatively featureless.	Stony litholic.	Stony litholic.	Sparsely cultivated.	539	0-4	2384	Livestock rearing, game reserve.
	e. Basalt undulating uplands.	500-900	Over 75	Basalt, basaltic columnium.	Gently to moderately undulating eroded upland plain with occasional rocky hills of high relief.	Short tree and scrub savanna.	Stony litholic, and some shallow stony litholic.	Sparsely cultivated.	207	0-4	1055	Forest reserve, with some smallholdings.
	f. Basalt hills.	650-1000	70-75+	Basalt.	Much dissected steep sided rocky hills of high relief.	Mixed foothill woodland.	No soil.	Uncultivated.	71	Nil	26	Forest reserve.
NSANJE HILLS	a. Dissected plateau.	1400-2200	45-65	Basement Complex.	Dissected plateau remnants of moderate slopes and occasional gorges. Higher altitudes less moderate to high relief.	Cultivation savanna.	Mainly ferrallitic.	Sparsely cultivated; maize, cotton.	50	10-20	958	Intensive cultivation; maize, tobacco, forest reserve.
	b. Escarpment hills.	1400-3000	65-75	Basement Complex, syenite, nepheline, and nepheline	Broken escarpment of steep slopes, high relief and moderate to high relief.	Brachystegia hill and escarpment woodland.	Stony litholic.	Sparsely cultivated.	350	0-10	1804	Intensive cultivation; maize, tobacco, forest reserve.
	c. Nsanje foothills.	300-600	Over 75	Basement Complex.	Moderately undulating eastern plain with much minor dissection.	Brachystegia foothill woodland.	Grey brown earths often stony, sometimes shallow.	Sparsely cultivated; maize, sorghum, groundnuts.	218	0-10	2594	Semi-intensive; maize, sorghum, groundnuts, tobacco, forestry plantations.
	d. Macchico Hills pied. plain.	1300-1800	70-75	Basement Complex, syenite, nepheline, and nepheline	Gently undulating depositional plain partially overlain by pediment deposits.	Brachystegia foothill scrub and woodland.	Litholic and shallow gravelly ferruginous loams.	Sparsely cultivated; maize, sorghum, cotton.	441	0-10	1093	Livestock rearing, pasture, fodder crops.
	e. Luswe valley.	1000-1600	Over 75	Basement Complex, syenite, nepheline, and nepheline	Steep to rugged hills linked by pediments of moderate slopes and moderate relief.	Low altitude mixed woodland.	Litholic and shallow gravelly ferruginous loams.	Sparsely cultivated; cotton, maize, tobacco.	131	0-10	1824	Intensive arable, cotton, maize, tobacco stock rearing and pastures.
	f. Neno escarpment.	900-1300	Over 75	Basement Complex, syenite, nepheline, and nepheline	Moderately undulating east facing pediment.	Brachystegia-Sterculia woodland.	Grey brown earths and vertisols.	Very sparsely cultivated.	271	0-10	1115	Forest reserve, forest plantations; livestock rearing and pastures.
MIDDLE SHIRE VALLEY	a. Livingstone Falls pied. plain.	400-1200	70-75	Basement Complex.	Moderately undulating east facing pediment.	Brachystegia-Sterculia woodland.	Litholic with sandy and loamy soils of low fertility in the Wankumadi valley.	Sparsely cultivated; maize, sorghum, tobacco.	75	10-20	928	Intensive arable, cotton, maize, sorghum, tobacco.
	b. Mwanza escarpment.	400-1500	Over 75	Basement Complex.	Highly dissected escarpment with much minor dissection and occasional hills.	Brachystegia-Sterculia woodland.	Litholic, and shallow often stony ferruginous soils.	Sparsely cultivated; maize, sorghum, tobacco.	207	0-4	975	Livestock rearing, pastures and fodder crops.
	c. Mwanza escarpment.	400-1500	Over 75	Basement Complex.	Highly dissected escarpment with much minor dissection and occasional hills.	Brachystegia-Sterculia woodland.	Litholic, and shallow often stony ferruginous soils.	Sparsely cultivated; maize, sorghum, tobacco.	416	Nil	Nil	Game reserve, forest plantations; pasture and livestock rearing.
	d. Mwanza escarpment.	400-1500	Over 75	Basement Complex.	Highly dissected escarpment with much minor dissection and occasional hills.	Brachystegia-Sterculia woodland.	Litholic, and shallow often stony ferruginous soils.	Sparsely cultivated; maize, sorghum, tobacco.	416	Nil	Nil	Game reserve, forest plantations; pasture and livestock rearing.
	e. Mwanza escarpment.	400-1500	Over 75	Basement Complex.	Highly dissected escarpment with much minor dissection and occasional hills.	Brachystegia-Sterculia woodland.	Litholic, and shallow often stony ferruginous soils.	Sparsely cultivated; maize, sorghum, tobacco.	416	Nil	Nil	Game reserve, forest plantations; pasture and livestock rearing.
	f. Mwanza escarpment.	400-1500	Over 75	Basement Complex.	Highly dissected escarpment with much minor dissection and occasional hills.	Brachystegia-Sterculia woodland.	Litholic, and shallow often stony ferruginous soils.	Sparsely cultivated; maize, sorghum, tobacco.	416	Nil	Nil	Game reserve, forest plantations; pasture and livestock rearing.
HILLS SCARPS GORGES					Steep, moderate to high relief, rugged.	Litholic.	Litholic.	Uncultivated.				Forest reserve.
					Steep, often rugged slopes.	Litholic.	Litholic.	Uncultivated.				Forest reserve.
MARSHESS					Deep, steep sided, narrow.	Marsh grassland.	Plains dark grey hydromorphic alluvial clays some textural differences, and dark grey clay vertisols.	Seasonal cultivation of rice and other crops but large areas uncultivated.				With water control, intensive cultivation of rice, cotton, vegetables; dry season pastures.
					Flat, reasonably or presumably flooded.	Marsh grassland.	Plains dark grey hydromorphic alluvial clays some textural differences, and dark grey clay vertisols.	Seasonal cultivation of rice and other crops but large areas uncultivated.				With water control, intensive cultivation of rice, cotton, vegetables; dry season pastures.

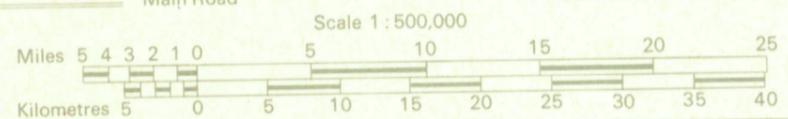
NOTES: (1) Altitude: Range of altitude given for each unit excludes isolated hills and peaks occurring within a unit. (2) Area under cultivation includes a proportion of recent forest. It also includes managed forest (e.g. 46c), but excludes settlements and associated areas. Values marked * refer to the whole of that Natural Area, not just the portion on this map. (3) Slope Class: Level 0-1 Very Gentle 1-2 Gentle 2-5 Moderate 5-15 Steep >15

Shire Valley Agricultural Development Project

NATURAL REGIONS



- | | | | |
|-------|------------------------|-------|---------------------------|
| ----- | International Boundary | ----- | Main Road (old alignment) |
| ----- | District Boundary | ----- | Minor Road |
| ..... | Project Boundary | ~~~~~ | River |
| ----- | Railway | ----- | Marsh |
| ----- | Main Road | ● | Main Centre |
| ..... | Control Area Boundary | ..... | Control Area Boundary |



- | | | | |
|---|----------------------------|---|---------------------|
| 1 | MWANZA ESCARPMENT | 5 | NSANJE HILLS |
| 2 | CHIKWAWA—THYOLO ESCARPMENT | 6 | MIDDLE SHIRE VALLEY |
| 3 | LOWER SHIRE VALLEY | | MARSHES |

DRAINAGE AND TOPOGRAPHY

The distinct identity of the Lower Shire Valley as a natural region is largely the result of physical geography. To the east, and constituting a most significant divide is the Thyolo Escarpment, rising very steeply from 300 feet (91 m) in the valley floor to 4,000 feet (1,220 m) in the Shire Highlands. This dramatic fault scarp is undergoing vigorous erosion, and is deeply cut into by a number of rivers, from the Likhubula and Mwamphanzi in the north to the Thangadzi and Ruo in the south. The Ruo has the largest catchment, and has cut a major valley, which provides the only acceptable gradient for a railway to the Highlands.

To the north, the limit of the Lower Shire Valley is set by the Kapachire Falls (formerly Livingstone Falls), the last series of rapids in the middle course of the Shire. The steeper gradient of the middle course made it an unattractive route for development when communication links were developing, as did the virtual absence of population in the area due to thin and unfertile soils derived from Basement Complex rocks. This broken country is now largely occupied by the Majete Game Reserve, the south-western flank of which is clearly delineated by a fault scarp about 300-400 feet (91-122 m) high running NW-SE and conditioning the alignment of the Mwanza river.

On the western boundary of the area is a line of hills constituting the watershed between the Shire and Zambezi rivers. In the north-west these hills represent the southern extremity of the Kirk Range; the average height is 1,800-1,900 feet (549-579 m).

To the south, and separated by a trough related to the Majete fault scarp is the dramatic syenite block of Salambidwe (3,205 ft./977 m). From there to Mwabvi Game Reserve the Western Hills are lower with variable topography dependent on geology. The highest point is Murukanyama at 1,917 feet (584 m).

The Matandwe Hills stretch from Namalambo Hill near Bangula (850 ft./259 m) due south, merging into the Malaŵi Hills. The range is very deeply dissected in the north and is unsuitable for any use except watershed protection. The average height in the northern part is about 1,500 feet (457 m) rising to over 3,000 feet (914 m) at Malaŵi Hill, and then decreasing to 1,500 feet (457 m) in the somewhat less rugged and densely populated area to the north of Lulwe Mission.

The valley floor itself is tilted down slightly from west to east, and is formed partly of pediments such as the Nsanje piedmont, flanking the Matandwe Hills, and plains of alluvial and colluvial deposition. Alluvial outwash fans are characteristic of the East Bank.

The average height of the valley floor is about 350 feet (107 m) around Chikwawa, 300 feet (91 m) around Ngabu and 200 feet (61 m) at Nsanje. The Mwanza Valley rises from 350 feet (107 m) at Tomali to 750 feet (229 m) at Chapananga. The plains have generally very gently sloping topography, but the erosion hazard is variable depending on soil type.

There are two major marsh areas in the valley, the Elephant Marsh, covering approximately 107,000 acres (43,300 ha.), and the Ndinde Marsh covering approximately 40,000 acres (16,190 ha.). The middle course of the Shire falls on average 25.1 feet per mile (12.3 m per km), but from the foot of Kapachire Falls to the Zambezi confluence the fall is 185 feet (56.3 m) over 174 miles (280 km), or 1.06 feet per mile (0.51 m per km). This sluggish gradient and the trough like structuring associated with the Thyolo scarp have created a perennially waterlogged area of enormous agricultural potential, if water control could be effected. The problem of Ndinde is slightly different, since the greatest cause of flooding there is the spill over of flood water in the Zambezi down the Ziuziu flood

channel and into the Lower Shire. This results in a ponding back or even flooding back effect as far as Nsanje. It has been estimated that 50 per cent of the flooding of the Ndinde is due to Zambezi floods rather than Shire floods.

A number of major engineering studies have been undertaken to review the potential for flood control, marsh reclamation and irrigation development. The potential is clearly enormous, but the costs of a complete programme are prohibitive at this stage. The first step in flood control was made, however, with the completion of the Liwonde Barrage, which is operated with the primary objective of maintaining a minimum flow of 6,000 cusecs throughout the year for the purposes of Hydro Electric Power generation in the Middle Shire. The contribution of the Barrage in evening out flow is important during the dry season, but much less so in the wet season since the Shire valley tributaries and in particular the Ruo make a large contribution to flood flows. One of the problems in water control is to balance the interests of the Elephant Marsh fishery, which requires a relatively high water level to encourage spawning and create conditions favourable for the survival of young fry, and the *dimba* garden cultivators who do not harvest their winter crop until December.

Flooding is endemic in the Shire Valley, and is likely to become worse as catchment areas are progressively denuded of vegetation. The Shire is estimated to have a mean flow (1949-68) of 11,000 cusecs, and the Ruo (1950-68) of 2,080 cusecs. However, the theoretical twenty year flood for the Shire at Maganga is calculated at 48,000 cusecs, compared with 135,000 cusecs for the Ruo at Chiromo. Although it has an area of only 1,750 square miles (4,532 sq. km) the Ruo catchment includes much of the land around Mulanje mountain which experiences very high rainfall. Makhanga Research Station has been completely flooded twice in the last 20 years. In 1948 the railway bridge at Chiromo was washed away, not so much because of the high water, but because of the wall of *sudd* (matted marsh vegetation) which built up against the superstructure, thus increasing the stress on it. The people of Ndinde Marsh live in a precarious position in the rainy season, and from time to time most of them have to evacuate the area.

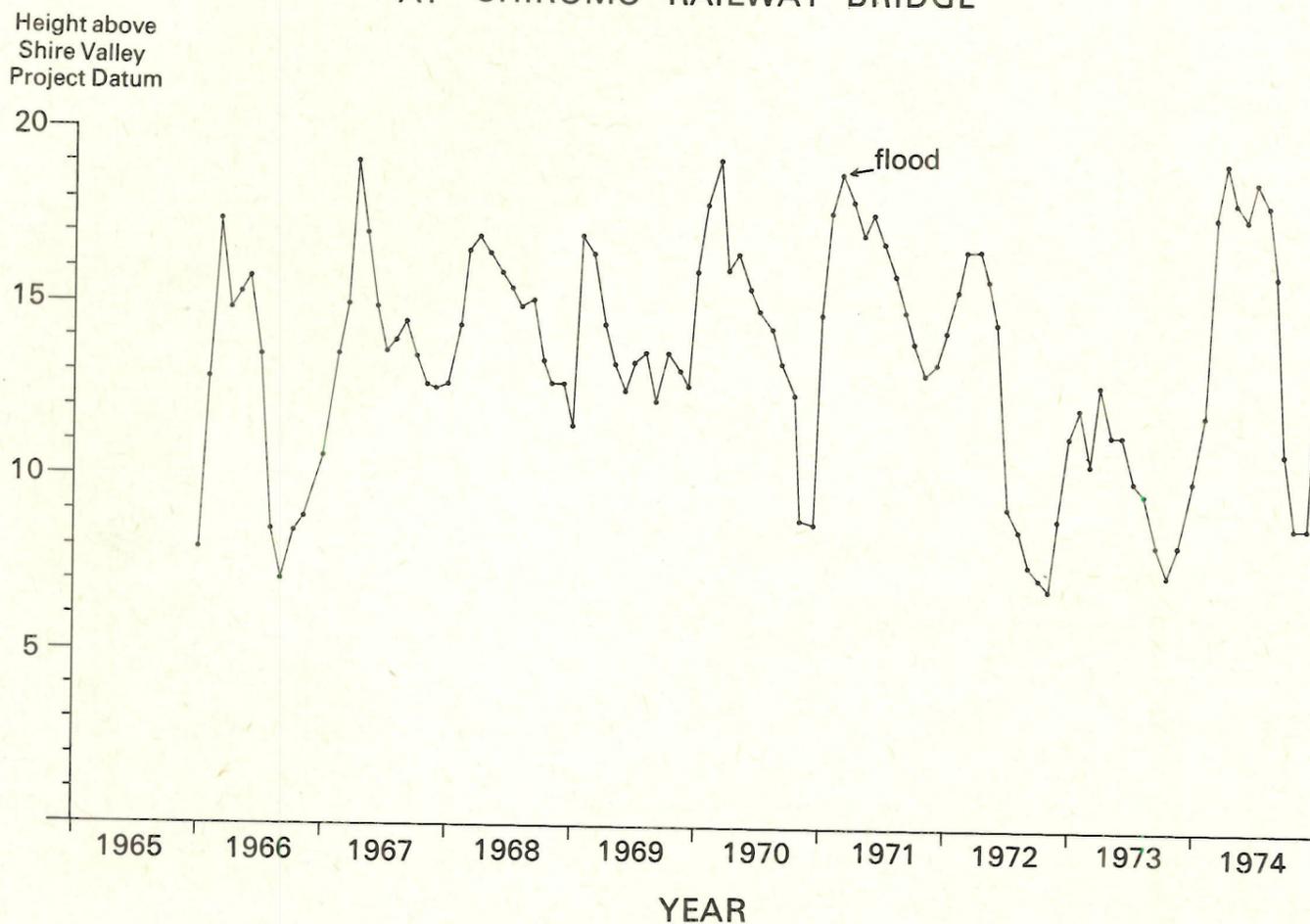
Most of the Shire tributaries in the Project area are seasonal, some flow continuously through the rainy season until May, June or July, whilst others are intermittent even during the rains. All of them are liable to flash flooding lasting from several hours to several days. On the West Bank the Thangadzi, Lalanje, Nyakamba and Namikalango are all liable to make drifts impassable to road traffic for short periods.

The Mwanza River is perennial in its upper course, but in the dry season all surface flow ceases downstream of the marshes near Tombondera. The East Bank Thangadzi is perennial, but the dry season flow is steadily diminishing as a result of catchment area clearing. This means that Mlolo Irrigation Scheme is only able to support a third of its acreage for a dry season crop. The potential utilization of other East Bank streams for gravity fed irrigation works is limited to wet season 'water control'. Dry season irrigation could only be effected using reservoir storage, and only the Maperera River appears to offer a suitable dam site.

REFERENCES

- Sir William Halcrow and Partners: Report on the Control and Development of Lake Nyasa and the Shire River. London, 1974.
- Lockwood Survey Corporation: Lower Shire Valley, Malaŵi. Irrigation Development Plan, Toronto, 1970.

MEAN MONTHLY HEIGHTS FOR THE RIVER SHIRE
AT CHIROMO RAILWAY BRIDGE



POPULATION

The population of Chikwawa and Nsanje Districts (excluding those parts of Chikwawa subsequently transferred to Blantyre) in 1966 was 246,000, or an overall average of 95 persons per square mile (246 per sq. km). Assuming an average population growth in this area of 3.0 per cent per annum (2.5 per cent natural increase plus 0.5 per cent net immigration) the estimated mid-1974 population is 312,000 or 121 per square mile (313 per sq. km). Sample surveys indicate an average household size of about 4.5 persons, which would result in an estimate of 69,000 households in the area, the great majority of which are actively engaged in farming.

Traditionally the densest population has been in Nsanje District, which in 1966 had 135 persons per square mile (350 per sq. km) compared with Chikwawa's 83 per square mile (215 per sq. km) (all population density figures relate to 1966 data). The greatest concentration of people is to be found along the edge of Ndinde Marsh, where there are localized concentrations of over 400 persons per square mile (1,036 per sq. km). This density is supported by intensive double cropping of *dimba* gardens in the Marsh, fishing, handicrafts and remittances from relatives working elsewhere. The population of the Marsh itself is concentrated along old levee lines, but in exceptionally wet years even these are not proof against flooding and there are occasional large scale movements out of the Marsh in the face of such exceptional floods.

On the Nsanje piedmont there are two clearly defined lines of settlement; one along the edge of Ndinde Marsh and the other at the break of the slope between the Malaŵi Hills and the Piedmont. Population in the hills is dispersed in many small hamlets, but numbers are growing rapidly, and the density (1966) of 130 per square mile (337 per sq. km) is very high for a hill area.

Population is also dense on the East Bank where alluvial fans of numerous streams and the marsh edges provide opportunities for intensive cropping. Average density of population is over 300 per square mile (770 per sq. km). The major movement of population into the Makande Plain area commenced with the development of boreholes in the 1950s giving a density of 250 per square mile (648 per sq. km) over the whole area. This compares with densities of 165 and 83 per square mile (427 and 215 per sq. km) for the Tomali

Drift Plain and Mwanza Valley respectively. These are the only remaining areas with a significant capacity to absorb further settlement, and there has been a very noticeable movement of population into these areas in the last ten years. The Gaga Hills were fairly densely populated in 1966 with 96 persons per square mile (249 per sq. km), and there has been a considerable influx of immigrants across the border since then.

The historical pattern has been of continuous immigration since the turn of the century and population pressure has traditionally been greatest in Nsanje South. Despite the gradual movement of these immigrants northwards into Chikwawa District, which was probably considerably accelerated by the intensive borehole programme on the West Bank, Nsanje South remains an area of great population pressure.

POPULATION BY CHIEF'S AREA (1966)

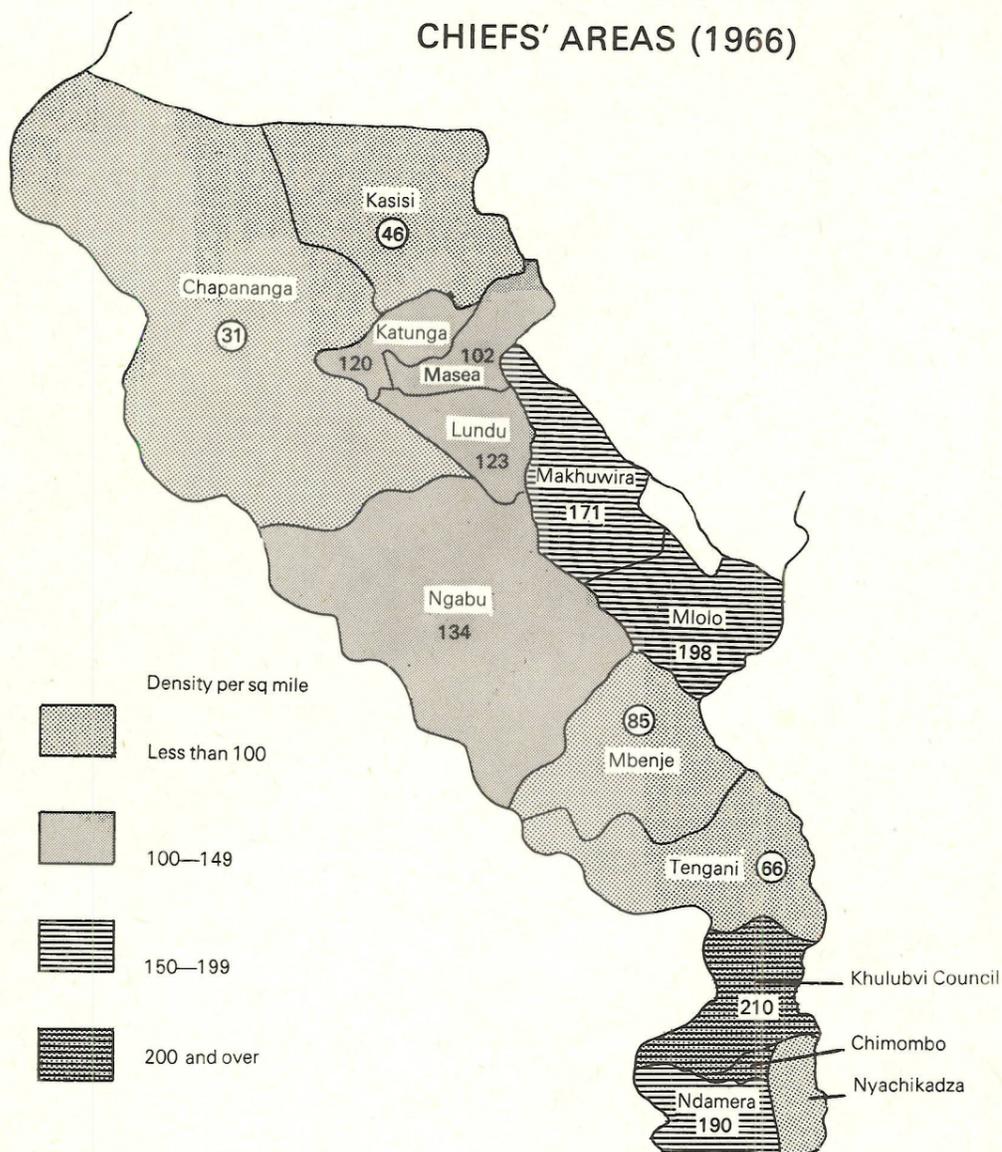
CHIKWAWA		NSANJE	
Ngabu ..	63,610	Ndamera ..	14,058
Lundu ..	8,582	Chimombo ..	5,175
Chapananga ..	24,114	Nyachikadza ..	3,476
Masea ¹ ..	7,215	Khulubvi Council ²	24,181
Katunga ..	7,298	Tengani ..	14,696
Kasisi ¹ ..	12,550	Mbenje ..	14,704
Makhuwira ..	23,093	Mlolo ..	23,571
Chikwawa Urban ..	902	Nsanje Urban ..	1,373
	<hr/>		<hr/>
	147,364		101,234
	<hr/>		<hr/>

¹ Approximately 2,400 people in Masea and Kasisi live outside the SVADP area.

² Now split into two chiefs: Malemia and Ngabu.

The non-rural population in 1966 was 10,200 or four per cent. This has greatly increased if the 27,000 residents at SUCOMA Sugar Estate are included. However, the majority of these men come from the Lower Shire Valley and are probably still involved in agriculture through their families.

POPULATION DENSITY BY CHIEFS' AREAS (1966)



WATER SUPPLIES

Traditionally, dry season water supplies came from the Shire River, locally constructed wells and waterholes along river beds. Shortage of water was a critical factor limiting settlement and inhibiting the development of good agricultural land on the West Bank. In the 1950s there was a programme of borehole construction on the West Bank, and by 1968 there were about 147 boreholes in the Lower Shire Valley. In the Phase I Project 206 boreholes were drilled, of which 169 were successful. In the first two years of Phase II a further 128 boreholes were drilled in the Project Area out of a Phase II target of 140 boreholes. Most settled areas are now well provided with boreholes, except for hill areas of Basement Complex rocks. The domestic water supply situation is particularly difficult in the Gaga Hills area. The possibility of small dams for this area has been investigated and found impractical, and in 1974 the Project commissioned 13 trial drillings in a final attempt to determine the feasibility of borehole construction in the area.

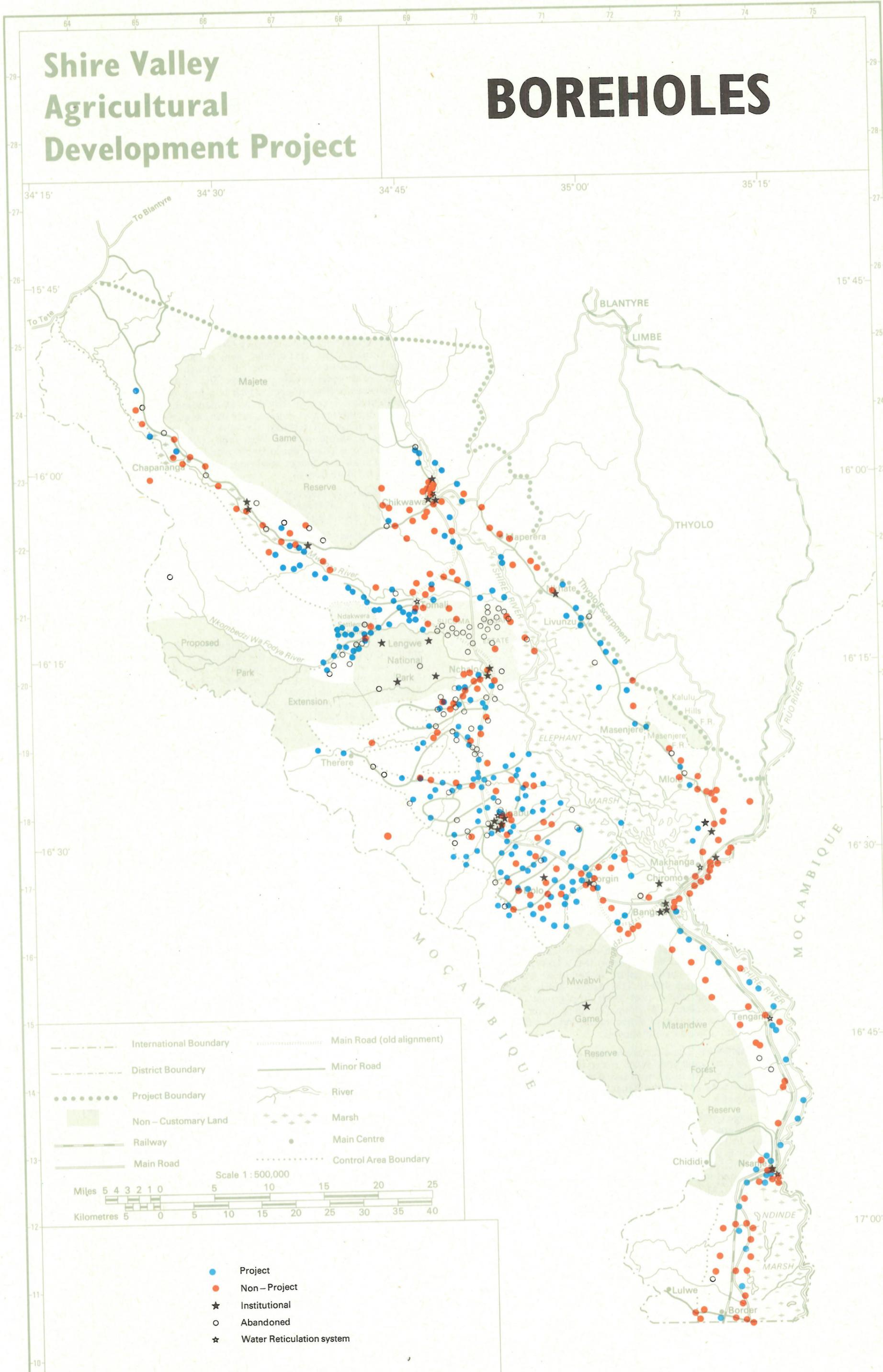
Boreholes are a particularly important aspect of development in the Lower Shire because not only do they fulfil a vital domestic function as they do in the rest of the country, but they also fulfil an important role in health and agricultural development. The agricultural role is in supplying water for knapsack spraying of cotton. This spraying technique requires up to a maximum of 25 gallons per acre (46 lt per ha) per spray application, an amount which makes it essential to have a reliable water source nearby. The supply of uncontaminated groundwater is also a critical element in preventative health work, especially in helping to control the spread of infectious diseases. A particular problem found throughout the valley, but specially acute in the Ndakwera and Nchalo/Ntowe area is the occurrence of saline water. Seven out of nine boreholes at Ndakwera Settlement Scheme produced saline water.

A major water reticulation system was installed at Ngabu during Phase I with a total 60,000 gallon (272,600 lt) storage, and is being expanded in Phase II with the installation of a new 25,000 gallon (113,600 lt) water tank. Major systems also function at Nsanje, Nchalo and Chikwawa, and minor systems either exist or will be installed in Phase II at Tomali, Sorgin, Makhanga and Tengani.

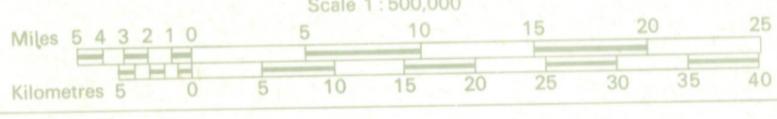
There are so many boreholes in the area now that there is a danger of dissipating ground water resources, and this problem will be included in the brief of a hydrology study to be commissioned by the Project in 1975 to investigate practical hydrological problems in the Lower Shire Valley.

Shire Valley Agricultural Development Project

BOREHOLES



- International Boundary
- District Boundary
- Project Boundary
- Non-Customary Land
- Railway
- Main Road
- Main Road (old alignment)
- Minor Road
- ~ River
- ~ Marsh
- Main Centre
- Control Area Boundary



- Project
- Non-Project
- ★ Institutional
- Abandoned
- ★ Water Reticulation system

CROPS

The major dry land crops of the Lower Shire Valley are cotton, maize, bulrush millet, sorghum and groundnuts. Pigeon peas and cassava are locally important in hill areas. Rice is widely grown along the Shire flood plain, some of it under irrigation control, and irrigated sugar cane is a major estate crop.

Cotton: has been grown commercially in the Lower Shire Valley since the start of the century when improved American Upland varieties were introduced. Before this time poorer quality varieties, introduced via the Arabs and Portuguese, were already widely grown for domestic use. Cotton was grown on a number of European estates in the area, but since the 1930s it has been an exclusively smallholder crop. It used to be widely grown in Nsanje, but now the great majority is produced in Chikwawa District. Development Area 1 has shown a sustained growth in production over the last ten years, whereas Development Area 3, which covers the Makande plain has shown much greater fluctuation from season to season and also a much slower overall rate of increase. This could be due in part to socio-economic factors, but it seems likely that many years of monocropping have led to loss of soil fertility and soil erosion.

Spraying of cotton has brought much higher yields than the average of 300 lb (136 kgm) previously attained. At correct application rates, with average weather, yields of 1200–1600 lb/acre (1345–1793 kgm/ha) are quite feasible, but the majority of farmers are reluctant to apply the recommended application of 12–13 sprays, and it is estimated that the average sprayed yield is about 900 lb/acre (1009 kgm/ha). A trial programme of aerial spraying was conducted over three seasons 1970–72 on blocks of open land to the south of Ngabu, but the administrative and social problems involved in organizing the blocks were such that the programme was discontinued.

In 1971/72 the ultra low volume (ULV) sprayer was introduced to farmers on a trial basis, and in the next two seasons about 250 ULV sprayers were sold to farmers. The ULV sprayer is a battery driven atomiser which produces an extremely fine droplet size facilitating improved penetration of the crop foliage. The machine is extremely light to handle, and requires only about 12 gallons per acre per season (132 litres/ha/season) (water based spray) at full application compared with 185 gallons per acre per season (2078 litres/ha/season) for a knapsack sprayer.

Maize: The Lower Shire Valley has been a maize deficit area for many years, and supplies have to be brought in from elsewhere to augment local production. Previously this trade was in the hands of private traders who often charged excessive prices, but now most maize is distributed by ADMARC at regulated prices. The requirement for improved maize production in the area is therefore important, particularly in the case of those farmers who insist on attempting to meet their minimum subsistence requirements before putting any labour into cash crop production.

It is felt that the synthetic variety SV 28 offers the best prospects in lowland areas, and after a pilot programme in Nkhate and Mlolo Units of the East Bank in 1973/74 it is to be made available throughout the lowland areas of the Project in 1974/75 complemented by SV 37 in the hill areas.

Maize grows well in the hill areas where the average yield of local maize is probably 800–1000 lb. (363–454 kgm) It is a risky crop in lowland areas however, and partial failure is common, with an average yield estimated about 400 lb (181 kgms). Maize is very important as a dry season *dimba* (wet land) crop grown in the Elephant and Ndinde Marshes and along the Shire River. It is impossible to estimate the acreage of *dimba* maize, but it makes an important contribution to food requirements.

Sorghum and Bulrush Millet: These crops are more drought resistant than maize and will give some yield when maize fails. Small areas are grown by most households as an insurance against maize failure, but in the Nsanje lowlands, south from Bangula they are much more widely grown than maize.

Groundnuts: The large confectionary nut Chalimbana is grown as a cash crop in the hill areas of Gaga and Lulwe/Chididi. Production was extremely low in 1974 due to excessive rainfall.

The Malimba nut is a small round-kernelled nut of the Gambia type, which is suitable for either oil expressing or the confectionary trade. It has been found to be the most suitable groundnut for the lighter soil lowland areas of Nsanje South, being more drought resistant than the Chalimbana nut and maturing in 110–120 days compared with 140 days for Chalimbana.

Rice has been grown along the Shire River for many years, but acreage has increased in recent years due to an attractive price to the smallholder and the development of two irrigation schemes.

In 1974 there were approximately 1100 acres (445 ha.) of developed land available for smallholder rice at Kasinthula and Mlolo Irrigation Schemes, though the full acreage was not planted at Mlolo due to water supply problems. The variety grown on irrigation schemes is Blue Bonnet, which is a high quality long-grained type suitable for export. Under good management and favourable weather conditions two crops a year can be grown.

Outside irrigation schemes the variety of rice grown is Faya, which is a shorter-grained local type. Unlike Blue Bonnet it is sensitive to day length (photoperiodic) and only one crop per year is practical since it is longer maturing; 160–170 days compared with 130 days for Blue Bonnet.

Pigeon Peas are undersown with maize and groundnuts in hill areas, particularly in the Gaga/Changoima area, and are harvested much later than other crops, in September/October.

Farming System—a high priority of the Phase II research programme is to define a farming system which will give good economic returns to the farmer, be economical in labour requirements, and maintain the structure and fertility of the soil.

At present there is no consciously practised rotation system used by farmers, and the situation is particularly serious on the Makande Plain where cotton has been monocropped on some plots for 15–20 years.

Sugar: Experiments with sugar for commercial production started in 1949 with a pilot project called the Alimenda Sugar Scheme. Unfortunately it was sited on somewhat saline soils and the results were disappointing. In 1960, a detailed study was made of the Elephant Marsh by a firm of Dutch engineering consultants, with a view to poldering it and using the area for estate sugar production. The capital costs of such a scheme would have been very high, and in 1963 Lonrho made a feasibility study of the area covered by the present estate. Development work started in 1964 and in 1965 the wholly owned Sugar Corporation of Malawi (SUCOMA) was formed.

The cane is planted from April to November and is ready for cutting in about 11 months. Initially, 500 lb. (227 kgm) of sulphate of ammonia was applied per acre, but subsequent research showed that optimum returns are achieved with an application of 700 lb. (318 kgm) per acre. Irrigation is effected by an overhead sprinkler system operated on a four-day cycle. Average application is about 9.5 inches (240 mm) per month, dependent upon precipitation, evaporation and stage of growth. There is a small experimental area of furrow irrigation, but the light soils of the area make most of the Estate suitable only for sprinkler irrigation.

Yields have been good despite the presence of some smut. Although some fields are now into their ninth ratoon, yield levels have not yet fallen sufficiently to justify replanting. Sucrose content of the cane averages about 12.9 per cent for 11–12 months old cane.

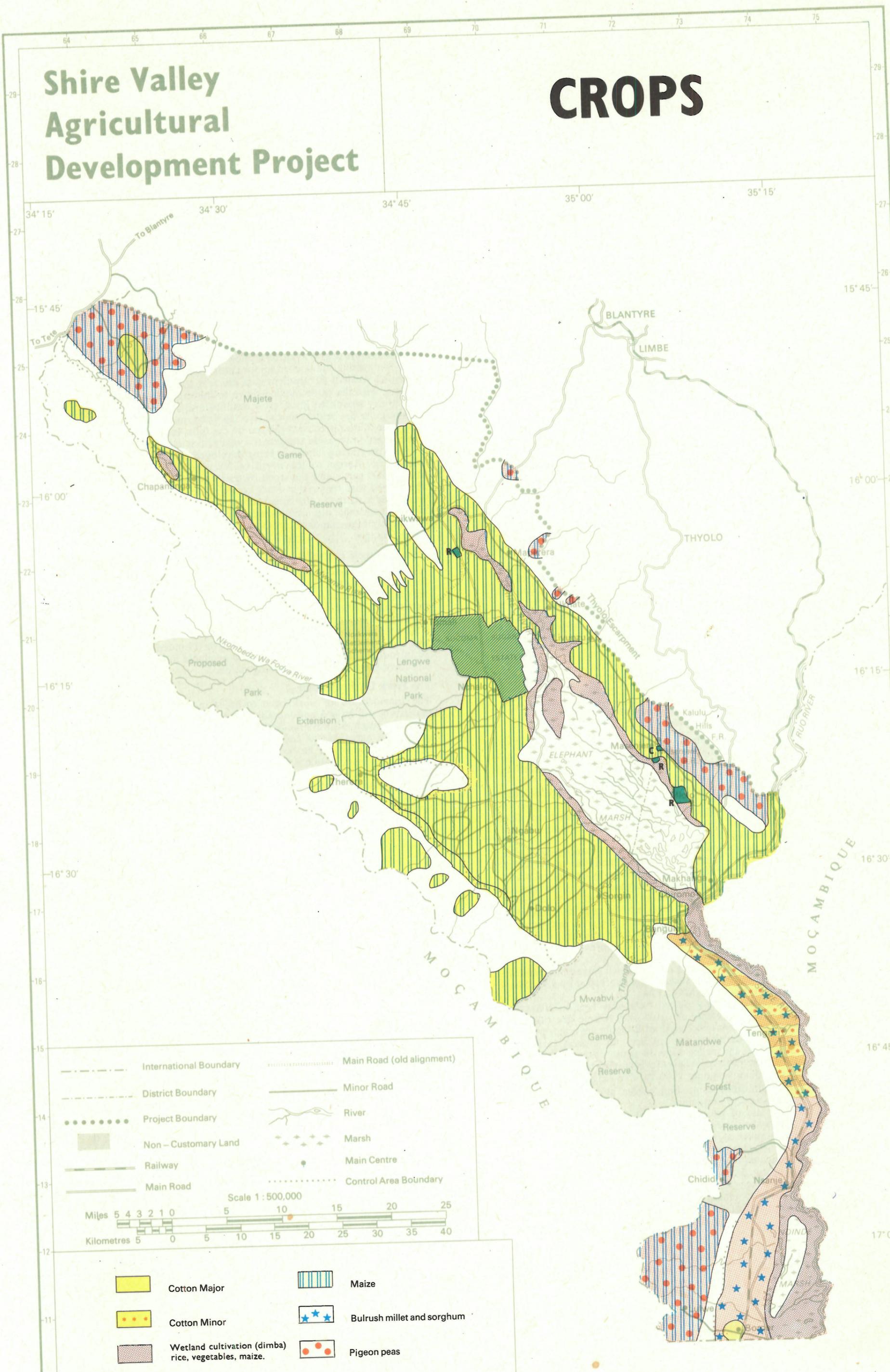
	Yield of Cane per acre (sh. tons)	Yield of Sugar per acre (sh. tons)	Sugar Production (sh. tons)
1966 ..	34	2.8	3,766
1968 ..	49	5.2	21,906
1970 ..	52	5.9	36,114
1972 ..	47	5.0	37,218
1974 ..	n.a.	n.a.	55,000*

* Provisional

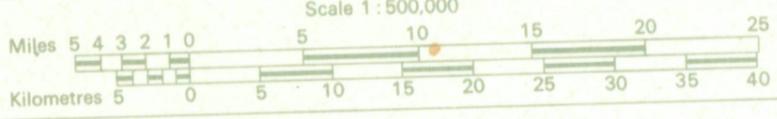
The target output of the estate at full development, from 1976 onwards will be 110,000 tons of sugar per annum. It is anticipated that domestic demand by 1976 will be 60,000 tons which will leave a considerable surplus for export. In 1974 the foreign exchange earnings from sugar will be about K8.0 million.

Shire Valley Agricultural Development Project

CROPS



- International Boundary
- District Boundary
- Project Boundary
- Non-Customary Land
- Railway
- Main Road
- Main Road (old alignment)
- Minor Road
- ~ River
- Marsh
- Main Centre
- Control Area Boundary



- Cotton Major
- Cotton Minor
- Wetland cultivation (dimba) rice, vegetables, maize.
- ▨ Maize
- ★ Bulrush millet and sorghum
- Pigeon peas

LIVESTOCK

The Lower Shire Valley with a cattle population of about 50,000 head, is one of the finest natural grazing areas in Malawi. The marsh and riverine flats provide excellent winter fodder when upland grazing is becoming scarce, and cattle with access to this grazing maintain condition throughout this normally difficult period at the end of the dry season. In the rainy season, when the river level rises and crops are planted in the dryland gardens, grazing becomes a problem for many herds. This is particularly serious in the area south of Bangula. With less than 10 per cent of households in the Lower Shire Valley owning cattle and with the continued increase in areas under cultivation, the problem is becoming more serious. Much of the Western Escarpment has potential for wet season grazing, but distance from *kholas*, difficulties of access through cultivated areas and poor water distribution in the hills has discouraged their use in the past.

Unlike the thoracically humped Zebu found in most of Malawi, the Shire Valley cattle tend to have a smaller, cervico-thoracically placed hump corresponding to the Sanga classification.¹ These cattle probably entered the Valley from the Zambezi basin with the Asena people. Limited introduction of *Bos Taurus* blood in the early 1900s from European owned estates may also have contributed to the smaller hump.² The Handbook of Nyasaland in 1922 quoted the cattle population of Ruo District as 1,806, of which only 28 were owned by Africans. At the same date the cattle population of West Shire District (which covered Neno and Chikwawa), was only 300, though the pig population of Chikwawa was estimated at 2,500.³

The cattle population in the valley has increased in a spectacular fashion since the 1950s.

Year	Cattle Population Three-Year Average	Percentage Increase In Population
1955	4,437	—
1960	6,631	8.4
1965	15,253	18.2
1970	28,255	13.2
1971	34,459	22.0
1972	41,797	21.3
1973	49,296	17.9
1974	52,776	7.1

Source: Regional Veterinary Office, Blantyre. Annual Reports.

NOTE: Data for 1972-1974 are one-year figures; not three-year averages.

Net population growth rate in the Phase I area was estimated at 19 per cent in 1972 on the basis of a year-long sample survey, and off-take was estimated to be 10 per cent.⁴ This compares with an estimated National Herd increase of four per cent.

The reasons for the high fertility of the Shire Valley cattle have not been fully defined, but there is no doubt that grazing is of extremely good quality. However, it should be pointed out that improved enumeration techniques could account for some of the rapid increase between 1970 and 1973.

The most serious endemic cattle disease is Trypanosomiasis, the main causal organism being *T. congolense* and the main vector *Glossina morsitans*.⁵ Mechanical transmission by means of biting flies, particularly *Stomoxys* spp. may also play a part in its spread. The challenge (incidence of transmission) produced by flies carried in vehicles and baggage, and the location of fly pockets outside the main tsetse concentrations in Mwabvi Game Reserve, and between There and Chapananga, has yet to be defined in detail.

Red Water is the most serious of the tick-borne diseases in the Valley.

An outbreak of Foot and Mouth disease which spread into Malawi from Mozambique in 1973 was successfully controlled by a vaccination and quarantine policy by May 1974.

The Shire Valley is ideally placed to supply beef to Blantyre. Cattle sold at markets around Bangula and Nsanje are railed to Blantyre, while cattle marketed north of Bangula are either trucked or walked up the escarpment by butchers. In general cattle are marketed heavier in the valley than in most other areas of the country and because of its proximity to Blantyre, prices tend to be high. Steers and bulls weighing 1200 lb. live-weight and over are not uncommon, and carcasses grading 'choice' and 'prime' from the natural grazing also occur frequently.

Until recently, use of oxen for draught purposes has not been widespread, mainly because of lack of training and credit facilities.

The Valley supports a large goat population which provides a valuable source of meat in the village. Pigs also thrive, but are periodically decimated by African Swine Fever.

Black Australorp chickens are sold annually in the valley, but the general standard of management is low.

The livestock development programme is principally concerned with the development of the cattle industry and has the following objectives:

Improvements of Disease Control and Marketing Services

The Project is initiating a detailed study of the Trypanosomiasis problem with a view to implementing a control programme. The loss caused by this disease, particularly in lowered animal productivity, is considerable.

Eleven dip tanks will be built, bringing the total number to 22. Some of these tanks will be sited in the hill grazing areas.

Cattle marketing facilities will also be improved by increasing the number of live-weight sale yards and trekking *kholas*.

Improved Utilisation of Grazing Areas

The need to identify and demarcate areas for grazing is becoming more and more urgent as cattle numbers build up, and areas formerly used for grazing are opened up for cultivation. Parts of the virtually unsettled Western Escarpment area are very suitable for wet season grazing, with the cattle moving down to the valley floor at the start of the dry season to graze crop residues and associated grass and finishing the dry season on the riverine flood areas. Where distance from the *kholas* precludes the use of the hills, local leaders will be encouraged to set aside areas on the valley floor specifically for cattle.

The first grazing scheme is being developed on the foothills of the Matandwe Range to the north of Nsanje. The scheme involves some 2,000 cattle and the stock owners have already provided half the barbed wire required to fence access routes to the grazing areas, as well as assisting in the construction work.

Once schemes are established and the management is of a sufficiently high standard, cross-breeding using Brahman bulls will be encouraged.

Intensive Cattle Fattening

As the cattle population builds up, the off-take of younger animals for intensive fattening, particularly by non-cattle owning farmers, will be encouraged. The credit backed stall-feeding scheme is a particularly suitable way of introducing cattle into the non-cattle owning smallholder situation.

Some herds in the valley are very large (in one case over 1,000) and it is anticipated that feedlot fattening on a limited scale will also be introduced. Molasses, being readily available in large quantities, will form the basis of the fattening ration.

The Work Ox Programme

The introduction of work oxen to assist in cultivation and crop marketing will have a considerable impact in an area where 90 per cent of households have no cattle but are, in some cases, cultivating quite large acreages. Ox training units are established at all Area Headquarters as well as Alumenda and Ngabu. The ox training season runs from March to October with a follow-up programme in the rainy season when extension staff visit farmers on their own holdings. Farmers may either bring their own oxen for training, or purchase oxen supplied by the Project on credit. There has been considerable interest in this programme as is shown by the following table.

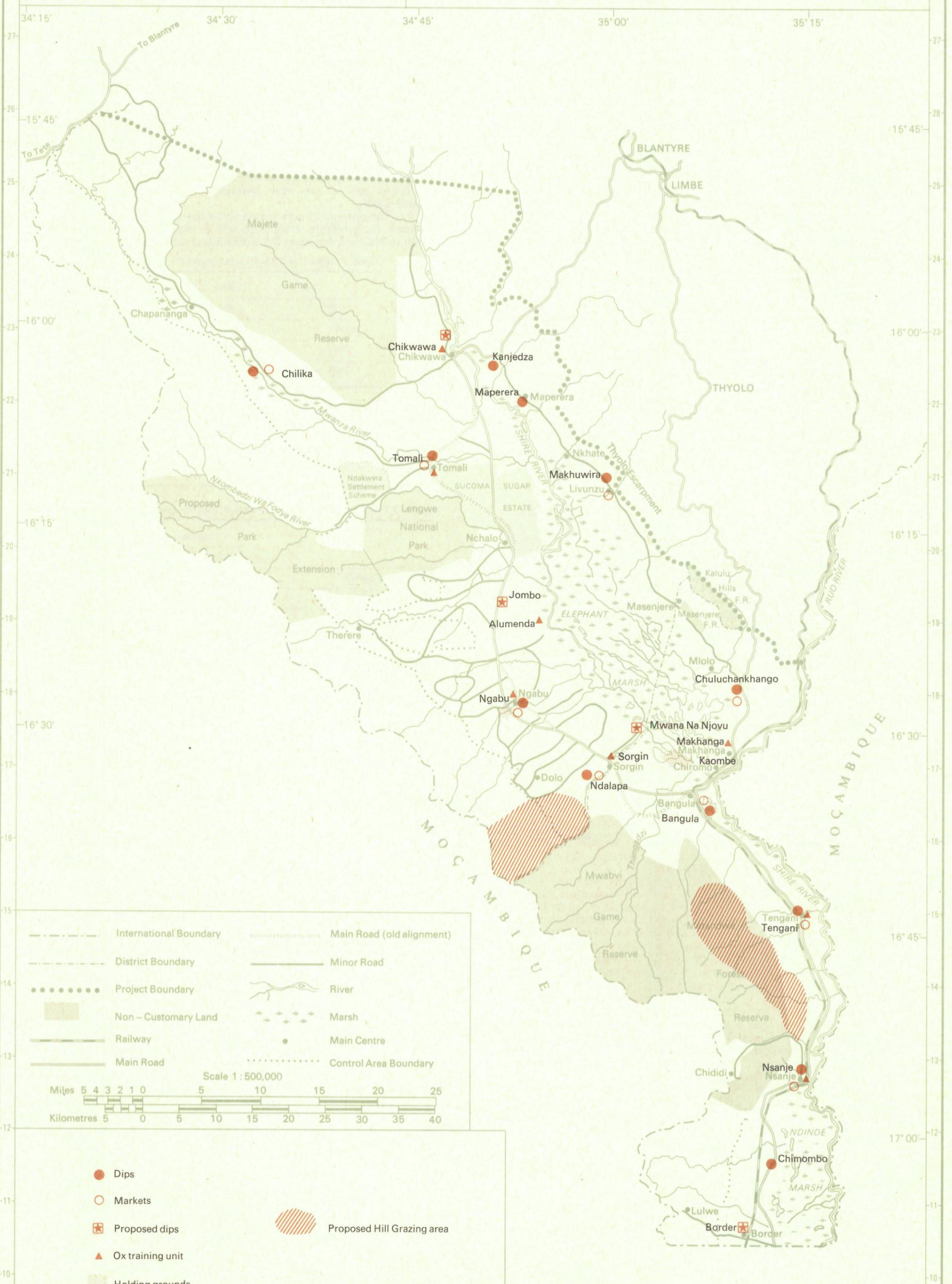
Year	Number of Pairs of Oxen Trained
1968	39
1969	75
1970	70
1971	75
1972	78
1973	65
1974	202

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Shire Valley Agricultural Development Project

LIVESTOCK



FISHERIES

The Fishery

The 'Inquiry into the Fishing Industry' published in 1956 assessed fish harvest from the Lower Shire at about 100 short tons per annum. Between 1968 when the Fisheries Department initiated a detailed survey, and 1974, the average yearly fish harvest was shown to be approximately 8,500 short tons. This represented about 20 per cent of the average National fish harvest. At 3t/lb. the beach value is estimated to be K510,000. The record 1972 harvest was valued at well over K1,000,000. On average about 680 short tons of smoked (dry) fish are sent by railway to the Shire Highlands each year; this is equal to about 1,700 short tons of wet weight equivalent or 20 per cent of Lower Shire total estimated harvest. The rail-exported dry fish has a total market value to the fish traders of about K204,000 when sold at 15t/lb.

A close relationship has been reported to exist between the flood in a particular year and the size of the fish harvest in the next. A good extensive flood is frequently associated with an abundant harvest the next year; a poor flood is often the precursor of a bad harvest the following year. In this respect the Lower Shire is similar to the Kafue flood plain of Zambia. The Liwonde barrage controlling the flow of water from Lake Malaŵi to the Lower Shire exerts a considerable influence upon the fishery and is potentially an extremely potent tool for its proper management.

The very poor fish harvest of 1973-74 was almost certainly a result of the abnormally low flood of 1972-73. However the relationship referred to above suggests that the more abundant flood of 1973-74 should result in a greatly improved harvest in 1974-75. The sharp decline in fish exports by rail, from the Shire Valley in 1973 (see Graph) was a result of the poor harvest and restrictions on movement resulting from cholera control regulations.

It is estimated that there are about 2,000 people in the area who own fishing gear, who are either full time fishermen or fishermen/farmers (see Table 1).

The most important fishing gear in the Valley is the 3" or 3½" gill-net (*machera*). Fish-traps (*mono*), long-lines (*mbedza*) and cast-nets (*chavi*) are widely used. In suitable areas the encircling fish fence (*psyailo*) is operated with great success. Seine nets are frequently seen at Bangula Lagoon and at other lagoons especially in Nsanje area. Less important are scoop or dip nets which are operated from a platform built over the edge of the river bank and plunge baskets which are used particularly after flooding. More unusual are the fish spear and the double headed fish arrow. For details of fish net sales refer to Table 2.

In terms of landed weights *Clarias* spp. (Catfish) have generally been of more importance than *Tilapia* spp. (Bream) in the total harvest. However the proportion of *Tilapia* spp. landed appears to be gradually increasing.

Research

The Lower Shire Fisheries Research Unit of the Fisheries Department was established in 1970 to enquire into the biology of the Lower Shire Fishery. By 1973 three sub-stations had been opened at Ndombo, Mchacha and Chiromo and a central research laboratory was acquired at Makhanga in late 1973. Further sub-stations are proposed for Kanjedza and Bangula Lagoons and eventually Nsanje.

A fish farm was constructed at Kasinthula Research Station as part of a UNDP funded programme to establish the technical and economic feasibility of fish farming on land otherwise unsuitable for agriculture. Thirteen ponds covering 52 acres (21 ha) of saline soil were constructed. Further experimental fishponds are to be built in 1975 covering an additional 2.5 acres (1.0 ha). The target yield of fish is 2,000 lb./acre/annum (2,242 kgm/ha).

Development

The IDA funded SVADP Fisheries Development Programme

commenced in April 1973 under the control of a Senior Fisheries Officer, who is responsible for the implementation of SVADP development work and for the co-ordination of all other fisheries activities in the Lower Shire Valley.

It is anticipated that greater fish harvest and profit to the fishery will be promoted by the following activities:

(a) Construction of roads to major fishing villages. This will help the fish traders to reach the beaches in the wet season and encourage the fishermen to catch more fish.

(b) Fishermen's training courses. Men spend five days at a residential centre and are shown modern methods of fish smoking and gill net hanging.

(c) Demonstration fish smoking kilns in villages. Fish processed in these improved kilns are better preserved than those processed in traditional kilns. The improved kilns are more economical on firewood and labour than traditional methods, and they also permit processing to continue in wet weather.

(d) Introduction of modern plank canoes, available for cash or on credit. Suitable trees from which traditional canoes are hollowed out are becoming increasingly scarce. Plank canoes can be made from timber available in Malaŵi by boat-builders trained at Mpwapwe Fisheries Training School near Mangochi. A canoe production unit has been established at Ngabu.

(e) At key centres new permanent fish landings will be established.

(f) The opening of a proposed water-bus service to the Ndinde Marsh from Nsanje. Fishermen will be easily able to sell their fish to Nsanje fish traders for distribution to the Shire Highlands.

TABLE 1 CENSUS OF CANOES AND FISHERMEN 1970-1973

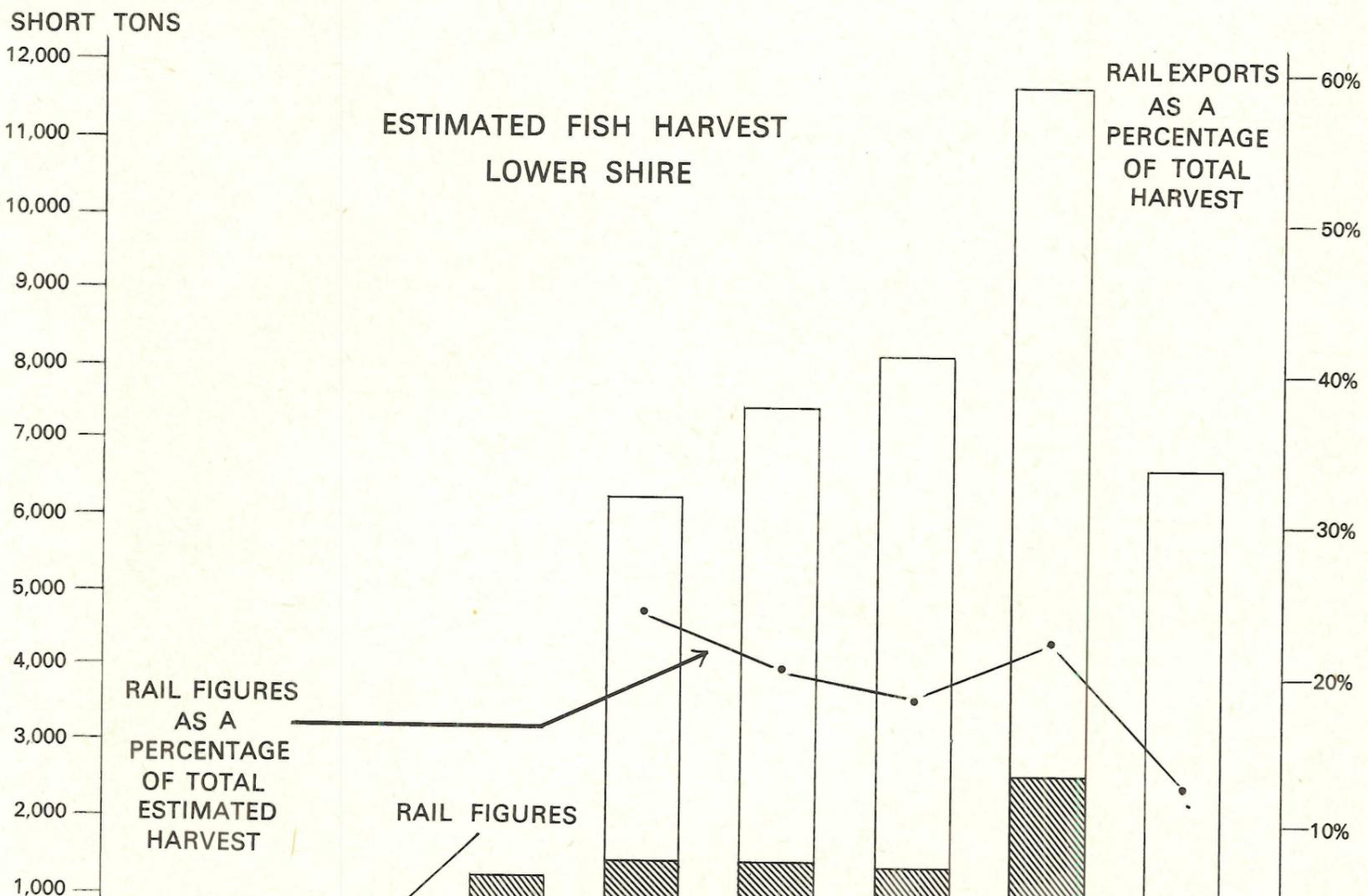
Year	Canoes	Fishermen
1970	1,900	2,445
1971	1,445	2,464
1972	1,186	1,800
1973	1,261	2,253

TABLE 2 SALES OF FISHING NETS AND TWINE TO THE LOWER SHIRE AREA

Year	1966	1967	1968	1969	1970	1971	1972	1973
VALUE (Kwacha)	8,810	15,710	37,720	28,548	24,360	24,171	19,202	2,742

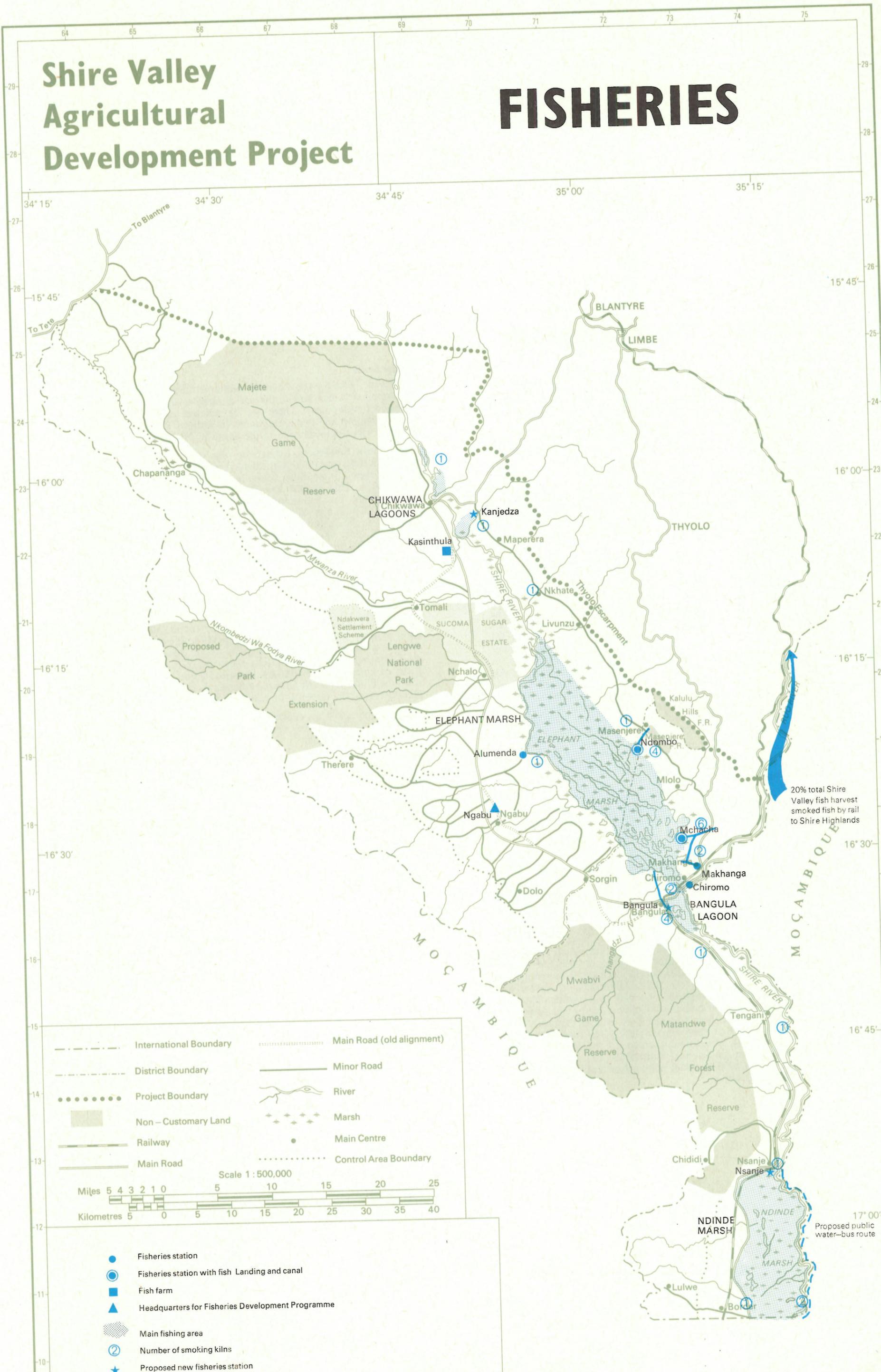
TABLE 3 PERCENTAGE OF FISHERMEN AND ESTIMATED CATCH BY AREAS—1973

	Fishermen		Catch (wet weight)	
	Number	%	Sh. tons	%
Chikwawa Lagoons	203	9.0	162	2.4
N. Elephant Marsh	543	24.1	847	12.6
S.E. Elephant Marsh	508	22.5	1,906	28.4
W. Elephant Marsh	233	10.3	540	8.0
Bangula Lagoon	367	16.2	792	11.8
Ndinde Marsh	399	17.6	2,456	36.5



Shire Valley Agricultural Development Project

FISHERIES



PROJECT ADMINISTRATION

Background

Prior to the inception of the Chikwawa Cotton Development Project the Lower Shire Valley constituted a Division under the direction of the Regional Agricultural Office (Southern Region) in Blantyre. The Division was split into two Areas, which were identical with the two Administrative Districts of Nsanje and Chikwawa.

The Chikwawa Cotton Development Project originally covered the Parliamentary Constituency of Chikwawa South, bounded to the North by the Mwanza River, and to the South by the Lalanje River. These boundaries, however, split a number of ADMARC markets, and in 1970 the Project boundaries were expanded to include the whole of Tomali, Sande and Sorgin Market Areas. In Phase I the Project was split into two areas, with Area Headquarters at Tomali and Sorgin. These two areas are identical with Development Areas 2 and 3 of the Phase II Project.

Development Areas

The field services of the Project are administered through two levels of organisation. At the primary level are the Development Areas of which there are six, and at the secondary level are Units of which there are to be 41 (including Chitseko). In Phase II the number of Development Areas has been increased to six, and the range of services provided by each Development Area Headquarters has expanded considerably to include a Day Training Centre for farmers (some have limited sleeping accommodation) Demonstration Farm, oxen training, and input storage sheds. Each centre has a personnel carrier for the daily transportation of farmers to and from the Training Centres, and also facilities for carrying out simple repairs to vehicles and motor cycles. Each Area Development Officer has a mobile radio telephone in his landrover to provide contact with Ngabu Headquarters. Although the Area Development Officer comes under the Extension Service, he acts as senior project representative in each Area and co-ordinates Project activities on behalf of all Services, Branches and Sections. All centres have been planned in accordance with recognised town planning procedures.

The Development Areas were planned on the basis of two criteria—number of farming families and size and shape. The difficult shape of Area 5 means that it has a considerably lower population than other areas.

Units

In each Development Area there are a number of Units. These Units are coincident with ADMARC market boundaries, which contributes to the better integration of input supplies, extension advice, marketing and credit recovery. Each Unit is controlled by an experienced Field Assistant with two years' training at Colby College of Agriculture, under whom are a number of Development Assistants. Each Development Assistant has a bicycle and is responsible for a specific geographical area within which he teaches farmers about improved agricultural techniques, using a variety of methods such as personal visits, group meetings, demonstrations, and radio listening groups. At full establishment there are 237 Extension Development Assistants working in 41 Units. They are supported by a further 50 specialized Colby trained Field Assistants. At the end of Phase I there was one D.A. to approximately every 40 spraying farmers and approximately every 150 rural households. This compared with a national average of one agricultural field extension worker to about 1,000 households. Full establishment at present provides a ratio of about one agricultural extension worker to about 200 households.

Special Areas

Integrated within the overall administrative framework of Development Areas and Units are a number of special areas of intensive development. There are six schemes of which four are under irrigation and two are dryland. In addition there is the Zunde Intensive Development Area to the South of Ngabu.

Ndakwera Settlement Scheme to the west of Tomali initially covered 9,100 acres (3683 ha), divided into 770 plots. An extension for a further 170 holdings covering 1,800 acres (728 ha) was laid out in 1974. This scheme has absorbed some blind farmers, who have had one year's training in agriculture under the auspices of the Royal Commonwealth Society for the Blind, but it is primarily designed to cater for families moved as a result of SUCOMA extensions and the implementation of the Western Escarpment Control Order (see Commentary 20). By the end of 1974 all holdings were occupied. A further settlement scheme was developed at Gola in the north-west of the Project Area in 1974 and now accommodates about 100 MYP settlers.

Irrigation schemes were developed at Mlolo and Masenjere by the Taiwanese Technical Assistance Mission from 1969–1972. The former has a net irrigable area of about 850 acres (344 ha) and the latter of just over 70. Double cropping at Mlolo is a problem because of the low water flows in the Thangadzi stream (see Commentary 7). At Kasinthula Research Station there are 225 acres (91 ha) of irrigated land under smallholder rice production. Water is pumped from the Shire River. At all three schemes there is little re-settlement involved since the majority of participants are local farmers.

In October 1974 an experimental cocoa plot covering six acres (2.43 ha) at Masenjere was allocated to six smallholders for commercial production.

The Zunde Intensive Development Area of about 2,000 acres (809 ha) covers the upper part of a typical catchment area on the Makande Plain. An intensive programme of gully reclamation, bunding and marker ridging was started over a small area in 1973 and was extended to the whole area in the 1974 dry season. Local participation has been promoted through the formation of a strong committee of local leaders and the response from farmers has been encouraging. The planting of timber trees, bananas and leucaena will be an important part of the gully reclamation programme. It is hoped that the conservation works will lead on to some form of land reorganisation, which will facilitate the adoption of an integrated farming system.

Shire Valley Agricultural Development Project

PROJECT ADMINISTRATION



RESEARCH

Research is a major component of the Project which was greatly expanded in Phase II. All SVADP research is co-ordinated by a Senior Agricultural Research Officer who heads the Technical Services Branch of the Project. The Branch incorporates three main Sections: Agronomy, Land Husbandry and Evaluation and also includes a number of related research programmes.

The Technical Services Branch maintains very close liaison and co-ordination with other bodies involved in agricultural research, particularly the Department for Agricultural Research, the Agricultural Research Council and the Development and Pest Control Branches of the Agricultural Development and Marketing Corporation.

Research Stations:

Makhanga Research Station, 3 miles (4.8 km) to the East of Chiromo, is under the control of the Department of Agricultural Research. Originally a private estate of 100 acres (40.5 ha), it was purchased as a seed farm in 1943. Additional land was purchased 1949 and 1956 and it now comprises about 350 acres (142 ha).

The station is situated on the alluvial fan of the Ruo and soils are a sandy clay loam. Periodic flooding, in recent years in 1952, 1956 and 1967 renews the deposition of alluvial silts. The unusual fertility of these soils makes them rather atypical of the Project area, and research results must be interpreted accordingly.

Sixty acres are under irrigation, half by sprinkler and half by furrow. In this area trials are conducted throughout the year. The main crops grown are cotton, maize, sorghum, rice and groundnuts. Minor crops include beans, kenaf, tobacco, vegetables, cocoa, coffee and sugar-cane.

Kasinthula Agricultural Research Station: In 1965 the Government of Malawi requested the United Nations Organisation for assistance in carrying out an investigation aimed at agricultural improvement in southern Malawi. In response to that request the United Nations Special Fund, later known as the United National Development Programme, authorised funds for 'Irrigation Investigations—Lower Shire Valley, and the plan of operations was agreed in September 1966. The Lockwood Survey Corporation of Canada was engaged to carry out these investigations. They selected a net irrigable area of 18,240 acres (7382 ha) to form a proposed 'Kasinthula Irrigation Project'. One of Lockwood's recommendations was for the establishment of a Pilot Farm adjacent to the River Shire; work on the Farm started in 1968.

Firstly, 49 acres (20 ha) of rice fields were constructed with a main irrigation canal and further bush clearing as a combined operation of the Malawi Development Corporation, UNDP and the Irrigation Branch of the Ministry of Agriculture. The UNDP posted an Irrigation Engineer to the Farm in 1970. Up to mid-1972 the Farm was financed both as regards capital development and recurrent costs by the Malawi Development Corporation. With a change of emphasis away from commercial farming in the direction of research the MDC withdrew and the Technical Services Department (Irrigation Branch) of the Ministry of Agriculture assumed responsibility for management until March 1973. As from April 1973 the Farm became part of the Shire Valley Agricultural Development Project with some funds still provided by Malawi Government. As the main irrigation station in the Lower Shire Valley, its primary object is to provide data for the development of irrigation within the whole project area.

Information is required on irrigation techniques, drainage, soil management, cropping patterns, farming practices, the use of artificial fertilizers, together with an assessment of the economic implications of different practices. Research into fish farming techniques also plays an important part of the Station programme.

The Station thus has three main activities:

1. Agricultural research with irrigated crops	210 acres (85 ha)
2. Small farmer irrigation	245 acres (99 ha)
3. Fish farming	52 acres (21 ha)
	507 acres (205 ha)

From April 1975 the Station is to be controlled by the Department of Agricultural Research, but will be partially financed by the Project until 1978.

Ngabu Research Station was established as a minor research plot in 1967 by the Department of Agricultural Research and was handed over to the Chikwawa Cotton Development Project in 1969 for further development. It covers 40 acres (16.2 ha) and has areas of heavy, medium and light soil.

Agricultural research on the station involves agronomy, plant breeding, plant pathology, entomology and soil productivity. Cotton sprays and spraying techniques and pheromone investigations are a major concern. The main crops are cotton and maize and, to a lesser extent, sorghum and groundnuts. Minor crops grown are cassava, guar bean and senna. The station includes a horticultural and tree crop nursery.

In addition there is a 2½ acre (1.0 ha) plot adjacent to the Training Centre where investigations are being undertaken as part of the leucaena research programme being undertaken by the FAO/UNDP Livestock Project.

The Station soils are basically alluvial and are characterised by

strong blocking structure with large cracks appearing in the dry season. Brown to black, they are slightly alkaline silty clay and clay loams of various depths and highly variable.

Tomali field station of 9 acres (3.6 ha) was acquired in 1968; the site was selected to represent soils of the drift plain series. An additional 7 acres (2.8 ha) has recently been acquired and the station integrated with Area 2 Headquarters. The same trials as at Ngabu are usually duplicated at Tomali.

Nsanje sub-station has been established for about 10 years and is being developed to include about 25 acres (10.1 ha) of trials. Soils are grey-brown earths of light to medium texture. Main crops grown are groundnuts, sorghum and millet. Minor crops include castor and cassava.

Maperera sub-station is to be established in 1975 on a plot of about 20 acres (8.1 ha) on the East Bank.

Zunde Field is a sub-station of 13 acres (5.3 ha) split into a five acre (2.0 ha) plot used for farming systems experimentation and an eight (3.2 ha) plot used for specific crop trials and observations. The objective of the farming systems research is to identify a combination of enterprises which will give optimum economic returns and technical performance on the Makande soils, with particular stress on soil and water conservation. The system currently being tried involves cotton, maize, a legume and improved grasses for stallfeeding to cattle. Most of the trials area is devoted to grass and leucaena.

Within the station there are also a series of soil erosion and water control observation plots where the soil and water losses under different methods of land preparation and crops are quantitatively recorded. The plots are 90 feet (27.4 m) long by 6 feet (1.83 m) wide on a 3.25 per cent slope, and the data on soil and water loss is related to rainfall records kept on an autographic rain gauge sited close by. This experiment also serves as a very valuable demonstration to farmers.

The Soil Productivity Research Unit

This unit was established in 1973 jointly financed by SVADP and the Agricultural Research Council, to investigate problems of importance to agricultural productivity outside the scope of the usual research services. The immediate research programme is the investigation into the problems of the Makande Plain. The Unit has its headquarters at Bvumbwe Research Station but SVADP has made available field staff, facilities and laboratory at Ngabu. Three experimental sites have been established, where a wide variety of land preparation techniques are being studied.

Pesticide Residue Study Programme

Because of the essential and widespread use of pesticides for successful cotton production, it was considered an advisable precaution to look into the possibilities of harmful residues, especially of the persistent organochlorine DDT, accumulating in the soils and thence into water and marsh fish. The Tropical Products Institute and Centre of Overseas Pest Research in U.K. are collaborating with the SVADP in a programme designed to investigate and assess the extent of the problem, if indeed there is one.

A series of soil samples are taken from two sites on two soil types at regular intervals three times a year. In addition gully, mud and fish samples will be analysed, by T.P.I. London.

Crop/Weather Reference Plots

With a view to providing some objective measure of the influence of weather (rainfall) on crop yields, and to measure the impact of this rainfall variable temporally and spatially, a series of 32 plots have been established throughout the Project area, where the three major crops are grown under a standard agronomic regime and with standard crop protection measures.

These sub-plots are one-tenth of an acre (.04 ha) and the crops grown are local maize, improved (synthetic) maize, improved cotton (sprayed), improved cotton (not sprayed) and groundnuts. It is intended to monocrop the first four and alternate the groundnuts with a fallow plot each year. The plots are supervised by trained field staff of the Extension Branch, but with technical supervision by the Research Branch.

Tree Trials

Trials on a number of different tree species planted in strips are being carried out at some 9 sites on the Makande Plain. The main tree species are: *Eucalyptus* (six species) *Gmelina arborea*, *Cassia siamea*, *Cordyla Africana*, *Melia azederachta*.

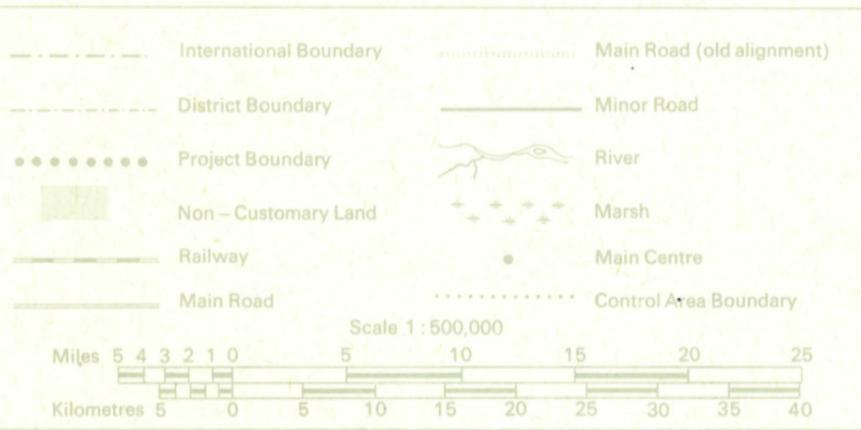
The intention is to find suitable species for shelter belts which will minimise wind erosion and provide alternative uses for poles, timber, fruit etc. The ultimate plan is to form a network of tree belts all over the Makande plain.

Evaluation

The Evaluation Section conducts random sample surveys of farmers in order to collect a wide variety of socio-economic data which are required to monitor the impact of the Project on small-holder production and income and for the overall evaluation of Project benefits. This data includes household size and characteristics, farm structure and cropping patterns, crop yields, production, income and wealth.

Shire Valley Agricultural Development Project

AGRICULTURAL RESEARCH



- Major Research Station
- ▼ Research Sub-Station
- Crop/Weather observation plot
- Crop observation plot
- Soil productivity research plot
- ★ Pesticide Residue study site
- ☆ Farming Systems Observation Site

ADMARC

The Agricultural Development and Marketing Corporation was formed in 1971 to take over the statutory marketing functions of the Farmers Marketing Board, and to assume additional responsibility for specific agricultural development work. ADMARC is responsible for a network of 43 markets in the Lower Shire Valley controlled from a Divisional Office at Ngabu. The markets purchase a wide variety of crops of which cotton, rice, pigeon peas, maize and groundnuts are the most important, and sell food maize throughout the year. Most farmers' inputs, from ox-carts and spraying machines to insecticide, are distributed through ADMARC markets under the control of the Shire Valley Agricultural Development Project credit programme.

The marketing network has been considerably expanded and facilities improved since the start of the Phase I Project. During Phase I a loan of K198,000 was made from Project funds to ADMARC, which contributed towards the re-equipping of all markets with automatic weighing scales, roller conveyors and other minor improvements, as well as the building of new markets at Mandalade, Saopa, Mangulenje and Mwala. At the same time ADMARC opened a new market at Border to replace the previous one at Marka.

In Phase II the market network is being further expanded and rationalised with the building of new markets at Misomali, Kakoma, Makhuwira, Ledza, Masenjere, Chitseko, Makhanga, Phokera, Dande, Mbenje and Tengani, as well as the creation of new temporary markets at Kanzimbi and Nkumaniza. The market at Chapananga has been improved by additional shed and offices to become a sub-depot, and Changoima Market has been upgraded. Nkadana, Tombondera, Moses and Mangulenge will be closed. In Phase II ADMARC is making a contribution of K1.1 million to Project finances for the purchase of farmer inputs.

The market network is very dense, with an overall average of one market per 1,500 farm families. It is estimated that over 90 per cent of growers live within three miles of a market. The improved network of markets, the increased efficiency of market operation, and the widespread use of trucks and ox-carts means that the farmer spends much less time in marketing his produce than in the past. By far the most important crop purchased by ADMARC is seed cotton, though the total amount showed wide variation from year to year before the start of the Phase I Project. The two previous peaks of production in 1962 and 1965 were followed by years in which output fell by almost 50 per cent (Table I).

In contrast production has been much more consistent since 1969. The next most important crop is rice, over half of which is purchased from the irrigated schemes at Mlolo and Kasinthula, followed by pigeon peas, groundnuts and maize. The increase in pigeon pea sales has been notable in recent years. The slump in groundnut sales in 1974 was due to exceptionally heavy and late rains.

TABLE 1 ADMARC CROP PURCHASES 1960-1974 (short tons)

	Seed Cotton	Rice	Pigeon Peas	Ground-nuts	Maize
1960	11,026				
61	10,292				
62	17,068				
63	8,899				
64	13,073			328	
65	18,925			519	
66	9,503			436	
67	7,176	410		550	
68	5,608	308		161	
69	11,984	584		300	
70	16,074	777		310	
71	15,977	1,400	177	450	85
72	16,731	930	222	430	78
73	11,214	1,535	989	320	117
74	16,709*	1,700†	837*	105*	525*

* Provisional figures.

† Provisional figure, including winter crop.

TABLE 2 SEED COTTON PURCHASES BY ADMARC BY DEVELOPMENT AREA, 1968-74 (short tons)

	1968	1970	1972	1974
Area 1 ..	1,088	3,510	3,393	3,405
2 ..	1,636	4,660	5,852	5,984
3 ..	2,184	6,939	6,724	6,335
4 ..	577	613	629	786
5 ..	113	335	119	193
6 ..	10	17	14	6
TOTAL ..	5,608	16,074	16,731	16,709

Shire Valley Agricultural Development Project

ADMARC



HEALTH

It is now generally accepted that improvement of the health of a population is an essential factor in national, social and economic development. Health affects socio-economic factors and is itself affected by these factors; notably income, food production and education.

This relation was accepted in the Shire Valley in 1971 and resulted in the improvement of some health facilities in the Phase I area. In Phase II a separate Public Health Section was created to guide the development of Health services in the whole Shire Valley as an integral part of the general development policy.

Health Situation

As in other parts of Malawi, no accurate statistics are available. Figures quoted in this section are derived from hospital statistics as collected by the Ministry of Health and from special surveys done in the Ngabu area by Ministry of Health staff in 1970, and others.

Child mortality is high, at about 43 per cent (1970). No other mortality statistics are available. Morbidity is difficult to assess. However, the Agro-Economic Survey (1972) found that four per cent of farmers' time was spent on sickness, attending the sick and attending funerals. Each person visits an out-patient department about three times per year.

Protein calorie malnutrition (PCM) is, as elsewhere, especially a problem of the under-five population. A Ministry of Health Survey (1970) found 43 per cent of the under-five children to be under 80 per cent of Harvard Standard and 14 per cent to show clinical PCM. This relates closely to the figures found at Under-five Clinics. Under weight percentages have a close relationship to the harvest season, being the highest between January and March (61 per cent of children under 80 per cent of Harvard Standard 1974) and the lowest between August and November (22 per cent, 1973).

Anaemia is widespread and possibly one of the most important factors influencing agricultural productivity in the area. Anaemia is predominantly of an iron deficiency type. Haemoglobin values under 5.0 gm per cent are a regular finding at all hospitals in the area. Ministry of Health Survey (1970) found an average Hb of 9.22 gm per cent, 62 per cent of the population being under 10.0 gm per cent (normal: 15.0 gm per cent).

Pellagra and Avitaminosis A are both seen frequently at all hospitals, mainly in the January-May period.

Infectious Diseases

Malaria is doubtless the most important cause of morbidity in all age groups and one of the important causes of mortality in the under-five group. Cerebral malaria is frequently seen, especially in December and January. Ministry of Health (1970) found 51 per cent of children to have a positive blood film and 46 per cent to have splenomegaly. *Plasmodium falciparum* is predominant. Vectors have been identified to be *Anophilus Funestes* and *Anophilus Gambiae*. In the marsh areas along the Shire River transmission is perennial. In the upland areas, mosquitoes virtually disappear from June to November.

Bilharzia is widespread, urinary bilharzia being most frequently seen. Prevalence of *Schizosoma haematobium* in school children varies between 30 per cent in upland areas to 89 per cent near the Kasinthula Irrigation Scheme. Intestinal bilharzia is more frequently seen on the East Bank area and in Nsanje South; prevalence of *Schizosoma mansoni* varying from nil near Kasinthula to 21 per cent near Mlolo. These figures are derived from single specimen examinations under primitive circumstances. Real prevalence is possibly much higher. The vector snail for *S. haematobium*, *Bulinus (physopsis) globosus* is found in the Shire Valley. *Biomphalaria pfeifferi*, vector of *Schizosoma mansoni* is mainly found on the East Bank and Nsanje South area.

The Gastroenteritis group is the most frequent cause of death in children in hospitals. Gastroenteritis is predominant at the end of the dry and beginning of the wet season. Typhoid fever and dysentery are frequently seen in hospitals. The area was infected by cholera in September 1973.

Conjunctivitis is epidemic from January to March, affecting up to 50 per cent of the population. Corneal ulcers and perforations are frequent. Ministry of Health Survey (1970) found 12 per cent of children infected by trachoma.

Tuberculosis incidence rates are the highest for Malawi, especially in Nsanje (224 per 100,000; sputum positive cases only).

Leprosy is found in the area; prevalence is estimated at two to three per cent. Since 1972 a total of 1,168 new cases has been registered.

Health Services before SVADP

The basis of the old health service structure was the District hospital, giving a full scale of health services to anyone living near enough to benefit. Scattered throughout the Districts were small dispensaries and maternity clinics. The service given was purely curative in character and a poor quality. Missions were giving hospital services in general of good quality, but purely curative in character and without any integration with the Government health services.

Preventive health was treated as a separate subject, left to Health Inspectors and a handful of Health Assistants.

Health Services Development under SVADP

The health component of the SVADP is a reflection of the recommendations of the fifteen-year National Health Plan for Malawi. The broad objectives are as follows:

- to provide basic curative and preventive health services to the entire population, at walking distance from their homes.
- to provide a good functioning referral system from less equipped to better equipped and staffed units.
- to provide for the efficient supervision of less trained staff at the smaller units by more highly trained staff based at the larger units.
- to integrate fully the activities of Government, Mission and District Councils in the health field.
- to integrate preventative and curative personnel into an all-round Health Team.

Pattern of Health Units

The Project Development Areas of approximately 50,000 people each form the basis for the health development programme.

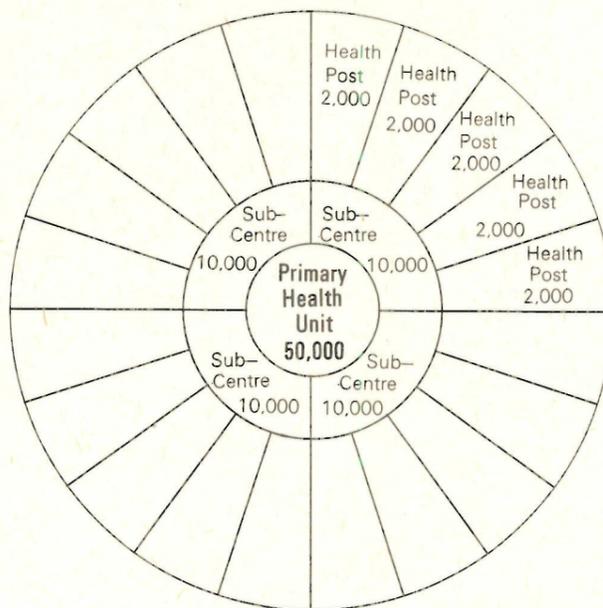
The *Primary Health Centre* is the heart of the health services in each area. It provides a well equipped out-patients department, including laboratory, as well as maternity and inpatient facilities. It has motorised transport and sufficiently highly trained staff to act as referral and supervision unit.

The *Health Sub-Centre* is a smaller unit under the guidance and supervision of the Primary Health Centre and is responsible for about 10,000 people. It consists of a dispensary, maternity and preventive health department. The staff (one Medical Assistant, one Midwife, one Health Assistant, one Health Homecraft Worker) will provide curative services in the mornings and preventive health clinics in the centre and the surrounding health posts in the afternoon.

The *Health Post* is the smallest unit and is the place where the preventive clinic team from Primary Centre or Sub-Centre visits once a week. It is staffed by a Health Homecraft Worker who is trained in health education, nutrition and hygiene. She undertakes routine and follow-up visits in the villages and reports back to the clinic team. Each health post covers about 2,000 people.

Basic Health Services for 50,000 people

MALAWI NATIONAL HEALTH PLAN



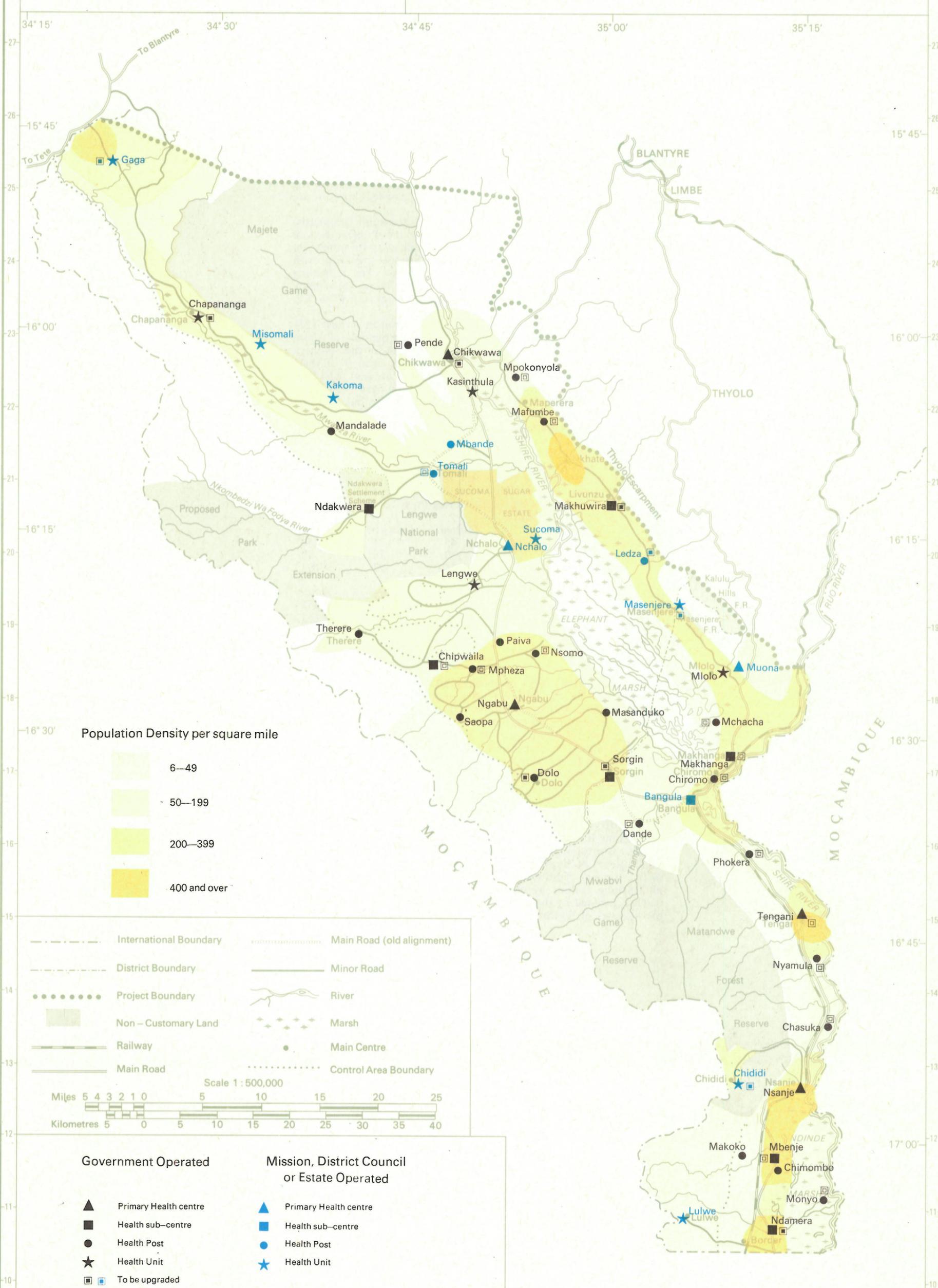
Health Services Development SVADP Phase II

	Pre-Project	SVADP Phase II	End Goal
Primary Health Centre	5	6	6
Sub-Centre	6	13	24
Health Post	—	18	96
Unclassified Small Health Units	10	4	—

References: Lower Shire Nutrition Survey. Ministry of Health, Blantyre, 1970. Agro-Economic Survey (7th Report), Ngabu, Planning Unit, MANR., February 1972.

Shire Valley Agricultural Development Project

HEALTH FACILITIES



EDUCATION

The educational facilities of the area consist of 102 Primary Schools, two Secondary Schools, two Correspondence College Centres and a number of Kwacha Schools concentrating on adult literacy.

The Primary School system is administered at District level by the Local Education Committee. The Chairman of the Education Committee is the Chairman of the District Council and Agencies are represented by their Educational Secretaries. The Secretary of the Committee is the District Education Officer.

The majority of Primary Schools are assisted, which means that they receive grants for teachers' salaries only direct from the Ministry of Education, whereas unassisted schools are entirely self supporting using school fees and funds from other sources.

The District Councils are directly responsible for running the majority of Primary Schools and most unassisted schools are operated by various mission agencies.

Primary schooling involves eight years of education (standards) after which students are eligible to sit for the Primary School Leaving Certificate, which is a necessary qualification for admission to Secondary School. Full Primary (F.P.) Schools are those with standards one to eight; there are 52 in the area. The remaining schools are either Junior Primary (standards 1-5) or Developing Primary (schools which are currently expanding up to F.P. or J.P. status).

Statistics prepared by the Ministry of Education in August 1974 showed a total of 19,076 pupils enrolled at Primary Schools, of whom 74 per cent were boys, compared with 62 per cent for the Southern Region as a whole. The percentage of children aged 6-13 years estimated to be receiving primary education is 33 per cent. The 1966 Population Census showed that of the population aged 5-24 years, 11.8 per cent were attending school in Chikwawa District, and 14.4 per cent were attending in Nsanje District. The maximum rate was for the 10-14 years age group, being 20.9 per cent in Chikwawa and 24.7 per cent in Nsanje. There has clearly been a notable increase in the proportion of children attending Primary Schools since 1966, with an average annual growth rate of enrolment of 3.2 per cent per annum in Chikwawa and 3.8 per cent in Nsanje. This is, however, considerably lower than the growth rate of 10.7 per cent per annum for the Southern Region as a whole.

Number of Primary Schools

<i>1973/74 School Year</i>		<i>Assisted</i>	<i>Unassisted</i>	<i>Total</i>
Chikwawa	.. ..	45	11	56
Nsanje	.. ..	30	16	46
Total	.. ..	75	27	102

Enrolment at Primary Schools

		<i>Boys</i>	<i>Girls</i>	<i>Total</i>
Chikwawa	.. ..	8,003	2,960	10,963
Nsanje	.. ..	6,046	2,067	8,113
Total	.. ..	14,049	5,027	19,076

Kwacha schools were established after Independence and are co-ordinated by the Ministry of Community Development and Social Welfare, with the objective of providing a medium of Adult Literacy Education accessible to ordinary villagers. Community Development Assistants provide advice, but the running of the schools is largely on a self-help basis, with volunteer teachers.

In addition to the above aspects concerned with general formal education, there is an important programme of agricultural education provided by the Project (see Commentary 13).

The two Secondary Schools are part of a national network of District Day Secondary Schools which are administered directly by the Ministry of Education. They were built as part of an ambitious programme to expand secondary education after Independence.

The Correspondence Centres at Nsanje and Ngabu are administered by the Malawi Correspondence College, which is part of the Ministry of Education. Pupils attend on a full-time basis and all teaching is done by post, under the supervision of a qualified teacher assigned by the Local Education Authority and paid for by the Ministry of Education.

Shire Valley Agricultural Development Project

EDUCATION



COMMUNICATIONS

The early importance of the Shire River as a communications artery was eclipsed with the completion of the rail link to Beira in 1935. The original terminus for stern wheel paddle steamers was at Katunga village, near Chikwawa, but as the river began silting up the terminus shifted to Chiromo. That terminus also began to suffer seriously from silting, and the transfer point from river to rail shifted to Nsanje with the extension of the railway line in 1908. The river has been used in recent years by flat bottomed barges carrying molasses from Nchalo—Bangula and sometimes to Sena, and it is now proposed to develop a water-bus service from Nsanje Town to Nkupila, near the Moçambique border. For the fishermen, farmers and traders of the Ndinde Marsh area the river offers their main, and often the only line of communication.

The railway link to Beira was completed in 1935 and from then until the opening of the Nacala rail link in 1971 this line carried virtually all of Malaŵi's imports and exports.

The road system was very limited until Independence and rainy season travel remains difficult even today, but will be radically transformed with the completion of the new bituminized road from Chikwawa to Bangula in 1976. The two access roads from the Shire Highlands are both steep and tortuous (particularly the M9) and difficult to traverse immediately after rains. The existing M8 road crosses several streams which may flood for periods from a few hours to several weeks. In the heavy rains of 1973/74 the road south of Ngabu was impassable to saloon cars for several weeks. The S38 road in the East Bank involves several difficult river crossings and previous attempts to build a drift across the Mwamphanzi river at the northern end have met with failure. This road is closed for much of the rainy season. The existing road from Bangula to Nsanje is also very difficult in the rainy season. The ferry over the Shire River at Chiromo can be a major bottleneck when the river level is high and in early 1974 the ferry was closed for over two months for this reason.

Major achievements since Independence have been the building of Kamuzu bridge across the Shire at Chikwawa, replacing the ferry, and the development of 160 miles (257 kms) of crop extraction roads in the SVADP Phase I area, of which 70 miles (113 kms) are gravelled. These roads have facilitated the movement of cotton to the markets and its extraction to the ginneries.

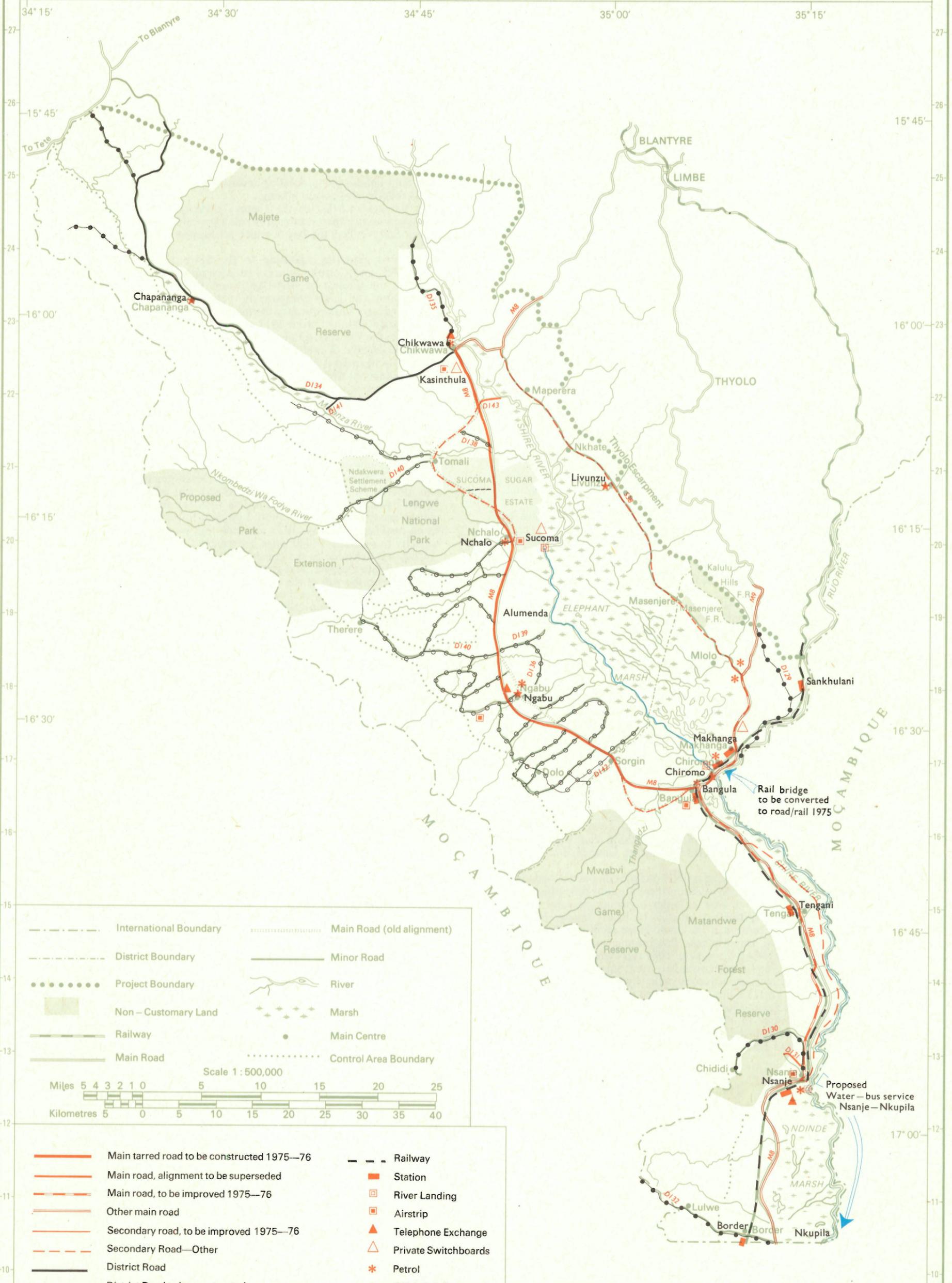
Striking further improvements will be made in the next few years with the completion of the bituminized road from Chikwawa to Bangula, the bridging and culverting of the southern section of the East Bank road, and the re-aligning of the Bangula—Nsanje road. This road will be moved back from its present line along the edge of the Shire River (by which it is occasionally inundated) to follow the alignment of a former main road built in the 1950s. A number of access roads will be provided from this road to population centres along the Shire River. Another major improvement to be effected in 1975 is the conversion of the Chiromo railway bridge to a joint road/rail bridge.

The Project will also put in a number of additional feeder roads, with the main emphasis being on roads into fishing beaches. This should greatly improve the efficiency of fish marketing.

The major roads shown on the accompanying plate are taken from the 1960 1:250,000 series, and they should be regarded as schematic only, since there have been a number of minor alterations to alignments. Minor roads constructed by the Project have never been plotted from aerial photography, and their alignment should be regarded as approximate only.

Shire Valley Agricultural Development Project

COMMUNICATIONS



COMMERCE AND INDUSTRY

Trading Centres

The major service centres in the area are Chikwawa, Nchalo, Ngabu, Chiromo and Nsanje. Nsanje and Chikwawa derive most of their importance from their role as District Headquarters (Bomas), though the status of Nsanje was enhanced by its position on the railway, lying close to the Moçambique border, which made it the most important point of entry into Malawi before air travel became widespread. The importance of Chiromo derives from similar historical factors, since in the early days of the Protectorate it was the end of the steamer route and the terminus of the Shire Highlands Railway before it was extended to Nsanje.

Chiromo however is in a cramped and difficult site on a narrow salient of land between the Ruo and Shire Rivers, and the new pole of development is Bangula which has the advantage of ample space for future development. Bangula is the most important railhead for the valley and in addition to handling cotton into and out of the ginnery it also handles sugar going for export, and up to Blantyre.

Ngabu has always been an important service centre, but its status has been greatly increased by the siting of the SVADP Headquarters complex there. In the wake of this siting came the relocation of the ADMARC divisional office from Bangula, and the opening of a Plant and Vehicle Hire Organisation Workshop for the Lower Shire Valley. The electricity power line to SUCOMA was extended to Ngabu in 1970 at the initiative of the Project. The importance of Ngabu as a service centre derives from its central position in the Lower Shire Valley and its rich hinterland of intensive cotton farming.

Nchalo is undoubtedly the 'boom' town of the Lower Shire and its growth has hitherto been of the spontaneous and somewhat disorganised nature associated with such townships. The source of this boom has been the adjacent sugar estate which has built up a labour force of about 7,000 by the end of 1974 and a total estate population of about 27,000, creating by far the largest centre of non-rural population in the valley.

There are a number of secondary service centres such as Tomali, Sorgin, Livunzu and Nkhate. These comprise about 5-10 large stores, but do not usually include postal or banking facilities or petrol stations. Outside these centres there are few large stores, but there are small canteens and groceries carrying a limited range of essential consumer goods, as well as the ubiquitous grinding mills providing their invaluable service.

Trading centres above a certain minimum size are categorised in four grades (A-D) by the Ministry of Trade, Industry and Tourism, on the basis of certain criteria, including number of valid trading licences and estimated cash turnover. Trading centres have not been depicted by these categories on the accompanying plate however, since the classification is a little out dated; instead they are ranked according to the number of valid trading licences at December, 1974. The total number of licences in Chikwawa District was 258 and in Nsanje District was 221 at end-1974.

District Council Produce Markets are located at a number of places in the two Districts and are generally coincident with the major trading centres. They operate on anything from one to seven days per week and are controlled by District Councils for revenue and health purposes.

There are two banks offering mobile facilities on one to three days per week at seven centres. In addition there are four post offices and five postal agencies in the area. In order to encourage rural savings on a wider scale SVADP has created 12 postal savings facilities at other important centres in the area. These facilities come under the Project's Rural Development Programme, and are physically associated with ADMARC markets. They represent an experimental programme to try and further stimulate rural savings.

A major 66kV power line was constructed by ESCOM to SUCOMA in 1966. In 1970 an 11kV line was extended to Ngabu and a reticulation system installed to Government housing and offices and also to the Trading Centre. In 1974 a new transformer was installed at Chikwawa and a reticulation system installed which included both the Township and Kasinthula Research Station.

Industry

The only large scale processing industries in the Shire Valley are sugar refining and cotton ginning.

In the first quarter of the century when cotton was grown on European estates there were many small privately owned gins in the Lower Shire Valley, the last of which (at Maperera) was demolished in 1972.

The two ginneries operating in the Shire Valley are run by ADMARC and Cotton Ginners Ltd. a company formed in 1972 to combine the interest of ADMARC and British Cotton Growing Association, the latter company having been associated with the cotton industry in the country for many years operating ginneries at Port Herald (Nsanje) from 1911 to 1940 and later at Balaka and Chiromo; the Chiromo ginnery is still held in a state of readiness and would be capable of producing 7,500 bales in a season if the size of the crop warranted it being opened up again.

The ginnery at Mitole which is operated by ADMARC has a bank of 5x80 saw Continental gins and is capable of producing 9,000 bales in a six months season.

The ginnery complex at Bangula which is run by Cotton Ginners Ltd. is comprised of two separate Ginning Factories, one built in 1961 has a bank of 4x80 saw Platt Murray gins and is capable of producing 18,000 bales per season. The other factory at Bangula which was built in 1966 to cater for the anticipated increase in cotton production from the Chikwawa Cotton Development Project has, two modern Platt Lummus Imperial 88 saw gins with a capacity of 18,000 bales. However, to keep in line with any further increase in cotton production, another Platt Lummus Imperial 88 saw gin is being installed and from 1975 onwards this Factory will have the capacity to produce 27,000 bales per season.

Cotton is delivered to the ginneries from the start of marketing in May until late October, and ginning may continue up to December depending on the size of the crop.

The Bangula ginnery is sited on the railway line and it handles all cotton from the Salima Lakeshore, the Balaka area and the Shire Uplands, all of which is delivered to the ginnery by rail.

The Sucoma sugar cane factory is located centrally in the estate area to minimise transport costs. The factory represents an investment of K7.5 million, and is the most important industrial enterprise in the area. Capacity was initially 45 tons of cane per hour and was gradually raised to 110 tons per hour by 1971. Major expansions to the plant in 1974/5 will bring ultimate capacity to 225 tons per hour. The factory works on a 24 hour basis throughout the cane cutting season (April to December).

Sugar for Blantyre-Limbe (about 20,000 tons) is moved by road, whilst for internal distribution north of Blantyre most sugar is moved by rail from Bangula; export sugar is also railed from Bangula. Much of the sugar is transported to Bangula by barge. Molasses are also exported by barge to Moçambique.

A great deal of power is required to operate the factory and in particular to pump water into the main canals and into the fields. In 1966 a 66kV transmission line to the Estate was completed by ESCOM, since when the Estate has been the largest single user of electricity in Malawi. In 1974 30 million units were used at a cost of over K0.5 million.

Plans are being prepared for an alcohol distillery using molasses as basic material, at the factory site. The distillery will meet Malawi's entire internal requirements.

LAND TENURE

The Laws of Malawi divide land into three major legal categories: customary land, public land and private land. There are however various Control Orders and Ordinances which may be applied to customary land, which curtail to varying degrees traditional rights of allocation and utilisation.

Customary Land Laws embrace the traditional concept of village lands as belonging to the community and not the individual. Individuals enjoy rights to cultivate land which they are allocated through the Traditional Authorities, but they do not own the land as such. Land held under customary rights may not be sold or leased and should not be transferred to another individual without the approval of the Traditional Authority's representative. The right to allocate land is vested in certain persons, usually the Village Headman, by the Traditional Authority, and, in the event of a dispute which a Village Headman is unable to resolve, the Traditional Authority is the final arbiter.

Public land embraces a wide range of lands which are occupied, used or acquired by Government. Any land which reverts to or is claimed by Government on the termination or surrender of any freehold or leasehold title becomes public land.

Private land covers all land which is owned, held or occupied under a freehold title, a leasehold title, or a Certificate of Claim which is registered as private land under the Registered Land Act.

If customary land is required for Government or commercial use, a simple sketch plan identifying the land is sent with an application to the District Commissioner for onward transmission to the Commissioner for Lands, after consultation with the Traditional Authority concerned. If the change in status of the land is approved, then persons in occupation at the time are compensated for buildings, standing crops and fruit trees, but not for the land itself, if it is required that they leave the area.

Within the Project Area approximately 63,420 acres (25,666 ha), or 3.75 per cent of the land surface including marsh are non-customary land, i.e. public, freehold or leasehold. This compares with 19.25 per cent for Malawi as a whole, most of which consists of National Parks. However, much of the remaining customary land in the Lower Shire is subject to various controls which restrict customary rights, and, taking these areas into consideration, 53 per cent of the land surface is subject to some form of control.

The major types of land tenure and control are as follows—

Public Land

This is the designation given to land which is acquired for the purposes of the Malawi Government. If an area of Public Land is not utilised, then, it may revert to customary use, but the designation remains the same. The total area of public land in current use in the Lower Shire amount to about 35,000 acres (14,160 ha). The older portion of Lengwe National Park (32,100 acres/12,990 ha) accounts for most of this area. It is open to the public for game viewing, and facilities include a road network and a rest house. The park has recently been extended, but the new area was declared under the Game Act; it is not public land, and is discussed later under 'Game Reserves'.

The Ministry of Agriculture and Natural Resources is responsible for the majority of public land plots in the Lower Shire Valley. In Ngabu, the headquarters of the Shire Valley Agricultural Development Project, these amount to approximately 250 acres (101 ha). At the six Area Centres of Chikwawa, Tomali, Makhanga, Sorgin, Tengani and Nsanje there are plots varying between 20 and 35 acres (8–14 ha). There are also numerous small plots scattered over the Project Area for purposes such as warehousing, cattle dip-tanks and the housing of field staff. In some cases these plots are shared with other Government Departments and adjacent plots are leased by the Agricultural Development and Marketing Corporation.

There are two full Agricultural Research Stations within the Project area. Kasinthula Research Station, near Chikwawa, has an extent of 632 acres (256 ha), of which 250 acres (101 ha) is under smallholder rice production. Makhanga Research Station covers approximately 345 acres (140 ha).

As well as the irrigated rice area within Kasinthula, there are three irrigated schemes; Mlolo (1,117 acres/452 ha), Masenjere Rice (70 acres/28 ha) and Masenjere Cocoa (6.3 acres/2.5 ha), which have non-customary systems of plot allocation administered by elected Allocation Committees.

Public land in the Lower Shire includes two training bases operated by the Malawi Young Pioneers at Kakoma (244 acres/99 ha) and Chikonje (390 acres/158 ha).

Government policy is to declare all administrative centres as Public Land, and this applies to the townships of Chikwawa and Nsanje.

Leasehold Land

Leasing is the primary method used by private individuals or organisations for the securing of land tenure. Land is leased from the Government, the term of the lease being dependent on the amount of existing or proposed development.

The largest occupier of leasehold land in the Lower Shire is the Sugar Corporation of Malawi which, in a series of expansion programmes, has now gained the use of 26,000 acres (10,522 ha) of land at Nchalo for irrigated sugar and sugar refining development.

The Agricultural Development and Marketing Corporation

leases approximately 45 plots throughout the Project area for housing, marketing and office functions—most of these are of no great extent.

The other major occupiers of leasehold land are the various missions operating in the area, which provide schools and hospitals as well as church facilities. The largest of these is Fatima R.C. Mission, which is situated near Mlolo on the East Bank.

To these areas may be added the small leased trading plots to be found mainly in the Chiromo, Nsanje, Chikwawa and Ngabu Trading Centres.

Freehold Land

Most of the freehold land in the Lower Shire lies in the Makhanga area of the East Bank, where rights to several small estates still exist. Certificates of Claim were issued at the turn of the century, covering about 50,000 acres, to several individuals and to large scale agricultural development companies, mostly near Nsanje, along the East Bank and near Chikwawa. Much of this land was held under freehold title until the early 1960's and was then sold at nominal value to Government. The Agricultural Research Station and the Malawi Young Pioneers' base at Makhanga are on land which used to be owned by estate farmers. However, much of the remaining freehold land is neglected, and has been encroached upon by surrounding villages.

At least two of the longer established missions in the Lower Shire have some freehold land, although all mission titles in the recent past have been leasehold. Some trading plots, notably at Bangula are freehold land.

The Malawi Housing Corporation has freehold rights in the administrative centres for the provision of housing as required, consisting of 28 acres (11 ha) in Nsanje and 45 acres (18 ha) in Chikwawa.

Controlled Areas

This designation applies where the desire is to conserve rather than develop the land concerned. Existing users of the land are not required to leave the area in every case, but it is desirable to make a census of population, huts, trees etc. so that, in the event of the land being acquired, compensation is paid only to those entitled.

It is the normal practice to place areas intended for marking out as settlement schemes under a Control Order, before designation as public land when the scheme is completed. This practice avoids the incursion of 'squatters' who would claim compensation when the scheme is developed. However, in the Lower Shire, this is not the case—the Ndakwera Settlement Scheme (8,706 acres/3,523 ha) is still a controlled area several years after establishment. The Gola Young Pioneers' Settlement Scheme near Chapananga (about 1,000 acres/404 ha) which was cleared in 1974, is within the Western Escarpment Controlled Area and was not occupied immediately prior to development.

The increasing population of the Project area imposes a threat on the currently marginal areas of agricultural land on the Western Escarpment. Tree felling, cultivation and clearing of vegetation increases erosion and water run-off in these important catchment areas. In order to prevent this, and the associated cycle of flash flooding and water shortage on low-lying areas, Control Orders have been placed on parts of the Western Escarpment not occupied by game and forest reserves. A total of 361,600 acres (146,340 ha) of the Escarpment are now controlled land, and a similar order has been placed on 10,560 acres (4,273 ha) of land in the Phwadzi River catchment area. In these areas the building of new houses, the opening of new gardens, the lighting of bush fires, and the uncontrolled felling of trees are prohibited.

A Control Order has been placed on the area around Ngabu to prevent squatting, but this will shortly be superseded by the declaration of a Town Planning Area of approximately 7,700 acres (3,100 ha), giving greater powers for positive planning.

Game Reserves

The Department of National Parks and Wildlife and the Department of Forestry occupy land within the area which, in the strictest sense of the word, is customary land. Rights to use this land are granted by virtue of relevant Acts of Parliament, without the basic designation of land being changed.

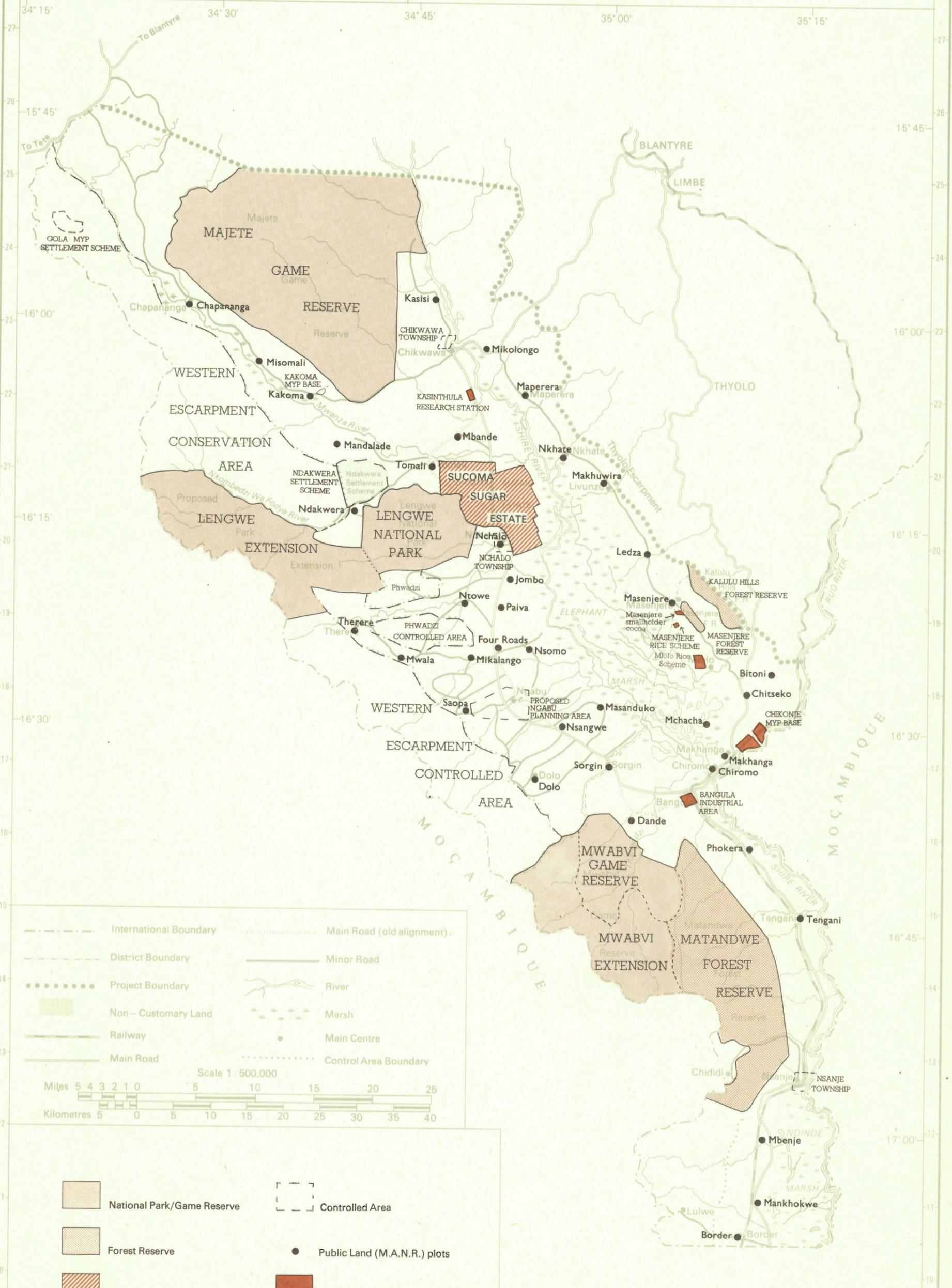
There are two Game Reserves within the Project area which are designated for conservation purposes; they are not, at present, open to the public. The largest is Majete, which covers 192,000 acres (77,700 ha), in the northern part of the area. Mwabvi, which covers 82,000 acres (33,200 ha) lies further south. The figure for Mwabvi includes a recent extension to the Mozambique border to form a game corridor, and a similar extension to the Lengwe National Park, consisting of 61,500 acres (24,900 ha) was arranged at the same time under the Game Act.

Forest Reserves

The Department of Forestry maintains three Forest Reserves in the area, the largest being Matandwe (79,500 acres/32,200 ha) which is adjacent to the Mwabvi Game Reserve. The Kalulu Hills (6,960 acres/2,820 ha) and Masenjere (800 acres/324 ha) Reserves lie close to each other on the East Bank.

Shire Valley Agricultural Development Project

LAND TENURE



N.C.A.E.
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