ECONOMIC AND SOCIOLOGICAL ISSUES IN THE DEVELOPMENT
OF THE LOWER SHIRE VALLEY

The first report of the Socio-Economic Survey of the Lower Shire Valley, prepared by Dr. D.R. Colman and Dr. G.K. Garbett of Manchester University.
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<td>ABS</td>
<td>Agro-Economic Survey.</td>
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<td>APPB</td>
<td>Agricultural Produce Promotion Board.</td>
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<td>BCGA</td>
<td>British Cotton Ginners Association.</td>
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<td>BIRP</td>
<td>British Irrigated Rice Project.</td>
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<td>CCDP</td>
<td>Chikwawa Cotton Development Project (now the SVADP).</td>
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<td>CDC</td>
<td>Commonwealth Development Corporation.</td>
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<tr>
<td>CRLDP</td>
<td>Central Region Lakeshore Development Project.</td>
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<td>EDP</td>
<td>Economic Planning Division in the Office of the President and Cabinet.</td>
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<td>FMB</td>
<td>Farmer’s Marketing Board.</td>
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<td>GCE</td>
<td>General Certificate of Education.</td>
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<td>ISA</td>
<td>International Sugar Agreement.</td>
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<td>LSV</td>
<td>Lower Shire Valley.</td>
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<td>MANR</td>
<td>Ministry of Agriculture and Natural Resources.</td>
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<tr>
<td>MCE</td>
<td>Malawi Certificate of Education.</td>
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<td>NSSA</td>
<td>National Sample Survey of Agriculture.</td>
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<td>SASH</td>
<td>Sample Survey of Agricultural Smallholders.</td>
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<td>SOLV</td>
<td>Socio-Economic Survey of the Lower Shire Valley.</td>
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<td>SUCOMA</td>
<td>Sugar Corporation of Malawi.</td>
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<td>SVADP</td>
<td>Shire Valley Agricultural Development Project.</td>
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CHAPTER ONE

INTRODUCTION

1.1 Aims and Objectives

The Survey was established in response to a request from the Malawi Government to the Overseas Development Administration for a Technical Assistance team to study economic and sociological aspects of the recent development history of the Lower Shire Valley in Malawi. The general objective as stated in the submission to O.D.A. was "to examine the impact both social and economic of the on-going projects as well as those in preparation on the livelihood of the people and the economy of the country as a whole". It was also anticipated that pursuit of this aim would involve "focussing attention on small-holder capabilities, labour supply responses to wage employment, future infrastructural support services, types of marketing organisation and incentives required for accelerating the development of the Valley".

More specific objectives were laid down in an earlier statement of the terms of reference for the Survey. These include that, "the analysis should start with an examination of the various planned investments in the Valley both by the public and private sectors - in particular the examination should compare the direct returns to investment in rainfed and in irrigated cropping regimes". In a similar vein it was suggested that the Survey should effect a "comparison between the final results of achieving a given output objective by unitary estates or by groups of smallholders. The question is of course closely related to the question of optimal balance between dryland and irrigated farming".

In addition to the explicit aims stated above the Survey team received the firm impression that the methodology of the Survey was expected to include the collection of new data by first-hand interviews and its subsequent analysis. Data collected in this manner was expected to fulfill a vital function in planning exercises in the Lower Shire Valley.

Within this very broad research horizon sketched out by the Malawi Government representatives a research program was drawn up to take into account the time allotted to the Survey (12 months) and also the manpower available for its execution.

A considerable proportion of the available resources have been employed in an extensive Survey of households which has been designed to
serve multiple objectives. These include:

a) examination of the structure and economics of smallholder agriculture,

b) calculation of the rate of population growth,

c) investigation of the present and past patterns of population migration within the area,

d) determining the factors governing participation in both local and overseas wage employment,

e) establishing the existence of and determining the types of changes occurring in the structure of society,

and

f) examining the sources of income and patterns of expenditure.

As the Survey progressed it became apparent that there were important issues such as the incidence of double-cropping systems, and local agricultural wage rates for different tasks about which comparatively few data were available. Since the manpower situation in the villages permitted data to be collected on these and other originally unanticipated questions it was decided so to do.

In order to obtain a better understanding of the long-term forces operating upon the population an attempt has been made to compile a brief history of recent social and economic events. This has been conducted by examining archival and other relevant materials.

A good deal of attention has been focussed on obtaining an understanding of the economics of crop production in the area. In particular consideration has been given to those crops which are the subject of development policies, namely cotton, sugar, rice and maize. The treatment of these crops has been somewhat uneven however, but this reflects the availability of data.

Bearing in mind the injunction in the Terms of Reference to compare the economics of estate versus smallholder and irrigated versus rainfed agriculture, an effort has been made on the one hand to conduct an examination of the impact of Phase 1 of the Chikwawa Cotton Development Project; on the other hand an attempt has been made to examine the choice between smallholder and estate grown sugar although data limitations on this part of the exercise have been quite acute.

In response to the requirement that the Survey should explore the question of producer motivation and response to incentives, a study of agricultural prices and their influence has been undertaken. This has centred on the relationship between cotton supply and cotton prices but
also includes a review of other material relating to the role of agricultural prices in Malawian agriculture.

The Survey was also asked to consider the alleged shortage of labour for wage employment, particularly for cane-cutting at Sucoma. The study of labour migrants and of persons engaged in local wage employment is envisaged as shedding some light on this issue. In addition, however, it was decided to undertake a small Survey of members of the labour force of Sucoma with the objective of establishing the characteristics of people who proffer their services for wage employment.

1.2. Structure of this Report.

This report is envisaged as being the first and main part of the discussion of our Survey. It thus contains coverage of all the analysis of secondary data (that previously collected by others) and of some of the major sets of primary data collected by SOLV. Areas of primary data not reported upon here include female fertility and child mortality, family movements, assets (wealth), wage rates for agricultural employment, family income and expenditure and data from one or two minor surveys. It is not considered that these omissions will affect the main conclusions of the survey, but that the results of analysing them will support the views expressed below. Potentially the most critical omission is that of the analysis of female fertility and child mortality as this would provide independent and possibly more reliable estimates of the natural rate of population growth than those presented in this Report. It is hoped that the results of analysing these and other data will be presented in a second report, which is envisaged as containing a mass of useful statistical information with the minimum necessary amount of commentary. Hence it is the present report which presents the main conclusions of the Survey.

The Report opens in Chapter 2 with a brief summary of our conclusions, a fuller version of which is presented in Chapter 13.

Chapter 3 starts the main body of the Report with a short review of some historical events which have shaped the present patterns of agriculture and general economic activity in the Lower Shire Valley. This is followed by a detailed examination of the economics of producing cotton, maize, rice and groundnuts, the principal rainfed crops grown in the area.

Chapter 5 then presents an analysis of the role of crop prices in controlling crop production and the supply of effort to agriculture. The main emphasis here is on the relationship between cotton supply and prices.
Following this partial examination of the determinants of cotton supply two separate attempts are made in Chapter 6 to calculate the additional cotton production resulting from the inauguration of the Chikwawa Cotton Development Project in 1968. This concern with cotton is pursued into the next chapter, on agricultural subsidies, with an analysis of the economics of the free cotton seed subsidy.

In Chapter 8 attention switches to the other major cash crop in the Lower Shire Valley, sugar. The economics of this crop are examined from the points of view of the Malawi economy, Sucona, and potential smallholder growers. As a corollary Chapter 8 also raises the issue of what might be the appropriate principles for compensating smallholders for land taken over for such estate enterprises as Sucona.

The next two chapters present survey results concerning population growth, labour migration, and employment. The first of these, Chapter 9, is primarily concerned with the levels and patterns of circulatory migration in search of off-farm employment plus details of local non-farm employment. Subsequently Chapter 10 presents estimates of the rate of population growth in the various parts of the Lower Shire Valley and for the whole area. These are accompanied by survey results indicating the way in which population pressure has caused a reduction in the area of arable land per person. In continuation of this exploration of relationships between the population and the land Chapter 11 examines the systems of land tenure found in the area, while Chapter 12 presents detailed information about the main land use systems found in the Valley.

Finally, drawing upon all the material presented in earlier chapters, Chapter 13 presents a summary of the major conclusions and derives from these what seem to us to be the implications for development planning in the Lower Shire Valley.
CHAPTER TWO
SUMMARY OF CONCLUSIONS

The majority of the population of the Lower Shire Valley is likely to be largely dependent upon smallholder agriculture for its livelihood for the foreseeable future. As a consequence it will be necessary to develop an agricultural system which is a) viable on the ever diminishing size of average holding which is resulting from the increased population, and b) stable in circumstances where rainfed agriculture is seen to be very risky as a consequence of erratic and inadequate rainfall.

In view of the presence of ample water in the Shire Valley, the intensive cultivation practiced by the locals in areas with good water supplies, and also of the success of irrigated development in the area it is suggested that a system of smallholder agriculture which is based on subsurface water exploitation or irrigation is the one best suited to meeting the requirements of the situation. Such a scheme could provide a highly intensive and stable agricultural system which would promote a high level of rural employment.

In the past there has been reluctance to implement smallholder irrigation schemes on the large scale sometimes proposed for the Lower Shire Valley. There have been good reasons for this caution, although it seems probable that large-scale irrigation is ultimately inevitable. It does not however appear that irrigation and water control schemes require large scale for economic viability. Social viability may be favoured by small-scale development. Small schemes also promise to be both economically and technically viable.

The Valley contains two great marsh areas, the Elephant and Ndinde marshes, both of which have within them patches of land which are intensively cultivated in addition to other areas of considerable arable potential. Water is always nearby in these marshes and it would appear to us as non-engineers that there must be a fair amount of land in blocks larger than, say, 100 acres which could be "reclaimed", or otherwise made into small blocks with continuous subsurface or surface water supplies, without the need for sophisticated and costly engineering; some of these areas would be of currently uncultivated land. The potential sites for such development are mainly situated in Nsanje, the district where population pressure on the land is most intense, which increases the potential social benefits of adopting this strategy.
There are at least two high valued crops which would fit into such a scheme of piecemeal "irrigated" development. One of these is cocoa. The other is sugar in the area close to SUOMA's Nchalo refinery, or in other areas if the small-scale sugar refining technology mentioned in Chapter 13 proves to be suitable. Such high valued crops may not be essential if it does in fact prove possible at low capital cost per acre to increase the area of land with continuous water supplies. It would then be possible to obtain adequate returns from lower valued crops than cocoa and sugar; irrigated cotton or even staple food crop production would be economically feasible in these circumstances. No doubt research will continue to seek crops which can extend the feasible range of choice in irrigated agriculture.

In proposing an increased emphasis upon water control and irrigation it is not suggested that there be abandonment of the efforts to improve dry land farming, but it is felt that the returns to investment will be higher in "irrigated" than in rainfed agriculture. There are areas where improvement in agricultural water supplies is not immediately possible including most of Chikwawa, and much of the population will have to rely on dryland farming. Improved standards of husbandry in rainfed agriculture are therefore essential, and the current efforts in this direction appear to be the most suitable possibly augmented by moves to improve livestock production based upon the newly identified fodder crops.

Intensification of arable production in the Elephant and Ndinde marshes as proposed may well conflict with aspects of the programme to expand the Lower Shire Fishery, especially those aspects concerned with expanding the body of water in the fishery. Unfortunately this Survey has not included an examination of fish production in the area, and it is not therefore possible to assess the benefits of agricultural expansion in the marshes in terms of fish production foregone. Clearly there may be such a tradeoff in developing water controlled agriculture, and an assessment of it should be included in what would seem a highly desirable study, that of the productive potential of the marshes and of the current productive activities undertaken within them.

The process of national economic development involves a steady expansion in non-agricultural employment and is usually accompanied by unwanted drift of population to urban areas. It would therefore benefit Malawi to intensify efforts to stimulate craft and other small industries in rural areas. Evidence from this Survey indicates that in the Lower Shire
Valley a large number of individuals are already engaged in craft and non-agricultural employment, many on a part-time basis. This demonstrates an entrepreneurial spirit and willingness to adapt which, if actively fostered through training and incentive schemes, could contribute to rural welfare and national employment, as well as reducing urban drift. Small-scale craft industries such as pottery and carpentry are likely to generate more employment than modern urban industry producing similar articles.

Examination of the issue of producer incentives has led to the conclusion that the role of producer prices in causing changes in production has been underestimated. It is felt that far more attention should be given to the effects of ADMARC's pricing policy, and that every effort should be made to improve the incentives farmers are offered for innovation and hard work. Prices paid to growers give the appearance of being arrived at by a rather ad hoc process which reconciles the interests of some but perhaps not all concerned parties. It is, of course, possible that these processes are not ad hoc but are tightly regulated by a formal set of rules. If this is so the unpublicised nature of these rules makes rational examination of the process of setting of producer prices virtually impossible. If, as seems likely however, no such set of formal rules exists there would be appreciable gains from establishing some, as this would permit scientific investigation of the costs and benefits of alternative rules concerning crop taxation or price and income stabilisation.

In the interim two specific changes are suggested in connection with the pricing policy for cotton. In view of the apparent strength of producer response to cotton returns it is suggested that a late upward revision of producer prices be made in years when it appears that cotton yields and possibly quality are expected to be poor. It is also suggested that charges should be introduced for cotton seed and that it should no longer be provided free to farmers. It is demonstrable that everyone including farmers can benefit from this change of policy.
CHAPTER THREE

MAJOR THEMES IN THE SOCIO-ECONOMIC HISTORY OF THE LOWER SHIRE VALLEY:

1914 - 1960

In the socio-economic history of the Lower Shire Valley there are a number of recurrent themes. It would not be appropriate here to discuss all of them, but two major themes are relevant to an understanding of the issues discussed in later chapters: one concerns the changing relationship between the population and the physical resources of the environment, notably land and water; the other, the effects of the introduction of cotton as a cash crop. The two themes are in large measure interrelated and a consideration of them will enable current development policies to be viewed in their historical perspective.

3.1 Land, Water and Population

The Lower Shire Valley is a harsh environment. Temperatures are high and rainfall is erratic in its temporal and spatial incidence with the possibilities of moderate to severe drought occurring on average about once every five years. Thus rainfed agriculture has always been associated with considerable risks. To minimise these risks and to exploit the most fertile soils, the population at the turn of the century was largely concentrated along the banks of the Shire river, particularly in and around the Elephant and Ndinde Marshes. Here perennial water was available and high water table land, periodically replenished with silt, provided rich soils which could be permanently cultivated to provide a dry-season crop. On the edges of the Marshes, two crops a year could be obtained. Away from the river, except around a few large tributaries of the Shire, where similar conditions obtained, the land was largely unoccupied and much of it consisted of forest.* Adjacent to the marshes the forest was exploited to provide rainfed crops. Here, gardens were cultivated for about six years until their fertility was exhausted and then new gardens were made and the old allowed to revert to bush. The cycle from virgin forest to regenerated bush probably took 30 years. Morgan † has estimated that the bush-crop-bush cycle could be maintained.

* General descriptions of the topography together with population distributions and maps are given in the West Shire District Book, 1904-06, NSC 3/2/1, and in the Ruu District Book, 1907.
in perpetuity without soil degradation with a density of 105 persons per square mile. He does not, however, take into account the permanent cultivation of high water table land which would have considerably increased the carrying capacity, possibly to 150 persons per square mile.

A system of agriculture thus developed which exploited the two types of land resources. Both types were necessary to maintain adequate subsistence since, whilst the high water table land was capable of permanent exploitation, the annual flooding of the marshes was variable in its extent and duration. In years when flooding was extensive and prolonged, a greater input was required on rainfed land. Conversely, when rainfall was slight, the marsh lands could be more fully exploited. The disastrous combination of high floods and low rainfall seems to have been a very rare occurrence.

The extent of the flooding of the marshes depended on three factors: the long-term cycle in the river level which in turn was related to the cycle in the level of Lake Malawi,* the rainfall in the basin of the Shire itself, and the behaviour of the Zambezi which, from time to time, caused "ponding back" in the lower reaches of the Shire, preventing the Marshes from drying out. From about 1890 to 1920 the dry season level of the river fell and large areas of the two marshes dried out and were available for cultivation.†

3.2 Cotton and the Distribution of Population

In the period from 1914 to 1935 two factors operated to radically affect the operation of the agricultural system which has been described. One was the rapid expansion of cotton production and the other, the relatively rapid increase in the population and its concentration in certain areas. These factors operated to intensify the destruction of the forest for rainfed agriculture and they are, to a degree, causally related.

The commercial production of cotton developed quite slowly but began to expand rapidly from 1920 to 1930 despite considerable fluctuations. In 1935, a record year, 3772 tons of seed cotton, valued at £35,672 were produced in what is now the Nsanje District‡ and from 1925 the value of

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* NSC 1/14/1, F. Debenham, "The Water Resources of Central Africa", Geographical Journal, CXI, 1948; FWD to Chief Sec. NS. 1/14/1; Memo to Chief Sec., 22/3/35, NS 1/14/1.
† See Ruio District Book, 1907, p. 212, for dry season river readings from 1907 to 1921.
‡ Lower Shire District Book, 1933-37.
the crop did not fall below £20,000. In the Chikwawa District production rose more slowly from 454 tons in 1925 to 2417 tons in 1930 valued at £29,205.* Some of the cotton, particularly in Chikwawa, was grown as a rainfed crop, but most was grown as a late planted crop on high water table land. With the expansion of the crop, more of the high water table land was given over to its production and more rainfed land was exploited for food production. The main centres of production were in and around the Ndinde Marsh and in the Elephant Marsh, south of Masenjere. These areas attracted considerable populations. From a population distribution map of the Lower Shire District prepared in 1935, † it would appear that an estimated 25,000 people were living in the Ndinde marsh with about 7000 around its edge. In the Elephant Marsh, south of Masenjere about 4000 people were living with about 6000 around its edge. From a census conducted in the Lower Shire District in 1921 ‡ it would appear that the total population of the District was in the region of 39,400. Of the adult population about 44 percent appear to have been immigrants mostly from Mozambique and from the Zambezi Valley. A similar census for the Ruo District conducted in 1923 § shows that the adult population about 48 percent were also immigrants from the same areas. Part of this immigration had occurred in 1917 after the suppression of the Barwe rising in Mozambique but immigration continued through the twenties and accelerated particularly after the stabilization of cotton prices in 1923. This continuing influx of people together with the higher rate of increase of the local population, began to cause pressure on the land resources. Already by 1930 there are firm indications in the administrative records that pressure on the land was apparent. † From 1919 onwards Chiefs and Headmen became particularly sensitive to the alienation of land to private estates. Food shortages became increasingly frequent whilst the destruction of the forest to provide rainfed gardens continued rapidly. In 1925 and 1931 several ordinances were passed to control the cutting of timber and to prevent people cultivating marginal land. Attempts were also made to encourage reafforestation by the

* Chikwawa District Book, 1928-32, NSC 3/2/5.
† Lower Shire District Book, 1907, p. 263.
‡ Lower Shire District Book, Vol. 1, 1907.
establishment of Village Forest Reserves in 1931 and by the planting of shade trees.* In 1929 the District Commissioner of the Lower Shire District issued an order prohibiting immigration from Mozambique unless immigrants possessed a visa. All immigrants were to pay tax.† Judging from later accounts ‡ this order appears to have had only a marginal effect on immigration. Nonetheless, it reflects the growing concern of the administration at the pressure of population on the land.

In 1929 the administration took steps to encourage the resettlement of people in Chikwawa District to "relieve the congestion in the South".§ In 1932 in Chief Ngabu's area 24 wells were sunk by the Geological Department.¶ However, these attempts to encourage resettlement met with little initial success as the Mang'anja Headmen stated that they did not wish to move from their villages.

3.3 Population Pressure on the Land

The increase in population in the southern part of the Valley together with the production of cotton on high water table land formerly used for the production of a food crop, had created, by the mid thirties, a situation in which pressure on the rainfed land was becoming particularly acute. Rice, originally grown in large quantities in and around the Ndinde marsh had given way in many areas to cotton.¶ Pressure on the food supply was already beginning to be felt and increasingly heavy reliance was coming to be placed on the cotton crop to obtain cash to purchase food. Frequently people obtained food and other goods from Asian traders on credit which they paid off with the next season's crop.¶ A considerable amount of food was imported into the area from the Chikwawa District.¶

In addition, considerable numbers of young men began to migrate to seek wage labour in S. Africa and S. Rhodesia. Census figures for the Ruo District for 1921 and for the Lower Shire District for 1923 suggest

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† Administrative Order 11/12/29; District Council Minute 22/3/29.
‡ District Council Minute 17/1/33.
§ District Council Minute 22/3/29.
φ Lower Shire District Book, 1907.
¶ District Council Minute 5/10/35.
that the Labour Migration rate for adult males aged 15 and over was of
the order of 13 percent. The rate appeared to stay at that level until
the outbreak of the Second World War when it fell slightly to 11 percent.*
From the census estimates for 1938 and 1939 it is clear that the
labour migration rate varied from area to area in response to population
pressure and the availability of local economic opportunities. The
highest rates (up to 23 percent) were experienced in the densely settled
areas south of Nsanje whilst on the more prosperous East Bank, in what
is today T.A. Mlolo's area, the rate appears to have been only between
5 and 7 percent.

3.4 The Price of Cotton

It is hardly surprising, given the situation which had now developed
in which the food crop was coming under pressure and cotton had come to
be of such major significance to the local economy, that growers should
have been acutely conscious of its price. As Pearson and Mitchell†
demonstrated the production of cotton through the twenties and thirties
varied directly with the price paid the previous season. Channock‡ has
set out in some detail the measures the Colonial Government introduced
in an attempt to stabilise the price of cotton. These worked tolerably
well through the twenties and growers welcomed and appreciated them.§
But the arrangements did not protect growers from the slump. From 1928
until the early forties, at almost every District Council meeting in
both Districts vociferous complaints were made about cotton prices and
the difficulties of paying taxes and meeting cash needs in the face of
steeply rising prices.¶ An attempt to reorganize the marketing of cotton
in 1938 appears to have had little success and initially led to considerable

* Lower Shire District Book, 1938-42, Vol. VI. The actual rate was
probably somewhat higher since the rate has been computed from an
estimate of male taxpayers who were working outside Malawi.
† E.O. Pearson and B.L. Mitchell, A report on the status and control of
insect pests of cotton in the Lower River Districts of Nyasaland,
§ Chikwawa District Book 1923-28, District Council Minutes 24/12/24,
NSC 3/2/4.
¶ See District Council Minutes in the Lower Shire, and Chikwawa District
Books from 1928 to 1942.
protest and to a marked fall in cotton sales.* In response to the low
cotton price growers appear to have smuggled large quantities of first
grade cotton over the border into Mozambique to take advantage of the
higher price paid there. † In retaliation, cotton buyers closed markets
early or refused to buy inferior grades.

3.5 The Flooding of the Marshes

In the midst of these difficulties a disaster of considerable
proportions overtook cotton production in the Valley. The effects were
felt in both the north and the south but they were most severe in the
south. The level of the Shire had been rising steadily through the
twenties but the topography of the marshes was such that this went
largely unnoticed until 1936. In 1936 the marshes were flooded and year
by year the flooding became more severe reaching its maximum intensity
in 1939. Large parts of the Ndinde and Elephant Marshes became perma-
nently flooded. In addition flooding of the marsh edges became more
prolonged and the area of the marshes was extended. In parts of the
south of what is now Nsanje District the marsh extended westwards over
a distance of five miles leaving only a strip a mile to a mile and a
half wide for cultivation. ‡ A number of roads and two cotton markets,
Munga and Lalanje, were inundated. § In 1937 an estimated 47 percent of
high water table land was taken out of production and by 1939, 120,000
acres were estimated to be permanently flooded. † It is difficult to
get accurate estimates of the number of people affected. Working from
the population distribution map given in the Lower Shire District Book
for 1933 it seems likely that some 4000 people were directly affected in
the Elephant Marsh, south of Masenjere, and at least 20,000 people in
the Ndinde Marsh.

This cataclysmic event immediately disrupted the system of agri-
culture which had developed centred upon cotton as a late-planted, dry
season crop. Between 1931 and 1945 an estimated 14,600 people left the

* District Commissioner, Chikwawa to Provincial Commissioner, Blantyre,
  7/7/38. NSC 1/2/1.
† District Commissioner, Port Herald to Provincial Commissioner, Blantyre,
  10/12/38. NS/16.
‡ Soil Conservation Officer, Chikwawa to Director of Agriculture. 4/8/43,
  24/4. 2/17/74. /880
§ Lower Shire District Book 1933-37, p. 138 and 1938-42, p. 154; Provincial
  Agricultural Officer to Provincial Commissioner, Blantyre, NS1/7/1.
† Memo., Department of Agriculture, 18/7/41. 24/4, 2/2/17F, /880
south, many of them migrating into Chikwawa, particularly to T.A. Ngabu's area, where more wells were sunk by the Geological Department.* In the same period the population of Chikwawa District is estimated to have increased by 23,700. Much of the influx into Chikwawa from the south occurred in 1938 and 1939.†

In the south after the flooding, people attempted to grow cotton as a rainfed crop and for a number of years some production was maintained. However, with the high water table land taken out of production, much larger areas of the less productive low water table land was required to produce both a rainfed food crop and cotton. In an attempt to maximise production on limited land resources cotton was increasingly interplanted with maize and millet.¶ The light soils of the south, however, could not stand intensive cropping and were unsuitable for cotton. Furthermore, the incidence of red bollworm attacks increased due to the long term pupae no longer being drowned by the floods. Under pressure of population garden areas decreased in size and much marginal land was brought under cultivation.§ By 1943 the south of what is now Nsanje District had become a depressed area with food in short supply and extensive soil degradation and erosion evident.¶ What high water table land remained available was then planted extensively to such high yielding crops as sweet and Irish potatoes.

3.6 The End of Late-Planted Cotton

It is possible that cotton production in the south could have been in part restored. By the mid forties the level of the Shire had begun to fall and some high water table land became available. However, cotton production in Chikwawa District, particularly in T.A. Ngabu's area had become firmly established as an early planted rainfed crop. Much of the cotton was grown by people who had migrated from what is now Nsanje District. At first, because much new land was brought under cotton each

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* W. B. Morgan, op. cit., p. 461.
¶ Memo. 6/7/44. 24/4, 2/12/17F, /880
§ W. B. Morgan, op. cit., p. 463.
/ Soil Conservation Officer, Chikwawa to Director of Agriculture, 4/8/43. 24/4, 2/17/74, /880
/ Provincial Commissioner, Blantyre to Director of Agriculture, 24/9/43. 24/4, 2/17/74, /880
/ Senior Agricultural Officer to Director of Agriculture, 8/10/43. 24/4, 2/17/4, /880
year, yields were high and for a time, until 1957, the incidence of red bollworm was also low.* Elsewhere in Chikwawa and Nsanje Districts the red bollworm became a severe threat to the rainfed crop. In Nsanje District because of the unsuitable soils, the high incidence of red bollworm and its proximity to sources of bollworm infestation from Mozambique, the Colonial Government was of the firm opinion that cotton growing should be actively discouraged there. † Furthermore, after the extensive research of Pearson and Mitchell in the forties into the control of cotton insect pests, it was eventually decided, in 1951, to move the uprooting date for cotton from the end of October to the end of July. ‡ This was put into effect by paying compensation to growers of late planted cotton according to the weight of unripened bolls remaining at the new uprooting date. This aided the rapid adoption of the new uprooting date. § However, this action effectively ruled out the possibility of cotton being grown again as a late-planted, dry-season crop on high water table land. Cotton production in the Nsanje District declined to virtually nothing.

Cotton Production in the Fifties

Cotton production through the fifties expanded rapidly in the Chikwawa District and by 1960 had reached 11,000 tons. As had happened previously in the south, growers came to rely heavily on the crop to provide them with cash not only for goods but also for food. ‡ Many pledged their next season's crop for credit at Asian stores. The area became a heavy net importer of food. Large areas of forest were destroyed and much of the area came to rely on a system of agriculture using only a short-term fallow. In some areas erosion began to become a problem and some marginal land was brought into production. Reading through the records one is struck by the many similarities between this period and the earlier period of cotton growing in the Nsanje District, particularly in the way in which cotton came to displace the food crop. Because it was more drought resistant than the grain staples the risks of failure

* Agricultural Officer, Chikwawa to Senior Agricultural Officer, Blantyre. 17/11/47. Memo. from E. O. Pearson, 17/6/57.
† Minutes of Meeting on Red Bollworm Control. 17/5/50.
‡ Executive Council Minute, 1951. 1/7/7R, 10735
§ Director of Agriculture to Provincial Agricultural Officer, Blantyre. 208/51.
ƒ Monthly Reports, Agricultural Supervisor Chikwawa to Provincial Agricultural Officer, Blantyre, 1960-62. 1/7/17F /10737.
were less, but when failure did occur the consequences were very serious indeed. Just as in the past people were acutely conscious of the price of cotton and production responded closely to the price paid the previous season.*

Much thought was given to the future of agriculture in the Valley through the fifties and numerous schemes, some fanciful† others more soundly based, were put forward. All hinged on some form of water control either through irrigation or through the control of the marsh floods. Extensive conservation works were instituted in Nsanje District in an attempt control erosion and to prevent flooding. Throughout the Valley increasing attempts were made to introduce improved farming practices. However, all these matters were overshadowed by political events, rooted in the foundation of the Federation, occuring in a much wider arena. These had their local repercussions in extensive resistance to conservation and extension measures instituted or recommended by officers of the Colonial Government. It was not until 1963, with Independence, that the whole strategy of development in the Lower Shire Valley could begin to be rethought in a calmer and more constructive atmosphere.

* Agricultural Supervisor, Chikwawa to Provincial Agricultural Officer, Blantyre, 1/3/60. See also chapter 5.
† Agricultural Officer, Thyolo to the Senior Agricultural Officer, Blantyre. 28/7/49. 24/4, 2/17/7F /880
CHAPTER FOUR
RETURNS TO LAND AND LABOUR IN RAINFOD AGRICULTURE

4.1 Introduction

Economic theory demonstrates that in order to maximise profits farmers must maximise returns to the scarcest of the resources under their control. In Lower Shire Agriculture the only controllable resources of any significance are land and labour.

If land is scarce and labour plentiful (that is, cheap) farmers will be expected to intensify production on the land so as to maximise returns per acre. In so doing they will produce crops requiring a high labour input, and will operate at levels where the last day of labour used contributes only a low value of additional output (marginal value product). Theoretically, labour will be employed up to the level where its marginal value product equals the cost of its hire, which in this case is low.

If the situation is reversed so that labour is scarce (expensive) and land relatively plentiful then one would expect to find less labour intensive forms of production. The value of output will be at a comparatively low level per acre, but the last day of labour employed per acre will have a high marginal value product.

The relevance and importance of these theoretical remarks is very well illuminated by the recent experience of the Central Region Lakeshore Development Project. At its inception the Project intended to develop rainfed agriculture in the Lakeshore area mainly through the development of sprayed cotton production. After the start of the Project a new crop was introduced into the area. This was the Mani Pintar groundnut which ADMARC are prepared to buy unshelled for oil extraction. The financial returns per acre from cotton are higher than for Mani Pintar at comparable yield levels. However the labour requirement per acre of groundnuts is substantially less than for sprayed cotton, as a consequence of which the returns per man-day of labour are much larger for Mani Pintar than for cotton.* According to the theory in situations of labour shortage it would be expected that farmers would concentrate on the crop giving the highest returns to labour. The Salima area does in fact appear to be one of labour shortage, and hence it is not surprising that there has

* From data for the 1971/72 season prepared by the Central Region Lakeshore Development Project.
been a large expansion in Mani Pintar production at the expense of cotton.

The question of whether the Lower Shire Valley has a land or labour shortage cannot be answered in a simple yes or no way. There are parts of the region such as most of Nsanje, southern Nyabu and most of the East Bank areas where pressure on the land is high and where by assumption labour is fairly plentiful. However not all families within these areas will have a shortage of land. Some families who have exported labour from the region may have a comparative abundance of land as also may small families and elderly people with a low work capacity.

Other areas of the Lower Shire such as North Chikwawa and the northern part of South Chikwawa still appear to have spare land, and the pressure for adopting labour intensive systems of agriculture does not appear particularly high at present.

In view of these remarks it is considered worthwhile attempting to estimate the returns per acre and per labour-day for the major rainfed crops grown in the Lower Shire Valley, and to see if these estimates, allied to the economic theory of resource allocation, can help explain various aspects of the crop production pattern in the area.

4.2 Margins per Acre and per Labour Day for Rainfed Crops

The processes and assumptions employed in calculating margins and labour requirements per acre are fully set out in Appendix II.

Only five crops are considered. These are sprayed cotton, unsprayed cotton, maize, rainfed rice and groundnuts. Other crops such as pigeon peas and sweet potatoes have a central place in the cropping system of certain parts of the region but there seems to be insufficient data to permit them to be examined along with the other crops.

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*All margins are calculated at 1973 ADMARC prices.*
Table 4.A: Continued

**Unsprayed Cotton**

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**Maize for Sale**

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**Maize for Subsistence**

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<td>Labour per acre (days)</td>
<td>132</td>
<td>141</td>
<td>150</td>
<td>159</td>
</tr>
<tr>
<td>Margin per labour-day (t)</td>
<td>38</td>
<td>47</td>
<td>55</td>
<td>62</td>
</tr>
</tbody>
</table>

**Chalimba Groundnuts (Shelled)**

<table>
<thead>
<tr>
<th></th>
<th>600</th>
<th>800</th>
<th>1,000</th>
<th>1,200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (Unshelled weight)(lbs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Margin per acre (K)</td>
<td>25.35</td>
<td>33.80</td>
<td>42.25</td>
<td>50.70</td>
</tr>
<tr>
<td>Labour per acre (days)</td>
<td>83</td>
<td>91</td>
<td>99</td>
<td>108</td>
</tr>
<tr>
<td>Margin per labour-day (t)</td>
<td>31</td>
<td>37</td>
<td>43</td>
<td>47</td>
</tr>
</tbody>
</table>

**Malimba Groundnuts (Shelled)**

<table>
<thead>
<tr>
<th></th>
<th>600</th>
<th>800</th>
<th>1,000</th>
<th>1,200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (Unshelled weight)(lbs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Margin per acre (K)</td>
<td>19.50</td>
<td>26.00</td>
<td>32.50</td>
<td>39.00</td>
</tr>
<tr>
<td>Labour per acre (days)</td>
<td>83</td>
<td>91</td>
<td>99</td>
<td>108</td>
</tr>
<tr>
<td>Margin per labour-day (t)</td>
<td>24</td>
<td>29</td>
<td>33</td>
<td>36</td>
</tr>
</tbody>
</table>

**Malimba Groundnuts (Unshelled)**

<table>
<thead>
<tr>
<th></th>
<th>600</th>
<th>800</th>
<th>1,000</th>
<th>1,200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yield (lbs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Margin per acre (K)</td>
<td>19.80</td>
<td>26.40</td>
<td>33.00</td>
<td>39.60</td>
</tr>
<tr>
<td>Labour per acre (days)</td>
<td>68</td>
<td>71</td>
<td>74</td>
<td>78</td>
</tr>
<tr>
<td>Margin per labour-day (t)</td>
<td>29</td>
<td>37</td>
<td>45</td>
<td>51</td>
</tr>
</tbody>
</table>
Before examining the implications of the data presented in Table 4. A it is worth stating a few obvious qualifications. Although every effort has been made to produce realistic estimates of the labour efficiency of the average farmer there must be a fair margin of error. This error is however likely to be exceeded by the range in performance achieved by individual farmers. Some will be markedly more efficient than the average in their use of labour and some less so. Consequently there will be considerable variation in the actual margins per labour-day achieved by individual growers.

The crops considered will not necessarily compete with one another on all available land. In general land suitable for rice will not suit cotton or groundnuts. Black cotton soils are not favourable for groundnuts. Sandy soils can be used for growing maize, cotton and groundnuts but not rice. In small areas of hard saline land on the edge of the marshes cotton appears to be the only crop hardy enough to be grown. Thus in many cases the type of soil limits the crops which can be grown, and possibly as a consequence continuous culture with the same crop or crop mixture appears to be characteristic of local agriculture. Nevertheless to the extent that holdings are scattered over different soil types and can be adjusted to suit the managerial capacity of the household there is competition between crops for available labour resources. A farmer can alter the mix between, say, cotton and rice either by not planting some land or by borrowing or exchanging cultivation rights on a temporary basis. Thus the whole or some subset of the crops considered compete in a wide variety of situations in the Lower Shire Valley, although rice only enters this competition where water supplies are abundant.

4.3 **Average Yields and Relative Importance of the Various Crops**

A useful preliminary to examining the implications of the estimated margins may be to establish some indicators of typical yields and the importance of the different crops.

The yields portrayed in Table 4.B are probably lower than average, for cotton at least. Data collected by the CCDP suggest that on average sprayed cotton yields 1,000 pounds per acre. Unfortunately CCDP data on unsprayed cotton yields were underestimated prior to 1971/72 for reasons laid out in the 1971/72 Farm Survey.* A survey of the results of various

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surveys and experimental trials suggests that it would not be unreasonable to assume that in years when sprayed cotton yields 1,000 pounds un sprayed cotton yields 400 pounds, although of somewhat lower quality.

Table 4.B: Average Yields in the Phase I CCDP Area 1971/72 (lbs/acre)*

<table>
<thead>
<tr>
<th></th>
<th>Cotton</th>
<th>Maize</th>
<th>Groundnuts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton Spraying Farmers</td>
<td>653</td>
<td>1,394</td>
<td>812</td>
</tr>
<tr>
<td>Non-Spraying Cotton Farmers</td>
<td>283</td>
<td>881</td>
<td>608</td>
</tr>
</tbody>
</table>

* Source CCDP Farm Survey 1971/72.

The 1971/72 groundnut yields reported above do not seem likely to understate the average yields. Preliminary results from the SOLV yield survey suggest slightly lower yields than these for 1973. The AgroEconomic Survey found average unshelled yields of Malimba groundnuts in Nsanje to be 773 pounds per acre in 1972. † As Chalimbana groundnuts typically yield less than Malimba it would seem unwise to assume that average yields exceed 600 and 800 pounds of unshelled nuts for Chalimbana and Malimba respectively.

Maize yields in excess of 1,000 pounds seem to be fairly common. Not only did spraying cotton farmers comfortably exceed this level in 1972 they were also recorded as averaging 1,484 pounds per acre in 1971. ‡ It therefore seems reasonable to assume average maize yields of the order of 1,100 pounds per acre.

In considering rice yields it should be emphasised that the term "rainfed" is simply taken to signify non-irrigated. However to the extent that rice is grown in the marshes of the Shire River water supply may in some places be as adequate as in irrigation schemes, although in all cases rainfed rice production can be assumed to be based on local seed rather than the new varieties employed on the schemes. It turns out that some very high yields can be obtained in local conditions. One subplot in our own survey has registered a yield equivalent to 5,999 pounds per acre. Very high yields have been recorded in other plots; preliminary data suggest an average yield of over 2,000 pounds, and this figure will be used for present purposes.


Finally to provide some perspective on the extent of cultivation
of the various crops: All households sampled in the Household Composition
Survey were asked what crops they had grown in the 1971/72 season.
Applying the weights presented in Table I.B, Appendix I, to the results
of this survey produces the estimates that 48 thousand families in the
Survey area grew maize, 20 thousand cotton, 9 thousand rice, and 24
thousand grew groundnuts although mainly on a small scale and often in
mixed stands.

4.4 Implications of the Estimated Margins

(a) All choices about what crops to grow involve decisions about
the amount of labour to be combined with particular areas of land. House-
holds with small acreages and plentiful labour with poor prospects of
off-farm employment will maximise their returns by adopting the most
labour intensive system of farming which is technically feasible. That
is they should select crops with a high labour requirement in order to
maximise returns per acre even if this means low returns per day of
labour used.

Families with a low labour endowment relative to their land will
tend to adopt systems requiring low inputs of labour per acre. There
are however at least two conditions under which they should adopt
intensive methods of cultivation. One of these is where hired labour
is available at a wage less than its average value product and where the
household has the necessary managerial capacity to cope with hired
labour. The other condition is where returns to intensive agriculture
are so high that it pays to concentrate on this on a small area and use
the remaining area with low labour inputs or not to cultivate it at all.

(b) This last condition appears to occur wherever rice is a feasible
crop. The returns to rice at yields of 2,000 pounds and above are such
that it is always an economically superior crop to the others under
consideration.

On our estimates cotton is the second most profitable crop but
it takes less labour to produce 2,000 pounds of rice with a margin of
K66 per acre than to produce even 1,200 pounds of cotton with a margin
of K58.66. Since this probably underestimates average rice yields and
overestimates those for sprayed cotton it is clear that households with
the technical possibility of growing both crops should maximise their
output of rice and then decide how to allocate their remaining resources
to the remaining land. This may still allow for sprayed cotton production
but possibly some more extensive form of production would be optimal.

(c) There is only one crop which is competitive at average yields with rice and this is maize for subsistence, but it is only competitive in situations favouring extensive forms of land use. * Three acres yielding 1,100 pounds of maize would produce K66 exactly the same as 2,000 pounds of rice but would require marginally less labour. In the unlikely condition where farmers had sufficient land to choose between cultivating one acre of rice and leaving three acres of maize land uncultivated the alternative choice of growing the maize and not cultivating rice would be marginally superior (at the assumed average yields and labour requirements). In all other circumstances at average yields it will pay farmers to maximise their rice production even if this means leaving some land uncultivated.

(d) In conditions where rice growing is not possible sprayed cotton is the most labour intensive of the crops under consideration. If labour to land ratios dictate that a farmer should aim for maximum returns per acre on all or part of his holding then sprayed cotton is superior to groundnuts, maize and unsprayed cotton.

(e) However sprayed cotton is not superior to all of the alternative crops in terms of returns to labour, and in general it is not true that it will pay farmers to leave some land uncultivated in order to maximise the acreage of sprayed cotton. In fact the ranking of the crops (excluding rice) in terms of returns per labour day at assumed average yields is:

1. Maize for subsistence (800 lbs) - 42 tambala
2. Malimba groundnuts unshelled (800 lbs) - 37 tambala
3. Sprayed cotton (1,000 lbs) - 35 tambala
4. Maize for sale (1,100 lbs) - 31 tambala
5. Chalimbana groundnuts (600 lbs in shell) - 31 tambala
6. Unsprayed cotton (400 lbs) - 30 tambala
7. Malimba groundnuts shelled (800 lbs in shell) - 29 tambala
8. Maize for sale (800 lbs) - 26 tambala.

If our assumptions are reasonable (and particular care has been taken not to undervalue sprayed cotton relative to the other crops) it would not pay to leave land uncultivated which could be used for the production of subsistence maize or unshelled Malimba groundnuts in order

* Maize for subsistence has been valued at 2 tambala per pound (the ADHARC selling price) although local prices for small purchases rise above this.
to increase the acreage of sprayed cotton.

(f) Even ignoring the need of farmers to safeguard their food supplies it is not difficult to see why maize has such a prominent place in the agricultural system of the area, for even at yields of only 800 pounds to the acre the returns per labour-day from subsistence maize are higher than for the other crops.

Even maize for sale succeeds in being relatively attractive from the labour returns standpoint if yields of 1,100 pounds or more are achieved.

(g) In years of good yields sprayed cotton returns are higher both per acre and per man day than returns to unsprayed cotton. However in years of poor yields such as 1971/72 when sprayed yields per acre averaged 653 pounds and non-sprayed yields 283 pounds the difference in returns per labour-day to the two crops is negligible (23 tambala for sprayed and 22 tambala for non-sprayed). Since there is additional risk attached to sprayed cotton production by virtue of the fact that there is typically credit to be repaid, it would not seem at all illogical for some farmers with adequate cultivation rights to farm extensively with unsprayed cotton in preference to adopting the more intensive spraying regime.

There will certainly be a variety of circumstances where the economics tilt against the spraying of cotton. One of these is where the water supplies required for spraying the water-soluble insecticides are distant from the site of application. Another is where only a small area of land is available for cotton growing after subsistence food needs (or some part of them) have been catered for. On smaller acreages the overhead costs of owning a sprayer rise, and there is a two acre minimum cotton acreage below which farmers become ineligible for a loan to buy a sprayer. This is perhaps not too serious a handicap as the hiring of spraying equipment is possible. In 1972 it is estimated that 2,544 cotton growers hired spraying equipment to undertake some spraying, as against 4,959 growers who used their own equipment. Nevertheless, it is undoubtedly significant that non-cotton spraying holdings do tend to be smaller on average than holdings where cotton spraying is performed - 4.75 acres as against 8.05 in 1972.

(h) Mention has been made of the higher risk associated with sprayed cotton production. This arises because the input of labour and particularly purchased inputs (insecticide and sprayers) is higher for sprayed cotton than for other rainfed crops, while the risk of failure due to weather conditions is probably no less. For example in 1971/72 the CCDP Farm Survey reports that out of 101 subplots for sprayed cotton 6 yielded
less than the equivalent of 150 pounds per acre, 17 from 151 to 300 pounds, and 14 from 301 to 450 pounds. Thus 37 percent of spraying farmers may in 1971/72 have obtained yields less than 450 pounds. Some of these must have been discouraged to the point where they would have decided not to grow the same crop again the following year, but to produce something requiring lower inputs per acre (such as maize or unsprayed cotton) which generates lower margins per acre, and to seek employment off their own holdings.

This is not to say that the probability of crop failure is sprayed cotton is worse than for the other crops. It is not, and in 1971/72 37 percent of unsprayed cotton plots had yields of less than 200 pounds. The figures do however illustrate two things: Firstly the high risks producers run in investing substantial resources in any form of rainfed agriculture, given their lack of financial reserves for a bad year. Secondly it highlights the misleading aspects of using average yields for planning purposes in this situation. A very remarkable feature of the yield distributions for crops grown in the Lower Shire Valley (and even within the Phase I CCDP area) is their flatness, that is the refusal of the values to cluster nicely around the mean. Hence even when average yields are high a substantial proportion of growers are likely to have done badly.

(i) Groundnut production does not appear competitive with sprayed cotton in terms of returns per acre but is competitive in returns to labour. It is a crop better suited to sandy soils than cotton, and will also tend to be favoured where labour to land ratios favour more labour extensive production systems.

It should be noted that the benefits from groundnuts are somewhat understated by our approach, since no allowance has been made for the increased yields of later crops resulting from the nitrogen fixed in the soil by groundnuts. This additional benefit is clearly recognised in practice as evidenced by the frequency of mixed cereal and groundnut stands.

(j) Table 4.A indicates the existence of an apparent anomaly in the 1973 pricing system for Malimba groundnuts. If the shelling percentage for Malimba is correctly assumed at 65, then there is a negative return to shelling with prices standing at 5 and 3.3 tambala per pound for shelled and unshelled nuts respectively. For 800 pounds of unshelled Malimba are worth K26.4, whereas the equivalent 520 pounds of shelled nuts are worth only K26.0. Only if shelling percentages are above
66 percent will there be any return to hand shelling by the farmer and then only if there are no 'splits and shrivels' or nuts which fetch less than top price. Under current pricing conditions it would clearly be illogical for producers to shell Malimba groundnuts for sale to ADMARC. 

(k) In attempting to use the data presented in Table 4.A to explain the pattern of agriculture it must be remembered that the margins have been calculated at 1973 prices and that in previous years prices and margins were lower. Nor have the prices of all crops moved together. Between 1972 and 1973 the prices for cotton and groundnuts have been raised but those for maize and rice have not. Thus the competitive position of cotton and groundnuts have been improved vis-a-vis the cereals.

The extent to which the competitive situation of the different crops has changed since 1970 is partially illustrated in Table 4.C. Of the crops portrayed it appears to be sprayed cotton and Chalimbana groundnuts whose competitive positions have been most improved, with increased returns estimated at 7 tambala per labour-day. Maize appears to have suffered a comparative decline in returns with an estimated increase of only 3 tambala per labour-day. It is also worth noting that the higher prices are estimated to have improved the competitive position of sprayed as against non-sprayed cotton. This results partially from the assumed higher quality of sprayed cotton and partially because equiproportional increases in the gross margins of the two crops cause net margins for sprayed cotton to rise more proportionally than those for non-sprayed cotton because of the fixed production costs of the former.

(l) One very important issue raised by the margins portrayed in Table 4.A concerns the attractiveness of small holder farming as against other farms of employment.

1,000 pounds of sprayed cotton per acre are estimated to give a return of 35 tambala per day for 136 labour-days. This daily rate is 11 tambala above the 24 tambala minimum daily wage in registered employ- ment. But whereas someone in regular employment at the minimum wage rate may expect to be able to work 300 days per year, the typical member of a farming family may be unable to work as much as 200 days a year in crop production activities (in a single cropping system at any rate).

Assuming then that an adult male could work productively for 200 days on his own holding at an average of 35 tambala per day his total earnings will be marginally less than those of a man working 300 days
<table>
<thead>
<tr>
<th></th>
<th>ADMARC Buying Prices</th>
<th>Margin per Labour-Day</th>
<th>Maize for Sale</th>
<th>Chalimbana</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade A</td>
<td>Grade B</td>
<td>Grade C</td>
<td>Sprayed 1,000 lbs</td>
</tr>
<tr>
<td>1970</td>
<td>5.0</td>
<td>3.33</td>
<td>1.87</td>
<td>28</td>
</tr>
<tr>
<td>1971</td>
<td>5.5</td>
<td>4.00</td>
<td>2.00</td>
<td>31</td>
</tr>
<tr>
<td>1972</td>
<td>5.5</td>
<td>4.00</td>
<td>2.00</td>
<td>31</td>
</tr>
<tr>
<td>1973</td>
<td>6.0</td>
<td>4.50</td>
<td>2.50</td>
<td>35</td>
</tr>
</tbody>
</table>

* The assumptions about costs, cotton quality and labour-days required are the same as those used in the preparation of Table 4.4.
at the minimum daily wage of 24 tambala, and in addition the farmer runs
the risk of income failure in poor seasons. It should also be noted
that the standard wage rate for permanent agricultural labourers in the
Lower Shire Valley is K4 per month. At an average of 25 days worked
per month this is equivalent to 16 tambala per day, and this excludes
the food paid to permanent labourers which may well have a value not
much less than the money wage.

In these circumstances it must be a very attractive financial
proposition for some adult males to seek employment away from their own
holdings, to concentrate on fishing or to work for neighbouring farmers,
whilst their wives and children are left to farm their holding on a
labour extensive basis. Indeed if a man can command a high wage else-
where it may well pay him to seek employment away from his holding and
to hire labourers to work in his absence.

There are a number of basic ways of making small-holder agriculture
more attractive:

1. to increase product prices,
2. to introduce new techniques which reduce labour inputs with-
   out reducing output (and without incurring monetary costs),
3. to introduce new methods which increase output proportionately
   more than the additional labour input (without incurring
   monetary costs),
4. by achieving (2) and (3) with 'acceptably' low costs.

These are all fairly self-evident, but it is possibly worth
commenting on (2) above: There seems to be some scope for this type of
improvement in the harvesting of cotton (and doubtless in other activities
also). Well-known methods are practised elsewhere for two-handed cotton
picking into special sacks or aprons which appreciably increase picking
efficiency. Indeed attempts are currently being made to persuade growers
to use special picker's aprons rather than the traditional baskets. What
is surprising is the apparent lack of success that this campaign has had
so far, in view of the alleged shortage of labour for picking. This sort
of innovation should theoretically be an attractive one.

Another possibility in cotton harvesting concerns grading by picking
only one grade of cotton at a time. This should save more time in grading
than it loses in picking especially if it is combined with improved
picking methods. Even after allowance is made for some small drop in
grading efficiency by this method it is difficult to see why the time
saving should not lead some farmers to find it rewarding. The price
mechanism will act as a strong incentive for skilled performance of the operation, since failure to grade well will cause more of the harvested cotton to be down-graded and down-priced. Nevertheless it might be necessary to slightly reduce the standards of cotton grading at markets if any serious attempt were to be made to introduce the technique of grading while picking. Farmers currently appear to feel that there is a high risk of their cotton being down-graded because of minor imperfections. If they are right the risk that cotton graded while picking would be classified as B or C might be unacceptably high. Some slight easing of grading standards could greatly reduce this risk without appreciably devaluing the very high standard of Malawi Grade A cotton.

Innovations leading to improved labour efficiency should prove increasingly acceptable whilst those which increase the amount of labour required will only be attractive if returns are increased more than proportionately to labour after discounting for risk.

(n) The previous points have all shied away from one very important factor and this is that some, possibly many, farmers practice double-cropping. Previously there has been no detailed study of the incidence of double cropping. It is however clear from our own Survey that in areas of the Elephant and Ndinde Marshes complicated multiple-cropping systems are practised. In other areas, where slightly higher than average rainfall enables an earlier start to wet season cropping, it is possible to replant gardens at the tail end of the rains (or to undersow with late maturing crops) with the consequence that double cropping is fairly extensively practised. Even in the drier areas on the valley floor attempts are made to extract crops of maize and beans after the main crops have been harvested. Details of the incidence of double cropping are presented in Chapter 12 below.

Except in areas such as the Elephant and Ndinde Marshes the possibilities for double cropping are unlikely to increase agricultural prospects sufficiently to diminish the attractiveness of non-farm employment.

One effect of double-cropping possibilities will be upon the optimal choice of wet season crop. Wet season crops which take a long time to mature and harvest will compete with second, dry-season crops. This competition will be both for labour and residual soil-moisture. For this reason producing cotton with either no or less than the recommended number of insecticide spraying may well represent an optimising strategy for some farmers as it will shorten the harvesting period.
The full implications of the presence of double-cropping systems are difficult to assess, but obviously they have an important bearing on any discussion of optimal agricultural practice in the Lower Shire.

All the margins discussed previously in this Chapter are those which accrue directly to the farmer. The purpose was to try and use them to explain the behaviour of small-holders. However to the extent that some inputs are subsidised the farmers' margins exceed the economic margins. That is the farmer pays less for certain inputs than they cost, and the costs of the subsidy which enables this are borne by people elsewhere who may receive no direct benefit from it. No more is said on this topic here, and no attempt will be made to calculate the true economic returns of the various enterprises. Some comments on the problems of subsidies are however included in Chapter 9 below.
CHAPTER FIVE

THE RELATIONSHIP BETWEEN AGRICULTURAL SUPPLY AND AGRICULTURAL PRICES

5.1 Introduction

The question as to whether or not peasant farmers are rationalists has been the subject of continuing academic debate. Two issues are involved in this debate; firstly whether peasant agricultural production varies directly with agricultural prices, and secondly if so whether the relationship is a strong quick-acting one.

Scanty and unreliable data have often done much to frustrate statistical examination of this price-supply relationship and have frequently led to inconclusive results. This is unfortunate in view of the practical importance of the issue. For if farmers in countries such as Malawi do respond strongly to changes in prices then prices provide a powerful policy instrument for controlling agricultural production in conformity with development plans. This is especially so where agencies such as monopoly commodity purchasing boards are established with control over agricultural prices. If on the other hand producer reactions to prices changes are weak, then development planning must rely less upon prices as instruments of policy and must lean more heavily upon the more complex and probably more costly tools of education through extension services, exhortation, incentive schemes involving the administration of credit, and so forth.

Malawi is fortunate in having rather reliable historical data on production, prices and weather. With this it is possible to conduct fairly sophisticated analyses of agricultural supply response. In fact several studies of this type have been performed in the past with interesting results which are briefly reviewed below. The current study has taken these investigations further by analysing the relationship between cotton production and cotton prices. Some results of this are presented below and show evidence of a very strong relationship between cotton production and prices in the previous year. The implications of this observation are reviewed at the end of the chapter.

5.2 Previous Studies of Crop Supply Response in Malawi

There appear to have been three previous statistical analyses of the response of Malawian small-holders to crop prices. The basic approach of the type of analysis adopted is to examine crop production over a
recent period of years, and to try and explain variations in this by
means of those factors which are rationally assumed to influence the
outcome, supply. Analysis is by means of Least-Squares Multiple
Regression and success is deemed to be achieved when the factors chosen
to explain production are found to be statistically significant and to
account for a high proportion of the variability in past production.
Since there are few discontinuities in the processes of crop production,
it is assumed that past experience relates to the future and that factors
found to have exerted strong influence over farmers past behaviour will
continue to do so in future.

The various analyses reviewed, including our own, all make common
assumptions about the factors influencing crop production.

One key assumption is that production in any year is influenced
by the prices received for the previous years crop. This is justified
on the grounds that when a farmer plants an annual crop he has no precise
idea of the price he will receive after harvest some 6 months later. At
the time of planting he will however know the prices he has just received
for his last crop and it is generally accepted that farmers use this as
a guide to the likely price of the next one.

A second, obviously necessary, assumption is that the value or
volume of production will be influenced by weather conditions during the
growing season. Any attempt to explain historical changes in these
variables must therefore take weather into account.

The third common feature is to make allowance for underlying trends
in such factors as technological changes, level of experience with the
crop, and the degree of involvement in the cash economy. It is not possible
in analysis to deal explicitly with these and other non-quantifiable
variables, and different techniques have been employed to deal with this
problem by each of the studies reviewed.

Chronologically the first Malawian supply response study was per-
formed by Dean* and focussed on the relationship between tobacco sales
during the period 1926 to 1960 and the various factors which might be
expected to explain these. Factors which he found had a statistically
significant effect upon tobacco sales were previous tobacco prices, an
index of consumer prices in the previous year, a weighted index of overseas

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* Edwin Dean, The Supply Responses of African Farmers: Theory and Measure-
ment in Malawi, North Holland Publishing Co., Amsterdam, 1966.
wage rates in the previous year, and the weather. *

Although not all of Deans data are wholly reliable and some of his devices for removing trends from the data are questionable, it is possible to agree with his conclusion that "peasant producers appear rather responsive to price", † when considering tobacco. In fact his chosen estimate of the price elasticity of supply is 0.48, which can be interpreted as indicating that a ten percent increase in the price received for tobacco will cause production in the next year to increase by 4.8 percent.

Similar conclusions emerge from the next study in chronologically sequence, which is that prepared by Minford and Ohs to cover the period 1949 to 1968. ‡ Their study examined the response of the value of total crop sales by Malawian small-holders to essentially the same set of factors used by Dean plus an additional variable for produce sold across Malawi's borders. In this case also regression results were obtained in which last year crop price (deflated by a consumer price index), weather, and wages overseas, as well as the "unofficial export" variable,

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* One of Dean's best results, equation 4.7 on p. 67 is the following, although his device of deflating tobacco sales by population is arguable:

\[
\log \Delta (S/\text{Pop})_t = 0.082 + 0.529 \log \Delta (PT/\text{PI})_{t-1} - 0.674 \log \Delta (W/\text{PI})_{t-1} \\
+ 0.311 \Delta D_{t-1} \\
(3.91) \\
(1.81) \\
(3.46) \\
R^2 = 0.43
\]

Von Neuman Ratio = 2.56

S = Recorded sales of tobacco by Trust Land farmers in Malawi (lbs)

Pop = Estimated population of Malawi (thousand)

PT = Prices index of tobacco

PI = Malawi price index of selected imported commodities

W = Weighted index of wages in surrounding countries

D = Weighted weather index

\( \Delta \) = Denotes change from one year to the next

Values in brackets are t statistics.

† Ibid, p. 76.

‡ Patrick Minford and Peter Ohs, Supply Responses of Malawi Labour, Mimeoographed paper, Zomba, 1968.
were all statistically significantly related to the value of crop sales.*

In this case the estimates of response elasticity are bunched around 0.60, which is surprisingly high when one takes into account the amalgam of crops considered. Thus the estimate that a 10 percent increase in the weighted index of crop prices might be expected to give rise to a 6 percent increase in the value of sales in the next year, again indicates a strong link between prices and production.

Both of the studies just discussed operated in the field of sales statistics which are pretty reliable. Gordon's study † departs from this approach and attempts primarily to forecast the acreages of different crops. In general this approach to supply response, in which yields and acreage are treated independently, is more likely to produce reliable statistical estimates of the influence of prices on supply. Unfortunately the crop acreage data for Malawi are not as reliable as the sales figures, and moreover Gordon's objective was forecasting rather than the identification of supply-price relationships. In consequence prices do not feature prominently in his acreage forecasting equations. However he did estimate an equation to explain the marketable surplus of groundnuts, which over the period 1954 to 1967 was found to be statistically significantly related to groundnut prices in the previous year. The elasticity of response for this relationship was remarkably high at 2.3, suggesting that a ten percent increase in groundnut prices would increase sales in

* One of Minford and Ohs' results is equation 1 on page 8 of their paper:

\[
\frac{O}{T_t} = 0.006 + 0.513 W_t + 0.612 \frac{P}{C_{t-1}} - 0.661 B_t - 0.318 M_{t-1} \\
(6.20) \quad (2.92) \quad (2.42) \quad (2.15) \quad (2.15)
\]

\[R^2 = 0.72 \quad \text{Von-Neumann Ratio} = 2.07\]

NB: All variables were expressed in logarithms of first differences.

O = Value of recorded crop sales by small-holders (£'000)

T = Least-Squares trend fitted to O

W = Weighted weather index of crop growing conditions for the various crops

C_2 = Consumer price index — a smoothed version of Dean's index

B = A weighted index of "border traffic"

M_t = Minimum wages in paid employment.

the following year by 23 percent. *

None of these studies individually provide conclusive evidence of highly price elastic supply responses by small-holders, since in each case criticism could (as it always can in such analyses) be made of the variables and the way they have been employed. Nevertheless each of the studies has obtained strong statistical evidence of a link between one year’s crop prices and small-holder production in the next; and when taken in conjunction with evidence of less formal statistical content and the results obtained by our Survey on cotton supply response (both of these are considered below) they paint a fairly convincing picture of small-holder responsiveness to agricultural prices.

5.3 Other Evidence on Supply-Price Relationships for the Lower Shire

In view of the fact that cotton is the only cash crop which has been grown in the Lower Shire Valley for any period of time and on any scale it is inevitable that the economic rationality or otherwise of small-holders in the area should be considered in terms of this crop. The problems of cotton growing in the area have attracted much attention in the past and there is considerable accumulated evidence on the reaction of cotton farmers to prices.

A recent paper by Channock † reviews in detail evidence in reports and correspondence during the period 1918 to 1930 of the relationship between cotton production and prices. It seems clear that the response of growers to falling cotton prices was politically vigorous. The Government, whose officers encouraged farmers to grow more cotton, were held responsible for the cotton prices paid at markets, and any fall in prices was consequently seen as a breach of faith on the part of Government. The concern of local growers appears to have been particularly

---

* The relevant equation in Gordon’s study, is:

$$\log \text{MSSg} = k + 0.2520 \log T + 2.348 \log P_{t-1}$$

$$(1.96) \quad (3.89)$$

$R^2 = 0.91$

Durbin – Watson Statistic = 2.37

MSSg = Marketable surplus of groundnuts

T = Time trend

P = Price paid to growers of groundnuts

k = constant

vociferous after the dramatic fall in cotton prices in 1931 which led
to a sharp decline in the industry.*

Not only were cotton growers sensitive to the prices of their
product, but as Channock's paper makes clear they were also concerned
about the increasing prices paid for the goods purchased. They expected
there to be harmony between these two sets of prices and reacted strongly
when prices of cloth and other goods rose more rapidly than the price of
cotton in the late 1920's and early 1930's.

Farmers reactions to poor cotton prices were however not confined
to vocal protests. It is apparent that production of cotton was closely
related to the price of cotton in the previous year. Pearson and Mitchell
(in their pioneering study, which seems to have provided the genesis of
many subsequent studies of, and developments in, cotton growing) amassed
a complete set of records on cotton production in the Lower Shire up to
1945 and make the following observation; "Comparison of the graph of
price per lb of No 1 seed cotton with that of the number of growers shows
that the latter rises and falls in sympathy with the price paid in the
previous year to a quite remarkable degree".†

A further manifestation of the economic rationality of farmers
was one which caused great concern to both the Colonial Administration
and the B.C.G.A. This was that in years of particularly low prices
producers took their cotton to Mozambique where prices were higher
because of a subsidy system. In 1938 it was estimated that as much as
half the cotton crop (1,500 tons) was smuggled to Mozambique to gain
the benefit of the higher prices.‡ Furthermore the cotton sold in
Mozambique was almost exclusively Grade A, leaving the lower grades of
cotton to be sold in Malawi. This also is rational since the higher
valued Grade A cotton would be better able to bear the cost of trans-
porting it across the border.

* In 1931 the price of grade 1 cotton stood at 5/8d per pound and this
compared with an average price to growers of 2.34d per pound in 1925/6.
Malawi National Archives.

† E. O. Pearson and B. L. Mitchell, A Report on the Status and Control
of Insect Pests of Cotton in the Lower River Districts of Nyasaland,
Government Printer, Zomba, 1945, p. 16.

‡ Malawi National Archives, File 1/2/1, letter of 10312/38 Reference to
smuggling cotton to Mozambique is also made in 1935 in File 1/2/1,
letter of 27/8/35.
Exhaustive examination has not been made of all possible sources to find evidence of the importance of prices to peasant farmers in the Lower Shire. The few observations cited have easily come to hand, and they do indicate that there has long been awareness by those connected with the area of the price responsiveness of cotton growers.

5.4 Statistical Analysis of the Relationship Between Production and Prices of Cotton in the Lower Shire Valley

In the context of this analysis the cotton prices considered are the average prices received by growers per pound of cotton and not the fixed prices per grade paid by ADMARC. Given that farmers can be expected to respond to the prices they actually receive, and since it transpires that such prices vary considerably for any fixed set of grade prices, the distinction between these two prices is an important one.

It seems possible to express the main relationships governing cotton supply by the following:

1. The average price of cotton received by growers this year depends upon
   (a) the prices per grade of cotton fixed by ADMARC
   (b) the distribution of cotton production between grades.

2. The distribution of cotton production between grades depends
   (a) mainly upon weather conditions
   (b) but also possibly upon other factors such as the price differentials between grades and upon the amount of the crop which is sprayed.

3. Cotton production next year depends upon
   (a) average cotton prices received this year
   (b) weather next year
   (c) cotton production this year
   (d) other factors such as changes in spraying technology, returns to other crops, and changing opportunities outside agriculture.

This is, of course, a simplified representation of the system, but such simplification is necessary to permit statistical analysis, and it is unlikely to produce misleading results provided that no major factors have been omitted.

It should be noted that the first relationship determining producer prices is an identity, for these prices are produced by an exact formula
using the grade distribution and fixed prices per grade. Hence only relationships two and three required statistical analysis to estimate the behavioural coefficients.

Before presenting the results several points need explaining. Firstly, regarding the method of statistical analysis employed, Least Squares Multiple Regression; this procedure merely measures the numerical association between a "dependent" variable and each member of a set of explanatory variables, and establishes the statistical significance of each of these associations. To infer from such results, as the analyst frequently does, that the explanatory variables cause the dependent variable requires an act of professional judgement based upon economic theory and technical knowledge. It is this type of judgement which has been made when in assessing the implications of our results statements are made concerning the response of production to prices or weather.

It would probably be agreed universally that changes in weather conditions cause major fluctuations in Lower Shire Valley cotton production. For this reason there may be some disappointment or even suspicion over the fact that in our results the statistical significance of this relationship does not turn out to be high, although it is acceptable. However the difficulties of producing a satisfactory index of the relevant weather conditions are considerable. A large number of alternative weather variables has been considered including several based on the pentade system* and more could be tested given time. The most satisfactory variable tested is total Ngabu rainfall for the period November to February.

With such a variable it is easy to see why statistical significance is unlikely to be very high. The main problem concerns the fact that there is an optimal level of rainfall during the growing period. There is a range where increasing rainfall increases yields, but beyond a certain level further rainfall reduces yields. Unfortunately this turning point is not fixed from year to year but varies with the seasonal distribution of the rainfall.† Hence a given total level of rainfall

* A full explanation of this system of recording rainfall is given in a paper by D. T. Johnson, Crop Production in Phase with the Climate, Draft mimeograph, Southern Region Agricultural Office, Blantyre, May 1972.

† It was hoped that variables based upon the pentade system would overcome this difficulty, but disappointingly this has not happened.
might be nearly optimal in one year but excessive in another. In circumstances like this the effects of weather are very difficult to account for fully.

5.4.1 Results - Cotton supply response 1955/56 to 1970/71

In all equations tested the previous year's cotton prices have been found to exert a highly significant positive effect upon cotton production. The difficulty has been to find a relationship in which the effects of rainfall achieve the sort of statistical recognition that their importance undoubtedly merits.

This problem is well illustrated by equation 1. It will be noted that there are three explanatory variables, comprising the previous years cotton price and two rainfall variables. The need for two rainfall variables became apparent upon observing that there were a handful of years in which the normal pattern of increasing rainfall leading to increased yields did not hold, but in which excess rainfall had a profound depressant effect upon yield. Thus an excess rainfall variable was called for in addition to that for total November to February rainfall at Ngabu.

Equation 1

\[
SC_t = -22,474 + 6,817 \text{PC}_{t-1} + 137 R_t^{0.75} - 2,764 \times XS^{1.22}
\]

\[
R^2 = 0.63
\]

\[
\bar{R}^2 = 0.54
\]

SC = sales of cotton to the Lower Shire Division of ADMARC (short tons)
PC = average price paid to growers by ADMARC (tambala/lb)
R = total Ngabu rainfall November to February inclusive (inches)
XS = a dummy variable for excess rainfall. It has the value 1 in 1955/56, 1962/63 and 0 in all the other years.

Notes
(i) Subscript t denotes the current year, t-1 denotes the previous year.
(ii) \(R^2\) is the multiple correlation coefficient; \(\bar{R}^2\) is the same coefficient adjusted for degrees of freedom.
(iii) Values in parentheses are values of the "t" statistic. With a one-tailed test \(t = 1.725\) is significantly different from zero with a probability of 95 percent, and \(t = 1.325\) is significant at 90 percent.

* Agricultural Produce Marketing Board and later Farmers Marketing Board annual reports indicate that the problem of excess rainfall was particularly acute in the 1955/56, and 1966/67 seasons. A zero-one variable has therefore been set up with the value 1 in these three years.
In equation 1 only the price variable is statistically significant. Neither of the weather variables achieves this status although both exert the expected type of influence. Furthermore the explanatory variables chosen only succeed in explaining 54 percent ($r^2 = 0.54$) of the variation in cotton production, and this is rather low.

The result is improved in all respects by re-estimating equation 1 with all variables, except that for excess rainfall expressed in natural logarithms. Doing this has the advantage of permitting non-linear supply responses; for example it permits cotton supply to increase by successively smaller absolute increments to each additional inch of rainfall. The results of this change are shown as equation 2. It can be seen that the explanatory power of the variables is improved to 74 percent and that the statistical significance of all the variables is increased, the excess rainfall variable now being significant at the 90 percent level.

Equation 2

$$\log SC_t = 2.4657 + 3.7988 \log PC_{t-1} + 0.3347 R_t - 0.3342 XS_t$$

(2.85) (0.95) (1.66)

$$r^2 = 0.79$$

$$R^2 = 0.74$$

Neither of the two preceding equations take into account explanatory factors such as changing technology, changing prices of goods purchased by farmers, the prices of other crops or other "trend" factors influencing production. Given that (a) technological change is difficult to quantify, (b) there is no satisfactory or even meaningful index of consumer goods prices for small-holders, and (c) there are no important cash crops competing with cotton in the Lower Shire Valley, there appears to be no purpose in introducing variables explicitly to deal with these effects, although these were adopted in one or other of the previously cited works on Malawian crop supply response. Nevertheless the presence of trends may have contributed to the extremely high (3.8) estimate of the elasticity of cotton supply response to price in equation 2.

To allow for such trend effects equation 2 has been re-estimated with the introduction of the previous years cotton production ($SC_{t-1}$) as an extra explanatory variable. The resulting distributed lag formulation is usually justified on more elaborate theoretical ground, but it appears to be an effective device for dealing with underlying trends.
Equation 3

\[ \log SC_t = 0.6411 + 2.3596 \log PC_{t-1}^t + 0.5379 \log R_t \]
\[ (2.23) \]
\[ + 0.3777 \log SC_{t-1}^t - 0.5157 \times S \]
\[ (1.68) \]
\[ R^2 = 0.83 \]
\[ R^2 = 0.77 \]

Equation 3 shows improvements in all aspects over the other two results and is the "best" one obtained. The statistical significance of both weather variables is increased as is the magnitude of their influence, and the amount of variation in cotton supply which is explained is increased to 77 percent. Also the estimated influence of the price variable has been reduced to a more acceptable level, although with a supply response elasticity of 2.36 price still retains a very powerful influence in keeping with prior indications. The simple interpretation of this result is that a one percent increase in prices received by farmers may stimulate a 2.36 percent increase in cotton supply in the following years, and a 3.36 percent increase in producer's revenues from cotton production. The full implications of this are discussed below.

5.4.2 Results - Cotton Quality 1955/56 to 1970/71

Some simple results are presented below on the effects of weather upon the grade distribution (quality) of cotton. For the purpose of analysis quality \((Q)\) is defined as sales of first grade cotton as a proportion of total Malawi cotton sales. Reference to Table 5.8 reveals that this proportion has varied between 61.3 and 93.6 percent over the period 1955/56 to 1970/71.

The main hypothesis tested is that heavy rainfall in the late part of the season causes a decline in quality. Two rainfall variables have been tested the first of which \((RF/A)\) is the rainfall at Ngabu from November to February expressed as a proportion of the rainfall from November to April. * If late rainfall in March and April is light this ratio will tend towards 100 and it is expected that cotton quality will be high. Equation 4 shows this expectation to be confirmed.

* Such a variable is not ideal for explaining cotton quality for all districts of Malawi, but since most cotton comes from the Lower Shire it may not be wholly inadequate.
Equation 4

\[ Q = 45.41 + 0.44 \text{RF/A} \]

\[ (2.94) \quad R^2 = 0.43 \]

\[ R^2 = 0.39 \]

Literal interpretation of this result is that if rainfall were zero from November to February cotton quality would be around 45.4 percent, and if rainfall in March and April were zero quality would be 89.4 percent \((45.41 + 0.44 \times 100)\). Given that the first of these two extreme cases is most improbable, the results seem highly plausible.

Essentially the same result is obtained in equation 5 using inches of rainfall at Nyabu from March to May (RMM) as the weather variable. In this case if late season rainfall were zero quality would be 91.3 percent, but this will decline by 1.76 percent for every inch of rain that falls during March to May.

Equation 5

\[ Q = 91.31 - 1.76 \text{RMM} \]

\[ (4.11) \quad R^2 = 0.55 \]

\[ R^2 = 0.51 \]

Equations 4 and 5 confirm the view that the quality of harvested cotton is heavily dependent upon, and inversely related to the amount of rain falling after February. 1972/73 has in fact been a year of comparatively heavy late rainfall, and equations 4 and 5 respectively suggest that the percentage of Grade A will be 79.3 or 76.7.

Since equations 4 and 5 explain only half or less of the variation in cotton quality a brief attempt was made to find variables which would explain some of the remainder. One variable tried was a zero-one variable with a value of 1 from 1968/69 onwards to represent the influence of spraying technology since the advent of C.C.D.P. Surprisingly this variable attracted a negative sign, and since clearly this is not a reflection of the impact of C.C.D.P. an attempt was made to search for an alternative variable which might logically have caused a recent decline in cotton quality. The search revealed that there had been a sharp reduction in the differential between Grade A and B cotton prices from 1966/67 onwards (see Figure 5.4). Such a change in the pricing structure would reduce the economic return to good grading, and might logically be expected to cause some reduction in the quality of the harvested and graded crop. This hypothesis was tested by introducing the variable for the difference between ADMARC's Grade A and Grade B prices \((P_1 - P_2)\) into
the analysis.

Equation 6

\[ Q = 89.09 - 1.73 \text{RMM} + 0.80 (P_1 - P_2) \]
\[ (3.88) \quad (0.38) \]
\[ R^2 = 0.55 \]
\[ R^2 = 0.48 \]

Equation 7

\[ \log Q = 2.2987 + 0.4687 \log \text{RF/A} + 0.0402 \log (P_1 - P_2) \]
\[ (3.18) \quad (0.60) \]
\[ R^2 = 0.46 \]
\[ R^2 = 0.38 \]

Equation 6 and 7 do not conclusively show that reducing the grade price difference has reduced the quality of cotton sold to ADMARC, since the \( P_1 - P_2 \) variable is not statistically significant in either case. The coefficients obtained for this variable do however hint that the greater the difference between the two prices the higher the quality of cotton. If this hint is reliable it shows further evidence of the economic rationality of producers, and suggests a very sensitive appreciation of the price mechanism.

5.5 Implications of the Statistical Results

5.5.1 General Conclusions

The basic conclusion is that crop prices have a powerful incentive effect on cotton growers and upon Malawian small-holders generally. Prices are thus powerful tools of agricultural planning and possibly deserve to receive more emphasis than they have been given in the past. Recent reports on the state of agriculture in Malawi or on particular major projects make only scant reference to price behaviour or to the possible response of output to that behaviour, and they place possibly disproportionate weight on the machinery of planning. As is shown below it appears that price fluctuations may have had significant effects upon Lower Shire Valley cotton production in recent years, and production of other crops is likely to have been similarly affected.

The effectiveness of crop prices for planning purpose is of course circumscribed by the normal economic rules. For instance where there are several competing crops, increasing the price of one crop by five percent may result in a large increase in output of that crop, but will
be expected to cause a reduction in the output of the others as resources are switched to the now more rewarding crop. In this case the changes in output of all the crops will be due largely to the reallocation between crops of resources already committed to agriculture.

If the prices of all competing crops were increased by five percent an increase of output in all of them would be expected, but the increased production of each crop would be less than if its price alone had been increased by five percent. This is because there will have been no change in the relative returns to resources between competing crops. What there will be is an increased return to all resources, particularly land and labour, from crop production. Thus some men who would previously have looked for work off the land will be induced by the price increase to enter crop production.

The importance of the influence of crop prices and of the rules governing these cannot be overstated in situations where, as in Malawi, prices paid to producers are fixed by a statutory marketing Board. It is not necessary to dwell on the difficulties inherent in such situations as they have been amply chronicled elsewhere. But it is pertinent to raise questions such as whether producer's and Malawi's interests would benefit from closing some bush markets, thereby reducing marketing costs and permitting an increase in the prices paid to producers. Such a policy would be feasible if the additional transport costs incurred by producers were less than the reduction in marketing costs from closing certain markets. The question of ADMARC's pricing policy for cotton is returned to below.

5.5.2 Movements in ADMARC Crop Prices 1967 - 1973

In view of the preceding remarks it is briefly worth noting the extent of recent movements in crop prices paid to producers. Table 5.A presents the prices paid by ADMARC for selected grades of certain key crops over the last 7 crop seasons. In none of the cited instances has


price remained constant, and with the sole exception of Grade B groundnuts there has been a net price increase. With minimum daily wage rates held constant during the period and with the selling price of the basic staple food, maize, increasing only by 9.6 percent (before which it had been effectively constant since 1955) some of the price increases will have had significant effects on the level of production and on the product mix. Price effects on tobacco production are likely to have been particularly marked with increases of 39, 53 and 8 percent for the grades recorded in the Table.

TABLE 5.A: Prices Paid by ADMARC for Selected Crops 1967/73 (t/lb)

<table>
<thead>
<tr>
<th>Maize</th>
<th>Cotton</th>
<th>Groundnuts</th>
<th>Tobacco</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade</td>
<td>Grade</td>
<td>Grade</td>
</tr>
<tr>
<td>A</td>
<td>Grade</td>
<td>Grade</td>
<td>Grade</td>
</tr>
<tr>
<td>1967</td>
<td>1.17</td>
<td>5.0</td>
<td>3.33</td>
</tr>
<tr>
<td>1968</td>
<td>1.05</td>
<td>5.0</td>
<td>3.33</td>
</tr>
<tr>
<td>1969</td>
<td>1.00</td>
<td>5.0</td>
<td>3.33</td>
</tr>
<tr>
<td>1970</td>
<td>1.10</td>
<td>5.0</td>
<td>3.33</td>
</tr>
<tr>
<td>1971</td>
<td>1.25</td>
<td>5.5</td>
<td>4.00</td>
</tr>
<tr>
<td>1972</td>
<td>1.25</td>
<td>5.5</td>
<td>4.00</td>
</tr>
<tr>
<td>1973</td>
<td>1.25</td>
<td>6.0</td>
<td>4.50</td>
</tr>
</tbody>
</table>

n.g. = no grade C.

Sources: Correspondence with ADMARC

N.B. 1. 2 tambala assumed equivalent to 2.4 pence.

2. Tobacco grades were changed from 1968 onwards.

Decreases in price are also important and the behaviour of maize prices, which fell by 17 percent between 1967 and 1969 then subsequently increased again by 25 percent, must have considerably influenced maize sales to ADMARC. Price changes of this magnitude may also have influenced maize production, which is of course not the same as the marketed surplus.

5.5.3 A Disincentive Situation with the Present Cotton Pricing System

It was shown by equations 4 and 5 that heavy rainfall late in the growing season causes a reduction in cotton quality which in turn leads to a fall in the average price per pound received by cotton growers (given the fixed prices per grade). It was also indicated in equations 1 to 3, and is generally accepted, that low rainfall in the main part of the growing season, November to February, causes a reduction in yields and probably also in the cotton acreage. On several occasions in recent
FIGURE 5.A. OFFICIAL COTTON PRICES 1950 TO 1971.

- A
- B
- C

No grade C for 1969 and 1970

FIGURE 5.B. COTTON PRODUCTION IN THE LOWER SHIRE AND AVERAGE PRODUCER COTTON PRICES IN THE PREVIOUS YEAR.

- Cotton Production
- Average Price of Cotton in Malawi Previous Year

(tons of cotton)

(tons per pound of cotton)
years these two weather effects have combined so that the disincentive
effect of low yields has been compounded by low average prices per pound
of cotton.

Table 5.8 presents evidence of the above mentioned circumstances
in the Lower Shire from 1955/56 onwards. The most dramatic manifestation
of the problem occurred in 1965/66 and 1966/67.

1964/65 was the bumper year for cotton in the Lower Shire Valley,
although the quality was not so high with the consequence that the
average price per pound was less than in 1963/64 despite stability in
grade prices.

1965/66 was a disastrous year; the mainfall at Ngabu was only
16.7 inches and as the F.M.B. report for 1966 puts it, "were it not
for the amazing drought resistant properties of cotton little or nothing
would have been produced in the Lower River". But not only were cotton
yields reduced, the quality of the crop was the lowest for 10 years thus
reducing the average price received per pound of cotton. To compound
the problem in this year the price of Grade A cotton was reduced from
5.41 to 5.00 tambala (from 6.5d to 6.0d) per pound. Not only was
production drastically reduced but the average price received by growers
also fell by some 12 percent per pound.

The following year 1966/67 was also a very poor one. The main
growing rains were light resulting in low yields, and there was relatively
heavy rainfall after February leading to even lower quality and prices
than the previous year.

The disincentive effect of two years of low returns must have
discouraged some farmers from planting cotton in 1967/68, although the
very low production of this year also owed something to the low rainfall.
However in 1967/68 crop quality improved causing average cotton prices
per pound to bounce sharply upwards despite stable official prices.

The situation of these years has been described in detail, but similar
problems of production, quality and prices also occurred in 1955/56 and
1956/57. Also in 1961/62 the fall in quality on what was a very large
cotton crop did much to nullify the effect of increased official prices
in that year.

It therefore appears that in 4 years out of the 17 examined,
production, quality and prices all fell together. The question is could
the pricing system be modified so as to overcome the sort of adverse
supply response reaction which these circumstance caused, particularly
in the depression from 1965/66 to 1967/68?
<table>
<thead>
<tr>
<th>Year</th>
<th>Lower Shire Production (Short tons)</th>
<th>Average Price of Cotton (t/lb.)</th>
<th>Grade A: Total Cotton (Percent)</th>
<th>ADMARC Cotton Prices Grade A (t/lb.)</th>
<th>Grade B (t/lb.)</th>
<th>Ngabu Rainfall November-February (inches)</th>
<th>March-May (inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1955/56</td>
<td>2,200</td>
<td>3.20</td>
<td>61.3</td>
<td>4.17</td>
<td>1.67</td>
<td>16.41</td>
<td>12.98</td>
</tr>
<tr>
<td>1956/57</td>
<td>3,600</td>
<td>4.22</td>
<td>76.5</td>
<td>5.00</td>
<td>1.67</td>
<td>31.30</td>
<td>7.59</td>
</tr>
<tr>
<td>1957/58</td>
<td>4,709</td>
<td>4.41</td>
<td>82.3</td>
<td>5.00</td>
<td>1.67</td>
<td>23.77</td>
<td>1.75</td>
</tr>
<tr>
<td>1958/59</td>
<td>8,966</td>
<td>4.65</td>
<td>89.4</td>
<td>5.00</td>
<td>1.67</td>
<td>22.47</td>
<td>3.60</td>
</tr>
<tr>
<td>1959/60</td>
<td>11,026</td>
<td>4.55</td>
<td>86.5</td>
<td>5.00</td>
<td>1.67</td>
<td>18.28</td>
<td>6.36</td>
</tr>
<tr>
<td>1960/61</td>
<td>10,292</td>
<td>4.51</td>
<td>85.4</td>
<td>5.00</td>
<td>1.67</td>
<td>16.07</td>
<td>3.76</td>
</tr>
<tr>
<td>1961/62</td>
<td>17,068</td>
<td>4.75</td>
<td>77.1</td>
<td>5.41</td>
<td>2.50</td>
<td>17.90</td>
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<tr>
<td>1962/63</td>
<td>8,899</td>
<td>4.85</td>
<td>79.4</td>
<td>5.41</td>
<td>2.50</td>
<td>27.54</td>
<td>9.01</td>
</tr>
<tr>
<td>1963/64</td>
<td>13,073</td>
<td>5.15</td>
<td>90.7</td>
<td>5.41</td>
<td>2.50</td>
<td>20.04</td>
<td>2.52</td>
</tr>
<tr>
<td>1964/65</td>
<td>19,025</td>
<td>4.92</td>
<td>83.0</td>
<td>5.41</td>
<td>2.50</td>
<td>27.07</td>
<td>3.53</td>
</tr>
<tr>
<td>1965/66</td>
<td>9,503</td>
<td>4.35</td>
<td>74.1</td>
<td>5.00</td>
<td>2.50</td>
<td>16.67</td>
<td>2.99</td>
</tr>
<tr>
<td>1966/67</td>
<td>7,159</td>
<td>4.22</td>
<td>67.5</td>
<td>5.00</td>
<td>3.65</td>
<td>16.94</td>
<td>11.44</td>
</tr>
<tr>
<td>1967/68</td>
<td>5,623</td>
<td>4.86</td>
<td>93.6</td>
<td>5.00</td>
<td>3.33</td>
<td>15.13</td>
<td>4.69</td>
</tr>
<tr>
<td>1968/69</td>
<td>11,974</td>
<td>4.48</td>
<td>81.7</td>
<td>5.00</td>
<td>3.33</td>
<td>24.38</td>
<td>4.34</td>
</tr>
<tr>
<td>1969/70</td>
<td>16,090</td>
<td>4.79</td>
<td>87.1</td>
<td>5.00</td>
<td>3.33</td>
<td>22.09</td>
<td>2.48</td>
</tr>
<tr>
<td>1970/71</td>
<td>15,829</td>
<td>4.96</td>
<td>78.9</td>
<td>5.50</td>
<td>4.00</td>
<td>23.64</td>
<td>6.30</td>
</tr>
<tr>
<td>1971/72</td>
<td>16,509</td>
<td>4.90</td>
<td>79.0</td>
<td>5.50</td>
<td>4.00</td>
<td>18.70</td>
<td>5.90</td>
</tr>
</tbody>
</table>

N.B. The average price of cotton and the quality of cotton are calculated for the Malawi crop since insufficient data are available to do this for the Lower Shire crop.
It is well known that price stability does not necessarily lead to income stability. With fixed product prices producer incomes tend to fluctuate equiproportionately with fluctuations in output, but in the case of cotton the effect of crop quality upon average prices means that incomes may fluctuate by a greater proportion than output.

In a closed commodity market fluctuations in income would be damped by having prices rise in years of low production and vice versa. Even in the case of an export crop such as cotton some such correctional action might be expected in an uncontrolled market. For in years of low production cotton ginners might bid prices up by competing amongst themselves to try and ensure throughput adequate to cover their fixed costs. Under the current arrangements such automatic balancing mechanisms are inoperative with the consequence that producer incomes and cotton production are probably less stable than they would be with a more flexible pricing system.

ADMARC does have provisions for a "price stabilisation" fund, and it is suggested that this be activated for the modified purpose of paying higher prices to production in years when weather conditions cause either extremely low production or a combination of reduced production with low cotton quality. It is apparent from our results and from the reports of agricultural officials that the likelihood of these circumstances arising can be ascertained before cotton markets open at the end of May. This would make it possible to adjust prices before payments to growers begin, thus obviating the need for a costly and perhaps unworkable system of second payments. Furthermore, the statistical results suggest that it might be possible to produce a mathematical decision model to calculate the sort of price adjustments required to achieve specified levels of income stabilisation.

5.5.4 Numerical Assessment of the Influence of Cotton Prices

On the assumption that the influence of cotton prices on production is adequately reflected by equation 3 it is possible to assess numerically the magnitude of this influence. Some qualification is however necessary: For this exercise the most critical coefficient is that for the production response to last year's price which is estimated at 2.3596. This estimate

*This was considered in a paper by C.P. Brown, "The Malawi Farmer's Marketing Board, East African Economic Review, Vol. 2, No. 1, June 1970 and led the author to conclude: "Relationships established ... show that price control may have destabilized farmer income neutralizing in part the possible production increasing effect of reduced price risk for cotton and groundnuts."
is that which (given the specification of the supply response system) has the highest probability of being the "true" coefficient. There are however definable probabilities that the true coefficient has other values. For example the probability that the true value lies between 1.30 and 3.40 is approximately 67 percent, while the probability that it is greater than 3.4 or less than 1.3 is 16.5 percent in each case. Thus in considering the following calculations it should be remembered that there is a range of values both above and below those presented which could be correct.

Another important qualification is that equation 3 is not designed to forecast; the aim in estimating it has been to try and correctly identify the supply-price relationship for cotton. The validity of the following exercises does not depend upon the ability of equation 3 to predict what actually happens but upon the accuracy of our key coefficient.*

One way of assessing the influence of prices is to ask:

(a) what would have been the predicted production in recent years given actual weather, prices and production in the previous year, and,

(b) by how much would production have differed if the average cotton price in the previous year had been different, but all other factors had been the same?

Table 5.C presents the results of this exercise, and the estimated effects of price can be seen to have been large. In 1967/68 for example it appears that had the 1966/67 price been 4.8 instead of 4.2 tambala per pound production might have been approximately 2,500 tons higher. Had the price been even higher at 5.0 tambala production might have been 3,500 tons greater than it was.

According to the equation used a one percent increase in price will always cause a 2.36 percent increase in production in the following year. Hence the larger the crop the larger the absolute effect of a given price increase upon production. In Table 5.C it is estimated that an increase in the previous years average price from 4.8 to 5.0 tambala

* Note that the equation can only produce estimates of production using actual or hypothetical data on weather, past prices and production. A "prediction" is therefore a statement of what production would be in stated circumstances, given that the cotton production system is represented by the equation. A prediction as the term is used here, is not a statement about the future.
might have increased production of about 950 tons in 1967/68 and 1,450 tons in 1971/72.

An alternative way of using equation 3 is to ask what would be the difference in predicted production have been if the price in the previous year had been the one prevailing two years before instead of what it actually was? That is, what would have happened to cotton production if average prices had not changed between the previous two seasons.

The estimated answer to this question is given in Table 5.D. It is estimated that the 0.66 tambala per pound increase in average cotton prices between 1966/67 and 1967/68 led to an increase in production of 3,246 tons in 1968/69. Similarly the decline of 0.38 tambala in price between 1967/68 and 1968/69 is estimated to have caused a reduction of 2,539 tons in 1969/70.

One further application of equation 3 is to estimate the answer to the question "what has or will be the effect on production of increased buying prices for cotton in recent years?" There have been two general increases in official cotton prices in recent years; one in 1971 when prices increased by 0.50, 0.67 and 0.13 tambala per pound respectively for grades A, B and C. According to equation 3, had these price increases been made one year earlier, in 1970, the 1970/71 cotton crop might have been approximately 4,500 tons larger than it was. The second change has been in 1973 with a 0.5 tambala per pound increase for all grades. Had this occurred in 1972 and had the 1972/73 season been one of normal pest incidence, the 1972/73 crop might have been increased by 4,600 tons.

All the preceding exercises have examined supply effects only for the year following the postulated price changes. However because of the (distributed lag) structure of equation 3 the full effects of a price change are not exhausted after one year, but continue with ever smaller increments in succeeding years. This is entirely what might be expected in that after taking account of other factors, production is more likely to be high in one year if it was so in the previous year. Thus a given price increase can be expected to have a cumulative influence over a number of years.

These numerical exercises have been conducted to illustrate the probable magnitude of the effects on cotton production of "quality" induced price changes and cotton pricing policy changes in recent years. It may be felt that the size of the estimated supply-price relationship is an overstatement of the true one. If in fact years of low prices
<table>
<thead>
<tr>
<th>Year</th>
<th>Actual Production</th>
<th>Actual Price t-1</th>
<th>Price in the Previous Year (tambala/lb.)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Actual Price</td>
</tr>
<tr>
<td>1967/68</td>
<td>5,623</td>
<td>4.22</td>
<td>6,990</td>
</tr>
<tr>
<td>1968/69</td>
<td>11,974</td>
<td>4.86</td>
<td>11,510</td>
</tr>
<tr>
<td>1969/70</td>
<td>16,090</td>
<td>4.48</td>
<td>11,985</td>
</tr>
<tr>
<td>1970/71</td>
<td>15,829</td>
<td>4.79</td>
<td>16,270</td>
</tr>
<tr>
<td>1971/72</td>
<td>16,508</td>
<td>4.96</td>
<td>15,476</td>
</tr>
</tbody>
</table>

N.B. 1. All predictions are made using the actual production in the previous year, and actual rainfall November to February.

2. All predictions are made using equation 3.
<table>
<thead>
<tr>
<th>Year</th>
<th>Predicted Production</th>
<th>Predicted Change</th>
<th>Actual Cotton Prices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual PC$_{t-1}$ (s.t)</td>
<td>Actual PC$_{t-2}$ (s.t)</td>
<td>in Production (s.t)</td>
</tr>
<tr>
<td>1968/69</td>
<td>11,510</td>
<td>8,246</td>
<td>3,246</td>
</tr>
<tr>
<td>1969/70</td>
<td>11,985</td>
<td>14,524</td>
<td>-2,539</td>
</tr>
<tr>
<td>1970/71</td>
<td>16,270</td>
<td>13,890</td>
<td>2,380</td>
</tr>
<tr>
<td>1971/72</td>
<td>15,476</td>
<td>14,255</td>
<td>1,221</td>
</tr>
</tbody>
</table>
had been predominantly associated with low yields then the estimated supply-price coefficient would have an upward bias, as it would include the effects of yield variation (and consequent variation in returns per acre) upon next year's cotton production. In the absence of a reliable time series of cotton yields from 1955/56 onwards it is not possible to satisfactorily test this hypothesis. While in some years low prices (given statutory prices) do appear to have been associated with low yields as for example in 1955/56, 1965/67 and 1966/67, there also appear to have been years in which low yields have been associated with relatively high prices e.g. 1957/58, 1962/63 and possibly 1967/68. Thus there is no strong evidence to suggest that the estimated relationship is necessarily biased. Nevertheless the possibility of upward bias does exist; but even if the true supply-price effects are only half the size of those estimated in equation 3, they are still large and suggest the existence of considerable benefits from a modified pricing system for cotton. Certainly the results suggest that the revival of cotton production since 1966/67 has owed much to increased producer prices resulting both from changes in ADMARC prices and from improvements in cotton quality.
CHAPTER SIX

ASSESSING THE CONTRIBUTION OF C.C.D.P. PHASE I TO COTTON PRODUCTION

As its name suggests the Chikwawa Cotton Development Project (CCDP) has been primarily concerned with the promotion of cotton production. The principal means of attaining this increased production has been by encouraging local farmers to spray their cotton with water soluble insecticides against prevalent pests, particularly red bollworms and cotton stainers, and to adopt improved husbandry methods such as planting in ridges. This strategy is spearheaded by the Project's extension service which operates with a high ratio of field demonstrators to progressive farmers, and by a credit scheme for the purchase of knapsack sprayers and insecticide. This campaign has been backed up by a programme of constructing roads for crop extraction, the drilling of boreholes to provide water for cotton spraying plus domestic use, and by a scheme for improving cotton marketing facilities. There is also a training programme covering a number of rural development topics, but the impact of this and other minor elements of the Project would be very difficult to measure. It had initially been intended to promote the introduction of improved maize varieties, but in view of uncertainty about the appropriate varieties this has been delayed until Phase II of the Project and the completion of certain trials.

The Project has created employment in the area, the improved water supplies will have alleviated many difficulties, the new road system will have improved communications, and there will have been numerous other elements of improvement in local conditions. Nevertheless increased cotton production was the prime objective of the Project, and this provides the key indicator of its success. The rest of this Chapter is concerned with trying to measure how much extra cotton production can be attributed to the C.C.D.P. during the first four years of its life, 1968/69 to 1971/72.

Disentangling the Project's contribution is complicated by the fact that many changing factors have been operating upon farmers willingness to grow and to spray cotton. Indeed, as indicated in Chapter 5 effective cotton prices have improved markedly since 1967/68, and these are felt to have played a not insignificant part in the recovery of cotton production. Presumably there are also other underlying changes which have affected production.
Given also that the Project's boundaries have expanded somewhat during its life it becomes difficult to arrive at an unequivocal measure of the Project's contribution.

Two alternative approaches to measuring CCDP's effect upon cotton production are attempted here. These are completely different in method and assumptions, but they lead to substantially the same numerical conclusion which tends to give them credence.

Method 1 treats the Project area as if it were an experimental plot, with the surrounding areas of the Valley as the control. Method 2 examines growth in the numbers of different classes of spraying farmers within the Phase I area, and aggregates their incremental production to obtain an estimate of cotton production due to CCDP.

6.1 Method 1.

All cotton is sold to ADMARC at its various markets. Each market serves a well defined locality, and all farmers within that locality can be assumed to sell their cotton at that market. Thus cotton production in the CCDP Area is equal to cotton purchases at all markets situated in that area. Similarly cotton production in the "Control Area" is equal to cotton purchases at those Lower Shire Valley cotton markets situated outside the CCDP Area. As can be seen from Figure 6.A the Control Area includes the whole of Chikwawa North, most of Nsanje North, Nsanje South, and that part of Chikwawa South to the east of the Shire River. Both the Control and CCDP areas have been subject to the same price changes, to broadly similar changes in climatic conditions and to similar fluctuations in pest incidence. The Control Area has basically fallen under the jurisdiction of the general Agricultural Extension Service run directly by the Ministry of Agriculture, the body which would have operated within the Project area had the CCDP not come into existence. Although there are some disimilarities between the two areas this is not thought likely to adversely affect estimation of CCDP's contribution in the Project area. The reasons for this judgement are touched upon in section 6.3 where cotton production indices for groups of markets are presented.

Definition of the two areas is complicated by the fact that CCDP boundaries have expanded during its life. Three markets, Sorgin, Sande and Tomali have been progressively assimilated into the Project until they are now completely within it; while the fraction of purchases at Tombondera and Moses markets which has been officially considered to emanate from the
Project area (to the south of the Mwanza River) has fluctuated from year to year.

It is the first three markets which present the major analytical problem. To illustrate this with the case of Tomali; in 1968/69 51 percent of purchases were considered to be from within the Project. This rose to 55.9 percent in 1969/70 and 100 percent in 1970/71. These proportions are based on the numbers of registered growers in the market area who fall under the control of Project extension staff. Quite clearly moving half of a group of cotton growers from the control of one extension service to another does not entitle the latter to claim all the production of these growers as being due to their efforts. In fact only a small proportion of this production can be rightly claimed depending upon the number of spraying converts made in the year of takeover.

To perform our calculations allowing the CCDP Area to grow and the Control Area to shrink would violate general experimental principles, and would lead to a gross upward bias in our estimates of the Project's contribution. The situation of minimum bias will be to define the CCDP Area to as to fully include Sande, Sorgin and Tomali markets at all times. Tombondera and Moses cotton purchases will be distributed between the two Areas using the weights applied in CCDP official statistics. Although these weights vary from year to year they reflect changes in the number of registered growers in the two areas and do not reflect changes in geographical boundaries. Thus the resulting CCDP and Control areas have constant geographical definitions.

Analytically it is assumed that the only difference between the two areas is that the Project is operative in the "experimental" area but not in the Control. Thus any growth of cotton production in the CCDP area over and above what would have occurred at growth rates equal to those in the Control area can be attributed to the Project.

The relevant calculations are presented in Table 8.A. First of all annual production is calculated for both areas as defined above, using the market data set out in Appendix III.1. From these series growth rates are calculated covering the first four years of the Project, with rates expressed as the ratio of one year's production to that of the previous year. Starting with the actual level of production for the base year 1967/68 it is possible to calculate what the CCDP area production would have been if production had grown at the same rate as in the Control area. By comparing this hypothetical production with actual production in the CCDP area it is possible
to estimate the Project's contribution to production.


<table>
<thead>
<tr>
<th>Year</th>
<th>Production CCPD Area (s.t)</th>
<th>Growth Rate CCPD Area</th>
<th>Production Control Area (s.t)</th>
<th>Growth Rate Control Area</th>
<th>Hypothetical CCPD Production without project</th>
<th>Actual Production CCPD Area (s.t)</th>
<th>Contribution of Project (s.t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1967/68</td>
<td>3,814</td>
<td>-</td>
<td>1,795</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1968/69</td>
<td>8,599</td>
<td>2.255</td>
<td>3,465</td>
<td>1.930</td>
<td>3,814</td>
<td>7,361</td>
<td>8,599</td>
</tr>
<tr>
<td>1969/70</td>
<td>11,601</td>
<td>1.349</td>
<td>4,475</td>
<td>1.291</td>
<td>7,361</td>
<td>9,503</td>
<td>11,596</td>
</tr>
<tr>
<td>1970/71</td>
<td>12,139</td>
<td>1.049</td>
<td>3,691</td>
<td>0.825</td>
<td>9,503</td>
<td>7,840</td>
<td>12,139</td>
</tr>
<tr>
<td>1971/72</td>
<td>12,575</td>
<td>1.036</td>
<td>4,160</td>
<td>1.127</td>
<td>7,840</td>
<td>8,820</td>
<td>12,575</td>
</tr>
</tbody>
</table>

Notes 1) CCPD area fully includes Sande, Sorgin and Tomali throughout, and those fractions of Moses and Tombondera used in official CCPD statistics.

2) The Control area production is all Lower Shire Valley cotton production not attributed to CCPD.

3) Hypothetical CCPD production in year t equals the year t-1 hypothetical production (starting with actual 1967/68 production in 1968/69) multiplied by the Control Area growth rate, i.e. column 4 times column 5.

According to this estimation procedure it appears that by the fourth year of the Project its annual contribution had risen to around 4,000 tons of cotton. One cannot necessarily say that this would have been higher had 1971/72 been a better growing season. This would depend upon the comparative growth rates of the two areas.

It has to be allowed that the control area is not exactly homogenous geographically and climatically with the CCPD area. There are however many similarities and both contain "difficult" areas. Whatever differences there may be there are reasons (as follows) for feeling that the comparison of the
recent production achievements of the two Areas is fair to the CCDP.

a) The base year 1967/68 had the lowest level of cotton production of any year since before 1958/59 and the slump was more pronounced in the CCDP area (see the indices in section 6.3). That is production in the Project area in 1967/68 was lower compared to previous levels than in surrounding districts. Thus given any restoration of confidence in cotton there was a bigger reservoir of previous experience in the CCDP area on which to base the expansion. Both the advent of the Project and increased "effective" cotton prices and yields created that confidence.

b) The Control area contains both Parliamentary Districts in Nsanje, which are the only ones in the Valley not to show any marked increase in cotton production since 1967/68 (see section 6.3). To a large extent this is accounted for by the fact that rice has become a major cash crop in the arable areas on the east side of the River.

It is true that these districts together accounted for only 4.5 percent of Lower Shire cotton production in 1971/72, but had they experienced the same growth as elsewhere this would have been 9 percent or more.

c) Both areas contain highly populated parts where land pressure is high. But equally both contain parts where new land is being brought under cultivation and which have contributed substantially to the growth in cotton production.

d) It does appear that, in anticipation of the expansion of the CCDP into a second phase covering the whole Lower Shire Valley, there has since 1971 been an increasing involvement of Project staff in the Control Area. This perhaps undermines the concept underlying the control versus experimental area idea, and if these staff have had a marked incremental (as opposed to substitutional) effect upon the Control Area then Method 1 will tend to underestimate the Project's contribution to cotton production.

6.2. **Method 2.**

In many ways this second attempt to estimate additional cotton production attributable to CCDP is less satisfactory than the first, in that it involves a larger number of assumptions, some of which are not as well
supported as one would like.

Method 2 is based upon the following assumptions:

a) The contribution of the Project is equal to the additional cotton production of all new cotton spraying farmers who have adopted the technology since the start of the Project in April 1968.

b) All classes of spraying farmers would in the absence of the Project have grown cotton without spraying on exactly the same acreage.

c) Hence the amount of a spraying farmer's output due to the Project equals the average yield for the type of spraying farmer minus the average yield of unsprayed cotton times the average sprayed acreage of the type of farmer.

d) There are three categories of spraying farmer:

(i) Registered spraying farmers who own sprayers.
(ii) Unrecorded spraying farmers, who hire sprayers and buy insecticide surplus to the requirement of registered spraying farmers.
(iii) Aerial spraying farmers - these participated in a scheme whereby cotton land was consolidated into blocks and sprayed by plane at a fixed price per acre.

e) The knapsack sprayed cotton acreage of aerial spraying farmers is treated separately but in the same way as the acreage of registered spraying farmers.

f) It is assumed that the Project has not caused any growth in the production of unsprayed cotton. This is tantamount to saying that the Project converts non-spraying into spraying farmers, and that any increase in the number of cotton growers is due to growth of the population and the response to economic conditions.

g) There were 145 farmers already spraying cotton in the Project area in 1967/68 before CCDP began. The production of these men has to be eliminated from consideration in order to assess the Project's output.
Table 6.B. Estimate A of the Additional Cotton Production Caused by the Chikawa Cotton Project - Method 2. (short tons)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Registered Spraying Farmers</td>
<td>1,146</td>
<td>1,789</td>
<td>3,371</td>
<td>2,613</td>
</tr>
<tr>
<td>2) Aerial Spraying Farmers (1)</td>
<td>-</td>
<td>102</td>
<td>376</td>
<td>277</td>
</tr>
<tr>
<td>(2)</td>
<td>-</td>
<td>53</td>
<td>172</td>
<td>99</td>
</tr>
<tr>
<td>3) Unrecorded Spraying Farmers</td>
<td>313</td>
<td>435</td>
<td>685</td>
<td>441</td>
</tr>
<tr>
<td>Total Incremental Production</td>
<td>1,459</td>
<td>2,379</td>
<td>4,604</td>
<td>3,430</td>
</tr>
</tbody>
</table>

Notes
(1) Details of the assumptions, data and calculations used are presented in Appendix III.2.
(2) Item 2.1 is the incremental production from aerial sprayed plots. Item 2.2 is the incremental production from the knapsack sprayed gardens of aerial sprayers.

The results presented in Table 6.B. are remarkably similar to those obtained by Method 1. However for the years prior to 1971/72 these results overstate the incremental production of spraying farmers. This is because the yield estimates employed are those published in official CCDP statistics and as is now accepted for years before 1971/72 these have a pronounced downward bias (see Appendix III.2 for details). After studying various yield data contained in the studies cited in Appendix III.3 it appears more reasonable to assume unsprayed cotton yields of 500, 400 and 400 pounds for 1968/69, 1969/70 and 1970/71 respectively. Recalculating the contributions of the various classes of spraying farmers using these assumed yields gives the results portrayed in Table 6.C.

It can be seen that these adjusted results show a broad measure of agreement with those obtained by Method 1. In view of the entirely different routes employed by the two methods this similarity is striking. It certainly suggests that an estimated contribution of 4,000 tons in years 1970/71 and 1971/72 will not be far from the true figure.
Table 6.C. Estimate B of the Additional Cotton Production Caused by the Chikwawa Cotton Project - Method 2.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Unsprayed cotton yields (lbs)</td>
<td>500</td>
<td>400</td>
<td>400</td>
<td>324</td>
</tr>
<tr>
<td>1) Registered Spraying Farmers</td>
<td>899</td>
<td>1,679</td>
<td>2,646</td>
<td>2,613</td>
</tr>
<tr>
<td>(2) Aerial Spraying Farmers</td>
<td>-</td>
<td>92</td>
<td>310</td>
<td>277</td>
</tr>
<tr>
<td>3) Unrecorded Spraying Farmers</td>
<td>217</td>
<td>358</td>
<td>471</td>
<td>441</td>
</tr>
<tr>
<td>Total Incremental Production</td>
<td>1,116</td>
<td>2,176</td>
<td>3,562</td>
<td>3,430</td>
</tr>
</tbody>
</table>

Method 2 would certainly have given a higher estimate of the Project's 1971/72 contribution had yields in that year been closer to normal levels. For example had yields averaged 900 pounds to knapsack sprayed land, 1,000 pounds to aerial sprayed plots, 600 pounds on land managed by unrecorded sprayers, and 400 pounds on unsprayed land, then the Project contribution would have been estimated at 5,238 short tons. This is in a sense the magnitude of the Project's potential contribution, and is certainly closer to the 1971/72 target than the actual achievement. It is, of course, possible to argue with some of the assumptions used in Method 2.

a) There must be a possibility that some land currently under sprayed cotton would have been planted to crops other than cotton in the absence of the Project. However the converse possibility also exists. Because of the high labour demands of sprayed cotton, it would have been possible for farmers to grow a larger acreage of cotton if it were not sprayed.

b) Some farmers would have become spraying farmers under the guidance of the normal Extension Service. In fact the number of spraying farmers outside Chikwawa South (basically the Project area) increased from 452 in 1967/68 to 1,058 in 1971/72. Thus by attributing all increased spraying farmers to the Project undoubtedly overstates the case and causes an upward bias in the estimated contribution.

c) A downward bias will have resulted if it were accepted that non-sprayed cotton yields would be lower if a substantial acreage was not now subject to pest control measures.
d) A thornier problem is posed by the assumption that the presence of the Project has not caused there to be more non-spraying farmers than there otherwise would have been. The crux of the problem is that the number of non-spraying cotton farmers is not known. The figure has traditionally been estimated by subtracting the number of spraying farmers from the number of registered growers. A registered grower is someone who obtains free cotton seed from ADMARC. It is well known that there is multiple registration by cotton growing households, and the basis for calculating Lower Shire cotton statistics has been substantially modified for 1971/72 to correct for this.

It is allowed that there has been a very substantial increase in the number of registered growers since 1967/68. But to the extent that there is multiple registration and to the extent that this may have changed (increased) it is impossible to estimate actual number of growers in the relevant years. Moreover some part of any increase in nonspraying growers which may have occurred will be the result of the improved returns to cotton and to a small extent due to population growth and not solely to the Project. To the extent that the Project has caused a greater rate of increase in nonspraying growers than in the Control Area, Method 2 understates the Project's contribution.

What direction (positive or negative) the sum of all these and other, possible biases may have is not possible to say. In the absence of certain knowledge of what might have been, the current estimates of the contribution of CCDP appear reasonably well founded.


Some interesting insights into recent and potential growth of cotton production can be obtained by subdividing the Lower Shire Valley into a number of smaller areas and examining the recent production histories of these. Each area thus defined comprises a small number of ADMARC markets which are related in some way. The following areas have been defined:
A. CCDP North is divided into three areas,

(1) Tombondera and Moses. These two markets in the Mwanza Valley are partially within and partially outside the Project. For the purposes of this section they are treated as wholly inside the Project.

(2) Tomali and Sande. These two markets are contiguous and were only finally fully assimilated into the CCDP area in 1970/71.

(3) The rest of CCDP North. This includes Mandarađe, Ndakwera, Mangulenje, Nchalo, Ntowe, Therere, Mwala and Mikalango.

B. CCDP South is subdivided into two areas,

(4) Sorgin, Masanduko and Msangwe - the three most southerly markets.

(5) All other markets - These include Msomo, Saopa, Dolo, Konzere and Alumenda. The latter two markets were closed after the 1964/65 season.

C. Chikwawa North is divided into three areas,

(6) Nkadana and Chapananga. These were the two most westerly cotton markets in the Mwanza valley prior to the current (1973) season.

(7) Mitole, Kasisi, Mikolongo and Massea. These are the remaining Chikwawa North markets on the west bank of the Shire if Tombondera and Moses are left out of account.

(8) Maperera and Nhake. These are on the east bank of the Shire.

D. Nsanje North is divided into two areas,

(9) Chakanza, Livunzu, Muona and Chiromo - all lie to the east of the Shire.

(10) Chithumba, Phokera and Tengani - all lie to the west of the Shire.

E. Nsanje South is not subdivided. For a number of years it has been an insignificant cotton producing area.
Two sets of cotton production indices are presented for the 10 sub-areas and 5 areas designated above. The first set in Table 6.D uses the base 1961/62 to 1963/64 inclusive. 1961/62 was a very good production year, while 1962/63 and 1963/64 were average to good. These were years when cotton production had apparently reached a stable fairly high level in the absence of insecticide spraying technology, and they provide a good base to which to relate current levels of production.

The second set of indices in Table 6.E employ the base of 1966/67 and 1967/68. These years represent the depths of the slump in cotton production and provide a good base for examining both the extent of the subsequent recovery, and also the scale of the decline which had occurred.

All indices are prepared from the data presented in Appendix III.1.

Taking the indices in Table 6.D first the following points clearly emerge:

a) The long term increase in cotton production since the early 1960's has been due mainly to the northern part of the Lower Shire Valley, which is where pressure on the land has been least.

b) The highest rates of long-term production have been in two of the three areas wholly in Chikwawa North and in Tambondera and Moses which are substantially in Chikwawa North.

c) Production increases since the base years in the two areas wholly in CCDP North (areas 2 and 3) have considerably exceeded those in CCDP South and in the various areas of Nsanje.

d) Production in the main growing area of CCDP South, that around Ngabu, had by 1972 only just reached the level of the early 1960's.

e) Although 1972 production in market area 4 in CCDP South was running 34 per cent above the base level, CCDP South as a whole was producing only 11 per cent more. Moreover since 1970 production in this area has shown a tendency to stagnate or even to fall, but this has been the case in all areas other than CCDP North.
f) In Nsanje North and South production in 1972 was running well below the base levels, particularly in the west bank areas (10 and E) where production has fallen to a quarter or less of its former level.

g) The basic conclusion appears to be that since the early 1960's cotton production increases have been small or non-existent in areas of well established populations, for example in areas 5, 7, 9, 10 and E. In area 5 this has been so despite the widespread adoption of cotton spraying, and it tends to suggest that the limits on long-term expansion of the cotton industry may be more severe than planning projections have allowed for.

By choosing a different base for the indices in Table 6.E different highlights of the data emerge, although the basic information in both sets of indices is identical. The following points in particular emerge clearly:

a) In speed and size of recovery in cotton production since the slump of 1966/67-1967/68 CCDP South has only been surpassed by the markets of Chapananga and Nkadana. This is not so surprising in view of the fact that the depression was more severe in CCDP South than elsewhere, with 1967/68 production less than a quarter of its 1964/65 level and just over one third of its 1963/64 level. These facts bear upon the assessment of CCDP's contribution to the general increase in production after 1967/68, since the speed of reaction of the CCDP area suggests that it is due in large part to improved confidence by growers (as a result of higher prices and yields and the fact of the Project's presence) rather than wholly to the impact of the new cotton spraying technology.

b) Cotton production in Nsanje North and South has hardly recovered at all since the slump of the base years, and in 1971/72 it stood slightly lower than the 1966/67-1967/68 average.

c) With the sole exception of market area (7) cotton production in all parts of CCDP North and Chikwawa North has recovered well from the depression.
Table 6.D Cotton Production Indices (1961/62 to 1963/64 = 100)

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a) Konzere and Alumenda production assumed at 630 tons. b) Mikolongo Production assumed at 150 tons. c) Base 1961/62 plus 1963/64 = 100. d) Chithumba production missing.
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a) Konzere and Alumenda production missing  b) Mikolongo Production missing  
c) Phokera Production missing  d) Chithumba Production missing
CHAPTER SEVEN

NOTE ON AGRICULTURAL SUBSIDIES

The main purpose of this Chapter is to examine some of the economic issues of giving free cotton seed to farmers, and it emerges that there is a strong economic case for abandoning this particular subsidy. However it seems pertinent to expand the discussion slightly to touch upon the nature of the transfer payments which finance the other subsidies available to small-holders, and this is done very briefly.

There are in fact comparatively few subsidies available to farmers in the Lower Shire Valley. Cotton farmers in the area are able to benefit from an approximately 45 per cent subsidy on the purchase price of knapsack spraying machines in addition to receiving free issues of seed. Free irrigation water is made available to the comparatively small number of farmers growing rice on the Muona Rice Scheme. Farmers in the area may also be adjudged to benefit from subsidies arising from the crop pricing system. This is probably particularly true of rice growers whose product appears to be currently overpriced and in effect subsidised; this contributes to the attractiveness to farmers of rice as a crop, which was noted in Chapter 4.

The main effect of subsidies, and indeed their aim, is to make some forms of economic activity more attractive. By making available inputs at below cost the farmer's returns from their use are higher than they would be at full cost. This creates an inducement which leads to increased use of the inputs, to more rapid adoption of the technology associated with them, and to the more rapid growth of agricultural production. In general, these are precisely the required effects when some new input or product is being introduced into the agricultural system. However when the product or technology is well established the maintenance of subsidies results in more resources being employed in a particular use than is justified purely in terms of short-run economic efficiency. This results from the fact that more resources are devoted to the subsidised products and less to the unsubsidised products than would be induced by prevailing market determined prices. Of course long-run economic efficiency may be consistent with occasional subsidisation of even established crops. There may also be non-economic considerations which determine the desirability of subsidising certain producers. Nevertheless it does seem worth making
a brief investigation of the implications of the subsidies affecting Lower Shire Valley farmers.

7.1. Free Inputs - Cotton Seed.

The problem with free inputs is that people will use them for purposes and at levels where the productivity of the resources is less than their true opportunity cost. In a sense this is a problem which usually arises where the cost of using an input does not vary with the amount used.

Free cotton seed appears to have given rise to precisely the situation just outlined. It is generally accepted that there is considerable wastage of seed. One source of this is the alleged extravagance of farmers in the number of seeds they plant at each planting station. Another is said to be the burning of seed to repel mosquitoes. It is possible to consider the costs of this particular subsidy in some detail, using as the case study area the former CCDP Phase 1 area for which adequate statistics are available.*

Table 7.A contrasts the output per pound of seed issued to growers (largely Young Pioneers) at Mangulenje Settlement Scheme in the CCDP area, with that for the CCDP area as a whole. It is perhaps wise to omit 1971/72 from detailed consideration as this was a year of low yields in which replanting of whole fields was common.

Taking the other two years it can be seen that for the CCDP area as a whole the ratio of production to seed issued was low. Certainly settlers at Mangulenje achieved much higher rates of performance with the same climatic and soil conditions. Admittedly all the cotton at Mangulenje is sprayed against insects with consequent higher yields, whereas this is not true for the Project area as a whole. Nevertheless if it is accepted that unsprayed cotton yields are typically about 40 per cent of sprayed yields then it would be consistent with the Mangulenje data to expect that, in an average year, the CCDP area as a whole (plus that outside the Project) should technically be capable of achieving an average output of 15 pounds of cotton to 1 of seed. If this level had been achieved in recent years approximately 50 per cent of seed issues could have been released for oil extraction, without any loss of cotton production. At the current price of K46 per ton of cotton seed for oil

* The statistics employed were provided by CCDP staff. They are not based upon a modified definition of the Project area such as that used in Chapter 6. For 1970/71 the data used vary slightly from those published in the CCDP Annual Cotton Statistics 1970/71 to allow for seed issued at new markets.
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<th>Mangulene</th>
<th>All CCDP</th>
<th>Mangulene</th>
<th>Per 1 lb Seed</th>
<th>15 lbs/1b Seed</th>
<th>Total Value of Seed Issued</th>
<th>Value of Seed per pound of Cotton Produced</th>
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Note: n.c = not calculated, because 1971/72 was a difficult growing year and the 1:15 standard may have been unattainable.
extraction this would be a valuable gain; the potential gain in
1969/70 of 780 tons of seed would have been valued at K35,880 and
in 1971/72 the figure would have been K33,304.

If an improvement in seed utilisation efficiency were brought
about as a result of charging farmers for the seed the potential
economic gains exceed those just stated. For if farmers were charged
for seed at the full rate of K46 per ton or 2.3 tambala per pound,
ADMARC receipts would increase to the full value of the seed issued
irrespective of whether it was sold for oil extraction or for seed.
In the last few years these additional receipts would have been large
enough to permit an increase in cotton prices sufficient to compensate
for their additional seed costs, but yet to leave ADMARC with additional
surplus. At the same time it would have released seed, which would
otherwise have been wasted, for oil extraction and the addition of
extra value.

To see how this would work consider the following example. In
1969/70 the total value of seed issued in the CCDP area was at 1973
prices worth K68,172, equivalent to 0.32 tambala per pound of cotton
purchased. Assume, conservatively, that after pure waste is allowed
for farmers actually obtained 10 pounds of cotton for every pound of
seed planted (i.e. 427 tons out of the 1,482 were wasted). If these
farmers had paid 2.3 tambala per pound of seed they would have been able
to recoup this if they received 0.23 tambala extra for each of the 10
pounds of cotton produced. In fact ADMARC would have been able to pay
anything up to 0.32 tambala per pound and still make a profit.

The same basic argument also holds for 1969/70 except that the
maximum additional payment by ADMARC would have been 0.22 tambala per
pound of cotton.

It is worth noting the following points about the proceeding
calculations:-

a) Any farmer who raised his efficiency above the 10:1
level could improve his returns if cotton seed cost
2.3 tambala per pound and the price of all cotton
grades were increased by 0.23 tambala.

b) In recent years when the average price per pound of
cotton sold has been less than 5 tambala a pound, a
0.23 tambala per pound increase would have been equi-
valent to a rise of more than 4.6 per cent.
c) If ADMARC paid back to farmers the full return from
the additional sales revenue from the former free
issues of seed, the break-even level of efficiency
in seed use would be less than 10 to 1. For instance
in 1969/70 when ADMARC would have been able to pay
0.32 tambala per pound for cotton a farmer would only
have had to sell 7.19 pounds of cotton at this price
to recoup the 2.3 tambala outlay on a pound of seed.
Amazingly this (7.19 to 1) low level of efficiency is
almost exactly the one actually achieved in that year
(7.12 to 1). Thus very little gain in efficiency would
be needed to start producing economic benefits.

There are three potential economic benefits which can
accrue from introducing charges for cotton seed which
result in increased efficiency of seed use. These are:
1. Increased seed delivered for oil extraction.
2. Increased profits to cotton farmers.
3. Increased profits to ADMARC.
Items 2 and 3 are inversely proportional, in that any
increase in payments to farmers decreases ADMARC's share
of the extra revenue. Provided that seed use efficiency
is above the level at which ADMARC has to pay all its
revenue from the sale of seed to farmers in compensation
for their costs of purchasing seed, there would be a
surplus to be shared between ADMARC and producers. The
calculations just performed suggest that this minimum
level of efficiency can certainly be exceeded.

e) Seed diverted for oil extraction would have value added
in the subsequent processing which would lead to
additional benefits to the Malawi Economy over and above
those accruing to ADMARC and the cotton growers.

f) The calculations performed indicate the potential benefits
for the former CCDP Phase 1 area only. These therefore
understate the total potential gains of nationwide abandon-
ment of the free seed policy.

g) If it is adjudged that K46 per ton is too high a valuation
of the opportunity cost of the free seed the scale of
benefits and charges in the above calculations should be
lowered. Exactly the same conclusions apply but the size
of the benefits and the seed prices charged would be lower.

From the above arguments it is clear that there is a strong economic argument for abandoning the subsidy of free cotton seed. Insofar as this case illustrates the problems of issuing free inputs in general, it is likely that there is a strong argument for making some charge for all inputs currently issued free.

7.2. Subsidies as Transfer Payments.

In the case of free cotton seed it can be argued that the costs of the subsidy are borne by cotton growers themselves. This is so to the extent that cotton prices might be higher were it not for the costs of distributing free seed. It is true that the most inefficient farmers benefit more than efficient ones, so that effectively there is a small transfer payment from the former to the latter. This is because the cotton revenue foregone by efficient farmers in effect exceeds the true costs of the seed they use, while the converse is true for inefficient farmers.

In the case of free irrigation water the costs of subsidisation are borne mainly by taxpayers. This is so irrespective of the proportions of capital and recurrent costs which have been provided from either Malawi Government revenues or from overseas aid funds. If the funds are predominantly from the former source it is clearly the taxpayers who bear the cost, and in the latter case taxpayers will pay the cost at a later stage when the loan is repaid. Thus in either case there is a transfer payment from taxpayers to the recipient farmers.

Possibly the most important subsidies are the inter-crop and inter-regional ones. With the current crop pricing policy some crops such as tobacco and groundnuts make consistent profits for ADMARC whilst others such as rice and maize make losses. Given ADMARC's commercial policies, the losses on some crops can only be tolerated as a result of profits on others. Hence the growers of profitable crops subsidise growers of loss making crops i.e. from tobacco and groundnut growers to those of maize and rice. Some areas produce more of the profitable crops and these therefore subsidise areas in which the main crops are those traded at a loss.

The most important source of inter-regional subsidisation is due to the policy of paying standard prices to growers irrespective of location. In a country with such expensive transport as Malawi market determined
agricultural prices would differ greatly from one area to another. A
detailed study could almost certainly show that fixed national prices
produce substantial subsidies from the growers in some regions to those
in others. Such a study would illustrate the economic costs of
achieving development objectives through the policy of nationally
fixed prices.
CHAPTER EIGHT

SUGAR

Commercial sugar production in the Lower Shire Valley commenced in 1966 with the harvesting and production of 3,417 short tons of raw sugar by the Sugar Corporation of Malawi (SUCOMA) at Nchalo in South Chikwawa. Production expanded rapidly to reach 37,218 tons of raw and mill white sugars in 1972 with a value of approximately K4 million ex-factory. This is valued at prices agreed with the Malawi Government, K90 per ton of raws and K106 per ton for mill white in bulk (a higher price is paid for sugar in retail packages), and has an appreciably higher value at current import substitution prices. However even valued at the agreed prices sugar had become by 1972 the most valuable single product in the Lower Shire Valley and had overtaken cotton, production of which was 16,509 tons in 1972 with a value of approximately K3 million after ginning.

A brief review of some aspects of the economics, agronomy and organisation of sugar production is clearly in order not only because of the importance of sugar to the region, but also because of its bearing upon two key issues in agricultural development planning for the Lower Shire Valley. One issue concerns the choice between irrigated and rainfed agriculture, and the other the choice between estate and smallholder development. One other matter is also briefly raised, and this relates to the possible social costs of estate development. In particular, it examines the economic valuation of land which is implied by the current compensation procedures by which land is transferred from smallholder to estate management.

8.1. Agronomic Considerations.

Average annual rainfall at Nchalo is approximately 26 inches. Temperatures are high, with a mean evaporation rate of 78.9 inches. Thus there is a considerable water deficit which cannot be tolerated by a perennial crop such as sugar which has a twelve month growing period between harvests. At the Nchalo estate this deficit is made good by applying between 40 and 50 inches of water per acre annually by means of sprinkler irrigation. With irrigation at this rate and fertilizer

* Gilroy Colman and David Humphrey, The Nchalo Sugar Estate, draft of an Information booklet.
applied at 700 pounds per acre it is however possible to create excellent growing conditions for sugar.

SUCOMA have been able to obtain average sugar yields in excess of 5 short tons per acre (see table 8. A). Furthermore it is expected that yields can be maintained at around 5.5 tons of sugar per acre, despite the fact that the estate is to be expanded onto soils which the Halcrow Survey considered likely to give slightly lower yields than those already under cultivation. These high yields have been achieved with cane cut at less than 12 months of growth, so that sugar formation has achieved remarkably high levels approaching 0.5 tons per acre per month. In part this achievement reflects the efficiency of the factory processes of extraction. Nevertheless from what we can gather, from an agronomic point of view, exceptionally high biological efficiency is also being achieved in the production of cane sugar.

Table 8.A. Yields of Sugar and Cane on the Sucoma Estate at Nchalo 1966 to 1972.

<table>
<thead>
<tr>
<th>Year</th>
<th>Average Yield of Cane (s.t./acre)</th>
<th>Average Yield of Sugar (s.t./acre)</th>
<th>Average Age of Cane at Harvest (months)</th>
<th>Sugar per Month of Cane Growth (S.t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1966</td>
<td>34</td>
<td>2.9</td>
<td>13.0</td>
<td>0.22</td>
</tr>
<tr>
<td>1967</td>
<td>45</td>
<td>4.3</td>
<td>12.5</td>
<td>0.34</td>
</tr>
<tr>
<td>1968</td>
<td>49</td>
<td>5.2</td>
<td>11.1</td>
<td>0.47</td>
</tr>
<tr>
<td>1969</td>
<td>48</td>
<td>5.5</td>
<td>11.3</td>
<td>0.49</td>
</tr>
<tr>
<td>1970</td>
<td>52</td>
<td>6.0</td>
<td>11.67</td>
<td>0.51</td>
</tr>
<tr>
<td>1971</td>
<td>50</td>
<td>5.7</td>
<td>11.24</td>
<td>0.51</td>
</tr>
<tr>
<td>1972</td>
<td>47</td>
<td>5.1</td>
<td>11.50</td>
<td>0.44</td>
</tr>
</tbody>
</table>

A further dimension to the efficient biological performance of cane in the Lower Shire Valley concerns the performance of successive ratoons on the SUCOMA estate. Apparently yields of successive ratoons have shown little tendency to fall off and are being maintained up to the sixth and seventh ratoons. It is normal for yields to fall off before this stage. The consequence is that the need for replanting cane is less frequent in the Lower Shire than in most other places. Since the plant crop is more expensive to produce than the ratoon crops this helps keep production costs down in this area.

8.2. **The Economics of Sugar Production.**

Discussion of the profitability of sugar production in the Lower Shire Valley is synonymous with discussing the profitability of SUCCO, which is the sole producer and refiner of sugar and a subsidiary of Lonrho. For obvious commercial reasons there are some facts which the company prefers not to make available for general publication, and these include the rate of profit on the operation. However in view of SUCCO's preparedness to expand its estate to approximately twice its present size - from an estimated 11,800 acres in 1973 to 22,000 acres in 1976 - it may safely be assumed that returns on the substantial capital investment involved are commercially competitive; and this is sufficient information for development planning purposes. SUCCO have, however, generously made other data available and these will be used below to make some brief comparisons between the economics of sugar production and those of other crops.

Before moving on to the microeconomics of sugar production a few points about the macroeconomic aspects: Regarding the contribution of sugar to Malawi's overseas trade balance it is possible to agree with Humphrey* that despite the import of expensive capital items SUCCO has made a substantial positive foreign exchange contribution. In 1965, the year before sugar production began at Nchalo, Malawi imported some 18,750 short tons of sugar valued at approximately K2 million. Due to the output of SUCCO, Malawi managed to be a net exporter of 1,000 tons of sugar in 1971, although in the following year there were net imports of approximately 2,000 tons. From 1973, when Malawi is to export 15,000 tons of sugar under a U.S. quota it is confidently expected that she will become a substantial net exporter. Malawi was also seeking to become an exporting member under the International Sugar Agreement (ISA). Without SUCCO, sugar imports would have risen substantially above their 1965 level since sugar consumption has almost doubled from 18,750 to approximately 38,000 short tons in 1972. It is likely that domestic consumption in 1972 would have been somewhat below this level in the absence of SUCCO, but if 38,000 tons had been imported in 1972 it would have cost well over K5 million in foreign exchange. The combined annual savings plus earnings of foreign exchange from sugar will continue to increase above the annual rate of K5 million which already provides an exchange surplus above the costs of imported capital and material items required for sugar production.

* David Humphrey, *The Economics of Sugar Production*, an unpublished draft paper.
Sugar production is also making a substantial contribution to the value of output in the National economy (as also is cotton). Humphrey estimated this contribution in 1971 to be K3.5 million to Gross Domestic Product (GDP) and K2.3 million to Gross National Product. Even at these levels sugar contributed about 1.4 percent of G.D.P. in 1971, and this will have increased since then.

Sugar, unlike cotton, is providing a substantial source of tax revenue to the Government. An excise tax of K10 per ton is levied in addition to a surtax of 10 percent of the value per ton, giving a total tax of approximately K20 per ton. There will be additional tax revenues from personal income and company taxation but the value of the direct taxes on sugar must have amounted to approximately K750,000 in 1972.

Turning now to the microeconomics of sugar production, it has to be allowed at the outset that the capital investment per acre of sugar far exceeds that for any other crop grown in the Lower Shire Valley. For this reason in order to permit comparison between sugar and other crops it is preferable to value sugar as it is delivered to the factory. In this way returns and costs in the processing of sugar can be left out of account and sugar can be valued as if it were grown by smallholders at its gross value to such farmers.

To obtain the value of cane delivered to the factory it is possible to use the type of pricing factor used for assessing smallholder cane where there are outgrower schemes. A typical arrangement would be that smallholders would receive 60 percent of the realisable sugar value in the cane, the other 40 percent being paid to cover the processing costs. This is a lower share than sometimes allowed to smallholders, but it seems to tie in fairly well with SUCOMA's breakdown of their cost structure. They in fact estimate that the direct cost of field operations (including delivery of cane to the factory) accounts for 44.1 percent of total costs. To this must be added the appropriate share of the administrative overheads which are assessed at 19 percent of total costs. If in addition the share of company profits attributable to the land as opposed to the factory are allocated to the land a 60:40 split between land and factory may well be reasonable. At the 1972 average price of approximately K100 which SUCOMA received for its sugar (after allowance is made for the proportions of raw and refined sugar) the value of one ton of sugar delivered as cane to the factory would therefore be K60. At average yields in excess of 5 tons of sugar per acre this is equivalent to over K300 which has to cover the
costs of transporting cane to the factory, irrigation water, labour, fertilizer and administrative overheads. Alternatively stated K300 is the amount that a smallholder cane grower might expect to receive per acre to cover the costs of production. Looked at from this standpoint the following observations appear pertinent.

1. According to figures prepared by SUCCOMA the estimated cost of producing an acre of cane and delivering the cane to the factory is K176. This costing only allows for 40 acre inches of irrigation water at K1.40 per inch. In fact recent experience suggests that 45 acre inches is a more realistic average figure, which would entail adding K7 to the production costs. This would give the following structure to costs.

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour - cane cutting</td>
<td>10</td>
</tr>
<tr>
<td>Labour - other</td>
<td>40</td>
</tr>
<tr>
<td>Transport (60t x 50 tons cane)</td>
<td>30</td>
</tr>
<tr>
<td>Irrigation (K1.40 x 45 acre inches)</td>
<td>63</td>
</tr>
<tr>
<td>Fertilizer (700 lbs per acre)</td>
<td>22</td>
</tr>
<tr>
<td>Tractor hours (K2 per hour)</td>
<td>10</td>
</tr>
<tr>
<td>Herbicides</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>183</strong></td>
</tr>
</tbody>
</table>

In a smallholder scheme the labour costs would potentially accrue to the farmer thus allowing reduction of his costs to K133. Insofar as the herbicide cost reflects a shortage of labour for weeding on the SUCCOMA estate, this cost would not be expected to be incurred by smallholders; costs reduced to K125. The cost of transporting cane would almost certainly be higher for an outgrower scheme sited on the periphery of the estate, with K1 per ton possibly being a realistic rate; this would add an extra K20 to costs pushing them up to K145. In addition there would be development and administration charges connected with the co-ordination of smallholder activities. If these were K30 per acre this would leave smallholders producing 5 tons of sugar per acre with a net income of K125 per acre after paying costs of K175.
2. At these rates of return per acre sugar seems to compare well with another irrigated crop, cocoa, now in the early stages of development as a smallholder crop. A paper by the Agricultural Planning Unit of M.A.N.R. estimates, on the basis of trials at Makanga and Masenjerere, that mature cocoa stands will yield about 2,000 pounds to the acre. It is also suggested in the paper that it may be possible to pay the smallholder 20 tambala per pound of cocoa beans, equivalent to K400 per acre. This return would have to cover the cost of water applied at approximately the same rate as for sugar cane, of fertilizer, of fermenting boxes and sheds, of administrative overheads, and of a small transport charge. These recurrent costs are likely to be less than for sugar and the Planning Unit paper estimates that smallholder net incomes from cocoa may be around K300 per acre, 2.3 times those for sugar. However when allowance is made a) for the fact that cocoa farmers are expected to be able to manage only 4 acres, whereas 8 acres of sugar appears to fall at the lower end of the range of acreages managed in various African smallholder schemes, and b) that cocoa does not start yielding until more than 2 years after planting and then not at the maximum rate whereas sugar can be cropped after one year, then sugar and cocoa appear to be on a par as candidate crops for smallholder development.

3. There appear to be no potential uses for the land, other than cocoa and possibly cashew nuts which compare with sugar in terms of returns per acre or per labour day. Certainly none of the rainfed crops examined in Chapter 6 are competitive, and irrigated rice is not comparable if water charges are made at full cost.

4. It is of course possible that suitable double cropping irrigation systems will be found which will be competitive with sugar. However the CDC/Halcrow Report

findings suggest that crops suitable for such systems have not yet been identified.

5. It is interesting that the taxation of sugar yields a revenue of approximately K20 per ton which is equivalent to K100 per acre at yields of 5 tons per acre. This is derived from the Excise tax of K10 per ton plus the surtax of 10 percent on the ex-factory value of sugar. Thus in addition to any profits made by SUCOMA the Government is receiving approximately K100 per acre per annum, which is more than the gross income per acre of land from most other uses in the Lower Shire Valley. This serves to emphasise the high productivity of sugar as a crop.

6. Finally it should be noted that the total wages paid to labour by SUCOMA greatly exceed the total net incomes which smallholders could have earned from rainfed agriculture on the same land. This is true firstly because the wages paid for field labour and cane cutters alone are estimated to average K50 per acre to which has to be added the wages of tractor drivers, factory staff and administrative staff. The estimated net income from 1,000 pounds of sprayed cotton per acre is K47,57 (see Appendix II, section II.4.1). Secondly under traditional smallholder management by no means all of the land currently growing sugar would have been used for intensive rainfed cultivation.

8.3. Sugar as a Smallholder Crop.

In the search for new ways to boost traditional agriculture the question arises as to whether sugar is a suitable crop for smallholders to grow. The basic answer appears to be that it is, but that economic efficiency may be less than if it is grown under estate management. Some of the factors which affect the issue are as follows:

A. In favour of smallholder sugar development:

1. As indicated in the previous section sugar is one of the most profitable uses for land in the Lower Shire Valley, and it is superior to most conceivable smallholder alternatives.
(2) Sugar is grown by smallholders as outgrowers to a nucleus estate in several African countries, including Kenya, Zambia and Swaziland. The problems of smallholder sugar growing are not therefore insuperable.

(3) Sugar is a crop with which the local people are familiar. They already grow small amount of cane in dimba gardens for domestic use and local sale. Many men from the area have by now had experience of work on the Sucoma estate which employs up to 3,500 men, and these are now familiar with the discipline of large scale production. This gives sugar an advantage over certain other smallholder crops such as cocoa and cashew nuts with which the local population is unfamiliar.

(4) Sugar is now a well tried crop of proven agricultural and commercial potential. Given that prospects seem to be for firm world market prices of sugar, but more importantly of a steady increasing domestic demand for it - this enables a pricing policy to be pursued independently of world markets if necessary to safeguard investment - the marketing conditions are capable of supporting further expansion of sugar production.

(5) As indicated in Chapter 10, pressure upon the land will become an increasingly serious problem and average holding sizes will continue to fall. If the incomes of those wholly dependent upon agriculture are to be improved there is a critical need to find more high valued crops suitable for very intensive exploitation by smallholders.

(6) Sucoma seems to have difficulty recruiting sufficient labour for field work. The use of herbicides is a reflection of labour shortage for weeding. Also once the annual rains begin and farmer's start preparing and planting their land Sucoma find it difficult to maintain their labour force at the required level. In these circumstances there is a possibility that further expansion of the estate might lead to the substitution of machinery and imported inputs for locally recruited labour in the performance of some tasks. This type of development seems unlikely to be optimal from the point of view of the Malawi economy, and one way of averting it might be to have smallholder develop-
ment in which all labour for field operations is provided by the farmers themselves.

(7) In order to try and stabilize its labour force SUCOMA had found it necessary to provide housing for over 2,000 of the 3,100 men currently employed in labouring jobs. This has involved the development of small townships on the estate. In addition to the housing costs this has involved, there are the costs of the supporting amenities such as water supplies, a sewage system, and personnel to supervise the townships. The costs and difficulties associated with this type of development could be avoided with outgrowers schemes, in which growers could build their own houses and settlement could be dispersed.

B. Against smallholder development:

(8) Rapid expansion of sugar production at rates such as those achieved by SUCOMA would not be possible with smallholders given the problems of recruiting suitable settlers and of directing their activities.

(9) It is accepted that effective management of cane growing, cutting and transporting is much more difficult where a large number of small growers have to be organised than it is with an estate. Whatever form of management system were adopted, there is no doubt that the contractual obligations of growers and the penalties for failing in these would have to be tightly enforced. Despite this very tight circumscribing of his activities it seems likely that the status of a smallholder cane grower would be much higher than that of a hired estate worker.

(10) Land use efficiency will probably be less under smallholder organisation. One reason for this would be that some land might have to be allocated for the production of food crops. In addition there is bound to be some turnover of settlers which would cause some land to be abandoned at any given time. It may be that settler turnover would be less with sugar schemes than with other crops since the net income possibilities will be much higher. Experience on settlement schemes currently operating in Malawi suggests that settler turnover rates in excess of 10 percent per year might be expected.
On some schemes turnover in some years has reached much higher levels than this, but this has usually happened when large batches of new settlers are drafted in at periods of rapid expansion. Very careful selection of settlers would be required to ensure that wastage was not on a scale which would render investment in smallholder sugar uneconomic.

Doubtless there are other arguments for and against smallholder sugar production. There are also some which cannot be easily compartmentalised, such as whether it is more desirable to distribute profits more widely to smallholders or to concentrate them in the accounts of large businesses. This question has to be resolved by judgements about the relative efficiency of the use of investable funds by different groups, and about the desirability of increasing consumption by the farming population.

It is true that more arguments have been specified for smallholder sugar development than against. But there is no doubt that the problem of finding a suitable management system for smallholders is a formidable one. Nevertheless on balance it does appear that there is a good case for the development of some such scheme using pumped water to provide furrow irrigation on suitable land as close to the SUCOMA factory as possible.

8.4. Land Compensation Costs.

When land is transferred from customary tenure to leasehold estate land compensation is paid to the customary land farmers. The principles of compensation date back to the Colonial era and involve payments based on the value of the smallholder's house, his standing crops and fruit trees. Thus in effect no value is put on the land - the compensation for standing crops is merely payment for the amount of produce currently on the land which will not come to harvest. No value is attributed to the future stream of production which might emanate from the land.

If one brushes aside the case that there should be some compensation for the disturbance to former users of the land, the principles indicated above are reasonable where equivalent land can be made available without charge to the displaced farmers. In such circumstances the farmers can reconstruct his house, using the compensation paid for that purpose and
can immediately start preparing his next season's crops. If these circumstances existed in the past, it is doubtful if they do now in the Lower Shire Valley, and it is almost certain that they will not in future. For the provision of comparable land, means making available an equivalent area of fertile land which is cleared of bush. While the Halcrow Report envisaged that the costs of estate expansion would include the cost of clearing resettlement areas this does not appear to have occurred with respect to the expansion of SUCOMA; settlers at Ndakwera, which is an area in which displaced households are offered the opportunity to settle, have to clear their own land. Also given that the Sucoma development has been promoted on some of the best available soils it is doubtful whether resettlement areas can be found of equal fertility.

More serious is the fact that pressure on the land is mounting (see Chapter 10) and that there is an increasing shortage of land in the Lower Shire Valley which is suitable for resettlement. Certainly the land currently earmarked for resettlement would be inadequate if all the displaced families in the Valley elected for settlement in these areas. It may of course be argued that because many families find their own solution to their problem without moving into the resettlement areas there is no shortage of suitable land. This is belied by the evidence in Chapter 10 which shows that in the L.S.V. available cultivated land per person has declined since 1969.

If the males in the population displaced by estate expansion were those who took advantage of the employment opportunities simultaneously created it might be claimed that the displaced population is adequately compensated for the loss of their cultivation rights. Unfortunately this equation does not hold and it is necessary to conclude that the moved families are not fully compensated for the costs imposed upon them by the move. It follows that SUCOMA is able to acquire land at below its value to smallholders, and that the profits of the company benefit accordingly.

The main thesis is that the value of the standing crops and structures upon the land does not adequately reflect its value in smallholder agriculture, given that large acreages of uncultivated fertile land are no longer available. This is emphasised when it is considered that some of the land now used by SUCOMA would annually have produced cotton for export as well as food crops. The value of standing crops at the time of
acquisition (which might be after harvest when there are no standing crops) cannot possibly be an adequate reflection of the opportunity cost of the land.

Only where there is a free market in land can a reliable current valuation be based upon the future stream of benefits expected from that land. At present there is virtually no market in land in Malawi, and there are only very limited areas where freehold land is owned. Nevertheless there does appear to be a case for saying that current compensation procedures undervalue customary land, and that this undervaluation problem will increase as the amount of spare cultivable land is further reduced. In these circumstances it seems appropriate to consider modifying land compensation procedures towards a system which establishes prices for grades of land in different localities.
CHAPTER NINE

LABOUR MIGRATION AND LOCAL WAGE EMPLOYMENT

9.1. Introduction.

In this section we consider some of the results obtained from the analysis of responses to questions asked in the SOLV Household Composition Survey about labour migration and local wage employment. We begin by estimating the de jure and de facto male and female populations in working ages (15 to 49 years) and relate these to the number of labour migrants to obtain labour migration rates for the traditional authority areas. As we shall observe, the rate for the SVADP Phase II area as a whole, for males in working ages (15 to 49 years) is almost 26 percent, a moderately high rate, but local rates vary from 12 to 14 percent in the cotton growing areas to from 25 to 53 percent in Nsanje District.

We relate these variations in the labour migration rate to variations in the pressure on natural resources and to variations in the availability of local economic opportunities. From the masculinity ratios revealed in the 1966 Population Census we infer the likely ranges of the labour migration rates for traditional authority areas in that year and demonstrate that there is a remarkably close correspondence between those rates and the rate estimated from the SOLV survey. This suggests that labour migration rates have not varied greatly from area to area over the six-year period.

We then turn to consider local wage employment and indicate the distribution of various occupational categories by traditional authority area. From these data we compute a number of rates and show how these appear to vary in response to population pressure on the land and to the amount of income that can be generated from farming. The wage employment rate, which includes male labour migrants and those in local full-time wage employment, is 35 percent for the SVADP with local rates varying from 14 to 19 percent in the cotton growing areas, to from 33 to 67 percent in Nsanje District. For some areas of Nsanje District it is clear that more than two-thirds of men in working ages are engaged in some form of off-farm money earning activity. Given the indications of high population pressure and the alarming drop in cultivated acreage per head in Nsanje District, both discussed in Chapter 10, the reasons for the necessity for men to find off-farm employment are obvious. It is also clear from the data that the proportion of the population engaged in rural crafts - pot
and mat making, carving, brewing, hunting, fishing and so forth - is also high in areas of land shortage and population pressure. If we combine those working in full-time non-agricultural employment, those in agricultural wage employment and those engaged in part-time rural crafts, the rate for the SVADP Phase II area is remarkably high, at 39 percent of men in working ages, with local rates varying from 16 to 21 percent in the cotton growing areas to over 70 percent in parts of Msanjje District.

### Table 9.A

Estimated Male Population, Aged 15-49 by Traditional Authority Area with Labour Migration Rates expressed as a proportion of the De Jure male population of that age.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Facto Jure</td>
<td></td>
</tr>
<tr>
<td>Chapananga</td>
<td>4,880</td>
<td>340</td>
<td>74</td>
<td>59</td>
<td>-</td>
<td>281</td>
<td>1,523</td>
<td>5,353</td>
<td>7,083</td>
</tr>
<tr>
<td>Ngabu (1)</td>
<td>11,401</td>
<td>170</td>
<td>132</td>
<td>208</td>
<td>-</td>
<td>529</td>
<td>2,118</td>
<td>11,911</td>
<td>14,426</td>
</tr>
<tr>
<td>Massea</td>
<td>1,374</td>
<td>26</td>
<td>26</td>
<td>26</td>
<td>13</td>
<td>65</td>
<td>233</td>
<td>1,465</td>
<td>1,724</td>
</tr>
<tr>
<td>Katunga</td>
<td>1,534</td>
<td>103</td>
<td>-</td>
<td>39</td>
<td>26</td>
<td>103</td>
<td>245</td>
<td>1,702</td>
<td>2,024</td>
</tr>
<tr>
<td>Makwira</td>
<td>4,692</td>
<td>39</td>
<td>116</td>
<td>194</td>
<td>-</td>
<td>233</td>
<td>1,783</td>
<td>5,041</td>
<td>6,941</td>
</tr>
<tr>
<td>Mbenje</td>
<td>2,211</td>
<td>28</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>28</td>
<td>794</td>
<td>2,239</td>
<td>3,061</td>
</tr>
<tr>
<td>Mloko</td>
<td>4,459</td>
<td>29</td>
<td>78</td>
<td>10</td>
<td>68</td>
<td>264</td>
<td>1,340</td>
<td>4,644</td>
<td>6,102</td>
</tr>
<tr>
<td>Tengani</td>
<td>2,084</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2,382</td>
<td>2,084</td>
<td>4,466</td>
</tr>
<tr>
<td>Khuluvi C.</td>
<td>4,516</td>
<td>141</td>
<td>141</td>
<td>-</td>
<td>141</td>
<td>423</td>
<td>2,963</td>
<td>4,939</td>
<td>8,043</td>
</tr>
<tr>
<td>Ndamerera(2)</td>
<td>3,240</td>
<td>40</td>
<td>20</td>
<td>-</td>
<td>-</td>
<td>70</td>
<td>1,731</td>
<td>3,300</td>
<td>5,081</td>
</tr>
<tr>
<td>SVADP Phase II</td>
<td>40,391</td>
<td>916</td>
<td>587</td>
<td>536</td>
<td>248</td>
<td>1,996</td>
<td>15,112</td>
<td>42,678</td>
<td>58,951</td>
</tr>
</tbody>
</table>

(1) Includes T.A. Lundu.
(2) Includes T.A. Chimombo and T.A. Nyachikadza.
(3) Adjusted by \( W_v / T_w \) where \( W_v \)=Total Wives within Village and \( T_w \)=Total Wives.
(4) Includes categories P., C.H., V., P.L., T.L.

T.Ab.=Temporarily Absent.
P =Permanent Resident; C.H. = Circulating Husband, V= Visitor,

For definitions, see Appendix III.

### 9.2. Labour Migration

In Table 9.A the estimated male population aged 15 to 49 years is
shown by Resident Status for each traditional authority area. The full
definitions of the categories of Resident Status are set out in Appendix
III. By summing persons in the categories of Permanent Resident, (adjusted)
Circulating Husband, Visitor, Permanent and Temporary Labour, we obtain an
estimate of the de facto population. These are in fact the weighted numbers
of persons who were actually present during the Household Composition Survey.
From the summation of those in the categories of Permanent Resident,
(adjusted) Circulating Husband, Permanent Labour, Temporarily Absent and
Labour Migrant, we obtain an estimate of the de jure population. These are
the weighted numbers of persons who were either present during the Survey
or who, according to the Household Head, considered the household to be
their place of residence. By dividing the estimated numbers of Labour
Migrants by the estimated de jure population of males aged 15 to 49 years
and expressing this as a percentage, the Labour Migration rate is obtained.

For the SVADP Phase II area the Labour Migration rate is almost 26
percent, which by standards of Central and East Africa is moderately high.*
It is almost certain that the actual rate is possibly higher than the
estimate. This is because first of all, not all Labour Migrants will have
been identified. Those who have been away for long periods, for example,
in Rhodesia, particularly where their kinsmen in their original home village
have either died or moved away, will not have been enumerated. That Labour
Migrants have been under-estimated in the Survey seems likely from a compari-
on of the estimated male and female de jure population aged 15 to 49 years
(Table 9.B). The masculinity ratio computed from the de jure population
is 1:1.12. Since we are here considering the de jure populations, we should
expect the masculinity ratio to be almost unity. The eleven percent discrepancy
suggests that the number of Labour Migrants has been under-estimated by
this amount.

Secondly, it is clear from an examination of the categories of
Residential Status in relation to the definitions given in Appendix IV that
for the population as a whole, the estimated number of Visitors and Temporary
Labourers should more or less equal the estimated number of those classed
as Temporarily Absent. In fact, there is a short fall of some 1,161 which
suggests that the under-estimation of the Labour Migration rate from this
source is of the order of two percent. The two sources of under-estimation
suggest that the true rate for the SVADP Phase II area is possibly from

*For comparative rates see Mitchell, J.C. 'Wage Labour and African Population
Movements in Central Africa' in K.M. Barbour and R.N. Prothero (eds)
two to four percent higher than the estimate. However, in all subsequent analysis we have ignored this possible under-estimation, and have worked with the rates as they are given in Table 9.A.

As can be seen from the Table, the rates vary markedly by area. They are relatively low in the main cotton growing area where between 12 and 15 percent of men in working ages are Labour Migrants. In T.A. Chapananga's area, the rate rises to 22 percent. Here economic opportunities until very recently, were limited. Here, too, as we indicate in Chapter 10, there is a very high rate of immigration from Mozambique. Similarly the rates are moderately high for the East Bank areas of T.A. Mlolo and T.A. Makwira, where population pressure is beginning to be felt. They rise dramatically, however, in the West Bank areas of Nsanje District. The very high rate for T.A. Tengan's area - 53 percent - is probably an over-estimate. However, as we shall observe when considering the masculinity ratios derived from the 1966 Population Census, the Labour Migration rate in 1966 for this area was probably in the region of 40 percent and appears to have been the highest in Nsanje District. We estimate that the Labour Migration rate for Nsanje District as a whole, is 34 percent. Only in T.A. Mlolo's area on the East Bank where rice growing and double-cropping ameliorate the population pressure, and in T.A. Mbenje's area on the periphery of the cotton growing region, do rates fall markedly below this.

In Table 9.B the estimated population of women aged 15 to 49 years, is presented by resident status and an 'absentee rate' is computed by relating the estimated number of women categorised as 'Labour Migrant' to the estimated de jure population of women of that age. Here, 'Labour Migrant' should be interpreted, in the main, as women who were away accompanying their husbands to their places of employment. In a few cases this category will also include the unmarried daughters of these men. We feel that there is no need here to suggest an adjustment of the rate on the grounds of misclassification of those temporarily absent; their numbers are slightly in excess of the estimated number of visitors (there were no female Temporary Labourers enumerated). However, the wives of long-term labour migrants will have been under-estimated slightly, but there is no means of assessing what the magnitude of this under-estimation is. Given the evidence presented in the Table, it is probably very slight.

For the SVADP Phase II area as a whole, only an estimated three percent of women aged 15 to 49 years accompanied their husbands (or, in a
Table 9.B. Estimated Female Population, Aged 15-49 by Resident Status by Traditional Authority Area with Absentee Rates expressed as a proportion of the De Jure female population of that age.

<table>
<thead>
<tr>
<th>Traditional Authority</th>
<th>P</th>
<th>V</th>
<th>P.L.</th>
<th>T.L.</th>
<th>T.Ab.</th>
<th>L.M. (1)</th>
<th>De (2) Facto</th>
<th>De (3) Jure</th>
<th>Absentee Rate (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapananga</td>
<td>8,370</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>74</td>
<td>340</td>
<td>8,370</td>
<td>8,784</td>
<td>3.87</td>
</tr>
<tr>
<td>Ngabu (5)</td>
<td>17,697</td>
<td>567</td>
<td>76</td>
<td>-</td>
<td>662</td>
<td>57</td>
<td>18,340</td>
<td>18,492</td>
<td>0.31</td>
</tr>
<tr>
<td>Massea</td>
<td>1,685</td>
<td>78</td>
<td>-</td>
<td>-</td>
<td>26</td>
<td>39</td>
<td>1,763</td>
<td>1,750</td>
<td>2.22</td>
</tr>
<tr>
<td>Katungu</td>
<td>1,960</td>
<td>13</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>168</td>
<td>1,973</td>
<td>2,128</td>
<td>7.89</td>
</tr>
<tr>
<td>Makwira</td>
<td>5,816</td>
<td>78</td>
<td>-</td>
<td>-</td>
<td>155</td>
<td>194</td>
<td>5,894</td>
<td>6,165</td>
<td>3.15</td>
</tr>
<tr>
<td>Mbenje</td>
<td>4,110</td>
<td>142</td>
<td>-</td>
<td>-</td>
<td>198</td>
<td>57</td>
<td>4,252</td>
<td>4,365</td>
<td>1.31</td>
</tr>
<tr>
<td>Mlolo</td>
<td>5,994</td>
<td>108</td>
<td>-</td>
<td>-</td>
<td>284</td>
<td>88</td>
<td>6,102</td>
<td>6,366</td>
<td>1.38</td>
</tr>
<tr>
<td>Tengani</td>
<td>4,466</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>4,466</td>
<td>4,466</td>
<td>-</td>
</tr>
<tr>
<td>Khuluvi C.</td>
<td>6,633</td>
<td>847</td>
<td>-</td>
<td>-</td>
<td>423</td>
<td>847</td>
<td>7,480</td>
<td>7,903</td>
<td>10.72</td>
</tr>
<tr>
<td>Ndamera (6)</td>
<td>5,614</td>
<td>40</td>
<td>-</td>
<td>-</td>
<td>30</td>
<td>111</td>
<td>5,654</td>
<td>5,755</td>
<td>1.93</td>
</tr>
<tr>
<td>SVADP Phase II</td>
<td>62,345</td>
<td>1,873</td>
<td>76</td>
<td>-</td>
<td>1,852</td>
<td>1,901</td>
<td>64,294</td>
<td>66,174</td>
<td>2.87</td>
</tr>
</tbody>
</table>

(1) Although defined as 'Labour Migrants' for the purpose of the Survey, these are, in general, women who accompanied their husbands to their place of work.

(2) Includes categories P, V, P.L., T.L.

(3) Includes categories P, P.L., T.Ab., L.M.

(4) Includes those classed as L.M. only.

(5) Includes T.A. Lundu.

(6) Includes T.A. Chimombo and T.A. Myachikadza.


Few cases, their parents) to their places of employment. There is a considerable variation in the estimated local rates, as one might expect given the very small proportion of women in the sample who were away, and there are no clear trends, except a very slight tendency for the rate of female absenteeism to reflect the distribution of the male labour migration rate.

It would appear, therefore, that it is usual for men to leave their wives and families at home when they seek employment. These data bear out
remarkably well the operation of the optimum economic strategy argued on theoretical grounds in Chapter 4, in terms of the returns to labour, that it would pay some men to leave their wives and children at home to farm the land extensively whilst they seek other income earning opportunities. However, there is some social cost involved in operating such a strategy. Wives and children may be left for long periods to fend for themselves. No doubt, in many cases, the labour migrant's brother, or the head of his kin-group, will give help and advice when required but the separation must impose some strain on the marriage. We have yet to determine if this is of general significance but preliminary evidence from our survey of the Family and Marriage indicates that marriages appear to be relatively unstable with a moderately high rate of divorce. Whether this is a recent phenomenon resulting from economic change and labour migration, or due to other factors rooted in the social organisation and structure, we have not yet determined.

9.3. An Estimate of the 1966 Labour Migration Rate.

Has the labour migration rate changed in response to the recent developments which have occurred in the Lower Shire Valley?

This is a difficult question to answer because the basic data are lacking. However, by using the evidence of the masculinity ratios in the 1966 Population Census we can obtain at least some indication of the probable magnitude of the labour migration rates in that year.

The assumption is that the ratio of males to females should be unity for the age group 15 to 49 years and that any decrease in the ratio reflects the fact that men are absent. There are, of course, other factors which affect masculinity ratios, principally, the effects of mortality operating differentially on males and females, either in the age group under consideration, or at earlier ages. However, for the age group 15 to 49 years, one would expect the masculinity ratio to approach unity.

Masculinity ratios are set out in Table 9.C and the upper possible limits of the labour migration rates compatible with these ratios are indicated in the third column. In the fifth column, the labour migration rates estimated from the SOLV Survey are shown for comparison. The cotton areas appeared to have a low rate in 1966, as they do now, but the rates increase, approximately in the same order of magnitude, for areas to the north, east and south. The highest rates in 1966 again appear in Nsanje District, with T.A. Tengani's area having the highest estimated rates in
Table 9.C. Masculinity Ratios by Traditional Authority Area computed for the Rural Population from the 1966 Population Census with an Estimate of the Upper Limit of the Labour Migration for Males, Aged 15 to 49 Years.

<table>
<thead>
<tr>
<th>Traditional Authority</th>
<th>Masculinity Ratio 1966. Males:Females Aged 15 - 49</th>
<th>Upper Limit of Labour Migration Rate 1966</th>
<th>Estimated Labour Migration Rate 1972</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapananga</td>
<td>1 : 1.36</td>
<td>26</td>
<td>22</td>
</tr>
<tr>
<td>Ngabu (1)</td>
<td>1 : 1.20</td>
<td>17</td>
<td>15</td>
</tr>
<tr>
<td>Massea</td>
<td>1 : 1.27</td>
<td>21</td>
<td>14</td>
</tr>
<tr>
<td>Katunga</td>
<td>1 : 1.21</td>
<td>17</td>
<td>12</td>
</tr>
<tr>
<td>Makwira</td>
<td>1 : 1.26</td>
<td>20</td>
<td>26</td>
</tr>
<tr>
<td>Mbenje</td>
<td>1 : 1.22</td>
<td>18</td>
<td>26</td>
</tr>
<tr>
<td>Mlolo</td>
<td>1 : 1.25</td>
<td>20</td>
<td>22</td>
</tr>
<tr>
<td>Tengani</td>
<td>1 : 1.68</td>
<td>40</td>
<td>53</td>
</tr>
<tr>
<td>Khuluvi C.</td>
<td>1 : 1.48</td>
<td>33</td>
<td>37</td>
</tr>
<tr>
<td>Ndamaera (2)</td>
<td>1 : 1.53</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>SVADP Phase II</td>
<td>1 : 1.31</td>
<td>24</td>
<td>26</td>
</tr>
</tbody>
</table>

(1) Includes T.A. Lundu.
(2) Includes T.A. Chimombo and T.A. Nyachikadza.

Note: The masculinity ratios were computed by extracting the African male and female populations from the detailed 'working runs' published by the National Statistical Office. These give the populations of Traditional Authority areas by age, sex and race. All persons living in townships, mission stations, estates and so forth were removed from the figures. In general, this virtually eliminated all Europeans and Asians. Where any remained, they were removed by assuming that Europeans were in working ages (15 to 49 years) and that Asians were distributed among the age categories in the same proportions as the African population.

both 1966 and 1972. Overall, one is left with the impression of little change. There appear to be indications that the rate has fallen in the cotton growing area and has probably increased in the south, but it would be unwise, given the assumptions involved in using masculinity ratios in this way, to press the point further.


In Table 9-D is given the country or district of present employment of current Labour Migrants by Traditional Authority area. The proportions
<table>
<thead>
<tr>
<th>Traditional Authority</th>
<th>Country of Employment</th>
<th>District of Employment</th>
<th>Estimated Labour Migrants Aged 15-49</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zambia</td>
<td>Mozambique</td>
<td>Rhodesia</td>
</tr>
<tr>
<td>Chamananga (1)</td>
<td>0.9</td>
<td>8.8</td>
<td>13.3</td>
</tr>
<tr>
<td>Nyabu (1)</td>
<td>10.0</td>
<td>25.4</td>
<td>36.3</td>
</tr>
<tr>
<td>Kavuma (1)</td>
<td>11.1</td>
<td>22.3</td>
<td>33.4</td>
</tr>
<tr>
<td>Katunga (1)</td>
<td>10.6</td>
<td>26.1</td>
<td>36.7</td>
</tr>
<tr>
<td>Mukwira (1)</td>
<td>2.2</td>
<td>8.7</td>
<td>15.2</td>
</tr>
<tr>
<td>Mbenje (1)</td>
<td>3.9</td>
<td>-</td>
<td>3.9</td>
</tr>
<tr>
<td>Mloko (1)</td>
<td>0.7</td>
<td>14.1</td>
<td>10.4</td>
</tr>
<tr>
<td>Tonga (1)</td>
<td>50.0</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nkhulwi C. (2)</td>
<td>5.6</td>
<td>50.0</td>
<td>-</td>
</tr>
<tr>
<td>Nhamera (2)</td>
<td>1.2</td>
<td>15.4</td>
<td>35.8</td>
</tr>
<tr>
<td>All Traditional Authorities</td>
<td>1.6</td>
<td>0.9</td>
<td>25.0</td>
</tr>
</tbody>
</table>

(1) Includes T.A. Lundu.
(2) Includes T.A. Chimombo and T.A. Nyachikidza.
(3) Tanzania and Zaire.
are expressed in terms of the estimated number of male labour migrants aged 15 to 49 years in each Traditional Authority area.

Considering first Country of Employment, it would appear that 42 percent of all labour migrants worked abroad. Local rates, however, vary considerably. Of those working abroad, almost 60 percent are working in Rhodesia and 33 percent in S.Africa. The remainder are working in Zambia, with very small proportions working in Mozambique, Zaire and Tanzania. There seem to be strong preferences for particular countries according to Traditional Authority area. Labour migrants in the northern areas of the Valley appearing to favour S.Africa, whilst in the southern areas, with the exception of T.A. Ndamera's area, they favour Rhodesia. The reasons for these different preferences are not clear although they may in part be a continuation of patterns of migration established many years ago. This tendency for labour migration to develop and persist between a particular area and a particular labour centre has been noted in other parts of Africa and elsewhere, and is related to the information about the labour centre which is transmitted through kinship networks back to prospective labour migrants. The labour migrant then starts out for the labour centre already knowing something of his destination, where he will live, what wage rates are likely to be, and so forth.

Of the 58 percent of labour migrants estimated to be working within Malawi, 34 percent work in Blantyre and Limbe, whilst 27 percent work in Chikwawa District itself. The balance between labour migrants who work in Malawi and those who work abroad, shows some patterning, with areas such as T.A. Chapananga's and those of the Nsanje Traditional Authorities, south of Mloolo having high proportions of men working abroad. In the cotton area there appears to be a strong tendency for men to find employment within Chikwawa District - presumably at SUCOMA and in the various townships. Factors determining the balance between migrating to seek work at home or abroad are related, presumably, to such matters as the availability of jobs, wage differentials, distance from and ease of travel to, labour centres, the age and marital status of labour migrants, and so forth. The analysis of our data on labour migrant's labour histories may enable us to better assess the relative significance of these various factors.

In concluding this discussion of labour migration, it is worth emphasising that we are dealing here with what has been termed "circulatory" labour migration. It is not that 26 percent of the male population of the Valley aged 15 to 49 years has left the Valley and will be away for
many years before returning. Men are continually leaving for work, whilst others are returning, either to rest for a while before returning to the labour centres again, or to settle. Very few have never been to work outside the Valley. The notion that it is only the most able, or most ambitious men who seek work either elsewhere in Malawi or abroad, which one finds expressed in a number of planning papers and publications currently circulating in Malawi, is not borne out by the evidence. Indeed, it may well be the case that many of the most successful cotton farmers gained the capital to start their farming enterprises by first working away from home for some years as labour migrants.

9.5. Local Wage Employment.

Table 9.6 shows for each Traditional Authority area, the distribution of men by occupational categories expressed as proportions of the estimated number of men employed in each age category. The age categories are 15 to 49 years, and 50 years and over.

The SLOV survey recorded a very wide range of full-time and part-time occupation. These have been grouped into broad occupational categories. Rural crafts include such part-time occupations as mat and pot making, brewing, charcoal burning, hunting, fishing and so forth. The Business category comprises owners of Stores, Shops, Bars, Canteens and Grinding Mills. The category of Service Trades includes Builders, Plumbers, Blacksmiths, Cobblers, Tailors, Painters and Radio and Watch repairers. In all, the Survey recorded some 54 separate occupations.

Considering the estimated proportions for the SVADP Phase II area as a whole, for all men aged 15 years and over, Rural Crafts and Fish and Cattle Trading predominate, with 26 and 25 percent of men respectively, with the Service Trades and Farm Labour with 13 percent of men each, being the other large categories. There is a shift in the pattern of occupations between older and younger men both overall, and from one area to another. Men aged 50 and over tend to be concentrated in Rural Crafts, whilst younger men, though to a much lesser extent, tend to be concentrated in Farm Labour and the Service Trades. The high proportion of men engaged in the Fish and Cattle Trade overall (25 percent) is largely due to the high proportion estimated to be in the Fish Trade in the areas of the Khuluvi Council and of T.A. Makwira and T.A. Ndamera.

Table 9.7 presents similar data for women. Here, overall, Rural Crafts predominate. Over 76 percent of women engaged in off-farm money-earning activities, are concentrated in this category. However,
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Crafts</td>
<td>13.4</td>
<td>13.6</td>
<td>10.9</td>
<td>54.3</td>
<td>18.1</td>
<td>25.0</td>
<td>15.3</td>
<td>33.3</td>
<td>27.6</td>
<td>52.2</td>
<td>44.8</td>
<td>20.5</td>
<td>41.6</td>
<td>26.2</td>
<td></td>
</tr>
<tr>
<td>Farm Labour</td>
<td>25.0</td>
<td>25.0</td>
<td>20.0</td>
<td>9.1</td>
<td>18.2</td>
<td>75.0</td>
<td>20.1</td>
<td>15.5</td>
<td>18.1</td>
<td>21.5</td>
<td>18.1</td>
<td>12.7</td>
<td>12.7</td>
<td>12.7</td>
<td></td>
</tr>
<tr>
<td>General Labour</td>
<td>6.8</td>
<td>6.8</td>
<td>12.7</td>
<td>10.6</td>
<td>19.6</td>
<td>50.0</td>
<td>30.1</td>
<td>4.7</td>
<td>5.5</td>
<td>1.9</td>
<td>1.9</td>
<td>0.9</td>
<td>0.9</td>
<td>0.9</td>
<td></td>
</tr>
<tr>
<td>Business</td>
<td>6.8</td>
<td>6.8</td>
<td>1.8</td>
<td>18.3</td>
<td>4.6</td>
<td>50.0</td>
<td>15.0</td>
<td>16.6</td>
<td>3.2</td>
<td>3.2</td>
<td>3.2</td>
<td>0.4</td>
<td>4.9</td>
<td>1.7</td>
<td></td>
</tr>
<tr>
<td>Fish/Cattle Trade</td>
<td>-</td>
<td>-</td>
<td>1.8</td>
<td>1.5</td>
<td>-</td>
<td>1.2</td>
<td>-</td>
<td>24.9</td>
<td>11.5</td>
<td>5.2</td>
<td>5.2</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Shop Assistant</td>
<td>13.6</td>
<td>13.6</td>
<td>3.7</td>
<td>3.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.5</td>
<td>1.5</td>
<td>2.0</td>
<td>0.7</td>
<td>1.6</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Service Trades</td>
<td>27.5</td>
<td>27.5</td>
<td>9.0</td>
<td>18.3</td>
<td>10.6</td>
<td>-</td>
<td>12.5</td>
<td>21.4</td>
<td>9.9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Local Govt. etc. (3)</td>
<td>6.8</td>
<td>6.8</td>
<td>21.8</td>
<td>18.2</td>
<td>-</td>
<td>25.0</td>
<td>30.0</td>
<td>14.4</td>
<td>11.6</td>
<td>9.9</td>
<td>5.6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Catering/ Domestic.</td>
<td>-</td>
<td>-</td>
<td>5.5</td>
<td>4.6</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>9.9</td>
<td>15.2</td>
<td>12.2</td>
<td>4.2</td>
<td>-</td>
<td>-</td>
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<td></td>
</tr>
<tr>
<td>Other</td>
<td>-</td>
<td>-</td>
<td>7.3</td>
<td>6.1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>2.3</td>
<td>5.6</td>
<td>1.9</td>
<td>-</td>
<td>100.0</td>
<td>99.9</td>
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</tr>
<tr>
<td>All Categories</td>
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<td>100.1</td>
<td>100.0</td>
<td>100.0</td>
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<td>100.0</td>
<td>99.9</td>
<td>100.0</td>
<td></td>
</tr>
<tr>
<td>Estimated No.</td>
<td>236</td>
<td>236</td>
<td>1,040</td>
<td>208</td>
<td>1,248</td>
<td>52</td>
<td>52</td>
<td>104</td>
<td>26</td>
<td>130</td>
<td>543</td>
<td>465</td>
<td>1,008</td>
<td>283</td>
<td>85</td>
</tr>
</tbody>
</table>

(1) Includes T.A. Lunda.
(2) Includes T.A. Chimonyo and T.A. Nyachikazza.
(3) Includes Local Government Officers, and those engaged in Education, Health and Agricultural Extension. Note that this is an estimate of only those who live in villages. The SOUV sampling frame specifically excluded townships, mission stations, schools and other special housing areas where, in the main, such Government Officers are likely to be found. This is not therefore an estimate of those employed in these fields in the SVADF Phase II area.
Table 9.F. Local Wage Employment by Occupational Category and Traditional Authority Area, Females Aged 15 to 49 years and 50 years and over, expressed as a Proportion of the Total Females employed in each age category for each Area.

<table>
<thead>
<tr>
<th></th>
<th>Chapanda</th>
<th>Ngabu (1)</th>
<th>Katunga</th>
<th>Makwira</th>
<th>Mlolo</th>
<th>Ndamera</th>
<th>SVADP Phase II</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Crafts</td>
<td>- - - - -</td>
<td>- - -</td>
<td>- - -</td>
<td>50.0 20.0</td>
<td>100.0 100.0 100.0</td>
<td>91.1 85.4 88.9</td>
<td>45.4 100.0 60.0</td>
</tr>
<tr>
<td>Farm Labour</td>
<td>50.0 - 50.0</td>
<td>50.0 - 50.0</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
</tr>
<tr>
<td>Business</td>
<td>- - - - -</td>
<td>- - -</td>
<td>- - -</td>
<td>50.0 20.0</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
</tr>
<tr>
<td>Fish/Cattle</td>
<td>- - - - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>7.3 2.8</td>
<td>- - -</td>
</tr>
<tr>
<td>Trader</td>
<td>- - - - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
</tr>
<tr>
<td>Shop Assistant</td>
<td>- - - - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
</tr>
<tr>
<td>Local Govt. etc</td>
<td>50.0 - 50.0</td>
<td>- -</td>
<td>100.0</td>
<td>- 60.0</td>
<td>- - -</td>
<td>4.4 7.3 5.5</td>
<td>- - -</td>
</tr>
<tr>
<td>Catering/ Domestic</td>
<td>- -</td>
<td>50.0 - 50.0</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
<td>4.4 - 2.8</td>
<td>9.1 - 6.7</td>
</tr>
<tr>
<td>Total</td>
<td>100.0 - 100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Estimated Number


N.B. No female employment was recorded for Massea, Mbenje, Tengani or Chuluvi Council.

(1) Includes T.A. Lundu.

(2) Includes T.A. Chimombo and T.A. Nyachikadza.
the distribution across the Traditional Authority area is not uniform and in the areas of T.A. Massea, T.A. Mbenje, T.A. Tengani and the Khuluvi Council, the Survey detected no women engaged in such activities.


In order to enable the significance of labour migration, local wage employment and other off-farm, money-earning activities to be assessed, Table 9.C has been constructed. This presents, for each Traditional Authority area, the estimated number of men aged 15 to 49 years who are either local migrants, in local wage employment, in farm labour, or engaged in rural crafts. For each category, rates have been computed. Save for the labour migration rate, presented previously in Table 9.A and expressed only in terms of the estimated de jure male population, aged 15 to 49 years all other rates have been expressed in terms of both estimated de jure and de facto populations. From the de jure rates we can assess the degree of involvement of all men in working ages in various forms of off-farm, money-earning activity and from the de facto rates we can assess the degree of involvement of those who are actually resident in the villages.

The labour migration rate is shown in column (c) of the Table. In column (c) the estimated local wage employment rate is indicated and in column (f) the two rates have been summed to give a Wage Employment Rate. In general, the local wage employment rate tends to follow the distribution of the labour migration rate. There are some exceptions. In the area of T.A. Ngabu and T.A. Lundu, whilst there is a relatively low labour migration rate, the local wage employment rate is almost five percent. The adjacent areas of T.A. Masssea and T.A. Katunga which also have low labour migration rates, have in the one case a zero rate of local wage employment and in the other a rate of two percent. This difference probably reflects the greater opportunities for local wage employment, particularly in T.A. Ngabu's area. The broad distribution across the occupational categories shown in Table 9.E for T.A. Ngabu's area, with Local Government, General Labour and the Service Trades being particularly prominent, would appear to indicate this. The other notable exception is in T.A.Ndamera's area, where a relatively low local wage employment rate is associated with a high labour migration rate. Whilst it would appear from Table 9.E that there are some opportunities in this area for men to work in Local Government, Business, the Fish Trade and in the Service Trades, these are fairly limited in extent. The
<table>
<thead>
<tr>
<th>Traditional Authority</th>
<th>Estimated Males Aged 15-49 Years</th>
<th>Estimated Males Labour Migrants Aged 15-49</th>
<th>Labour Migration Rate</th>
<th>Male Males in Local Wage Employment Rate as a % of D.J. Males 15-49 Years (Estimated)</th>
<th>Male Males in Farm Labour Rate as a % of D.J. Males 15-49 Years (Estimated)</th>
<th>Male Males in Farm Labour Rate as a % of D.F. Males 15-49 Years (Estimated)</th>
<th>Male Males in Rural Crafts 15-49 Years as a % of D.J. Males 15-49 Years (Estimated)</th>
<th>Male Males in Rural Crafts 15-49 Years as a % of D.F. Males 15-49 Years (Estimated)</th>
<th>Male Males in Rural Crafts and in Local Wage Employment as a % of D.J. Males 15-49 Years (Estimated)</th>
<th>Male Males in Rural Crafts and in Local Wage Employment as a % of D.F. Males 15-49 Years (Estimated)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheapsanga</td>
<td>5,353</td>
<td>7,063</td>
<td>21.50</td>
<td>145</td>
<td>2.06</td>
<td>23.55</td>
<td>2.71</td>
<td>59</td>
<td>0.83</td>
<td>1.10</td>
</tr>
<tr>
<td>Ngabu (1)</td>
<td>11,911</td>
<td>14,426</td>
<td>16.68</td>
<td>719</td>
<td>4.98</td>
<td>19.66</td>
<td>6.04</td>
<td>308</td>
<td>1.44</td>
<td>1.75</td>
</tr>
<tr>
<td>Masena</td>
<td>1,465</td>
<td>1,724</td>
<td>8.80</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>39</td>
<td>2.26</td>
<td>2.66</td>
</tr>
<tr>
<td>Katunga</td>
<td>7,002</td>
<td>2,024</td>
<td>12.10</td>
<td>30</td>
<td>1.93</td>
<td>14.03</td>
<td>2.29</td>
<td>65</td>
<td>3.21</td>
<td>3.82</td>
</tr>
<tr>
<td>Nkwira</td>
<td>5,041</td>
<td>6,941</td>
<td>1.78</td>
<td>293</td>
<td>1.36</td>
<td>29.05</td>
<td>4.62</td>
<td>271</td>
<td>3.90</td>
<td>5.36</td>
</tr>
<tr>
<td>Nyerere</td>
<td>2,239</td>
<td>3,061</td>
<td>7.94</td>
<td>233</td>
<td>3.16</td>
<td>33.32</td>
<td>10.09</td>
<td>57</td>
<td>1.86</td>
<td>2.55</td>
</tr>
<tr>
<td>Nilo</td>
<td>4,444</td>
<td>6,102</td>
<td>1.34</td>
<td>800</td>
<td>14.59</td>
<td>36.55</td>
<td>19.16</td>
<td>362</td>
<td>5.93</td>
<td>7.60</td>
</tr>
<tr>
<td>Tanganyi</td>
<td>2,084</td>
<td>4,466</td>
<td>2.38</td>
<td>596</td>
<td>13.33</td>
<td>66.69</td>
<td>28.69</td>
<td>298</td>
<td>6.67</td>
<td>9.26</td>
</tr>
<tr>
<td>Kavutu C.</td>
<td>4,930</td>
<td>8,043</td>
<td>2.96</td>
<td>2,116</td>
<td>26.31</td>
<td>63.15</td>
<td>42.84</td>
<td>141</td>
<td>1.75</td>
<td>2.88</td>
</tr>
<tr>
<td>Emmannza (2)</td>
<td>3,300</td>
<td>5,081</td>
<td>1.31</td>
<td>340</td>
<td>4.72</td>
<td>38.79</td>
<td>7.27</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>42,679</strong></td>
<td><strong>58,851</strong></td>
<td><strong>15.12</strong></td>
<td><strong>5,204</strong></td>
<td><strong>8.83</strong></td>
<td><strong>34.46</strong></td>
<td><strong>12.19</strong></td>
<td><strong>1,202</strong></td>
<td><strong>3.04</strong></td>
<td><strong>2.82</strong></td>
</tr>
</tbody>
</table>

(1) Includes T.A. Lundo.
(2) Includes T.A. Chimbo and T.A. Nychikaza.
(3) Residential Categories: Permanent Resident, Visitor, Permanent Labour, Temporary Labour, Circulating Bushiri/Angwa.
(4) Residential Categories: Permanent Resident, Permanent Labour, Temporarily Absent, Labour Migrant, Circulating Bushiri/Angwa.
(5) Includes all Farm Labour and those engaged in Rural Crafts.
(6) Includes Labour Migrants.
(7) Excludes Labour Migrants.
neighbouring areas of the Khuluvi Council and of T.A. Tengani have high proportions of men engaged in fish trading. If these are removed, the local employment rate (de jure) falls to almost seven and a half percent in each case. Clearly, it is the trade in fish which is of particular significance in these areas. We have assumed that men in this category are more or less full-time middlemen engaged in the buying, selling and transporting of fish. This may not, in all cases, be wholly correct, and there is some seasonal variation in the volume of the fish trade.

In addition, we note that whilst our sample villages in the Khuluvi Council area and in the T.A. Tengani's area are near to the Ndinde Marsh, in T.A. Ndamera's area only Ndamera village itself is so situated. The other sampled village, Msiyankhuni, is in the western hills adjacent to Lulwe Mission, with no opportunities for fish trading and few opportunities for other forms of local wage employment.

The Farm Labour rate (column (i)) shows a fairly even distribution. It is very low in T.A. Chapananga's area. The highest rates occur in the areas of T.A. Makwira and T.A. Mlolo, where almost four and five percent, respectively, of men in working ages are estimated to be so employed. These slightly higher rates almost certainly reflect the somewhat higher demand for labour in these areas which border the Elephant Marsh where double cropping and rice-growing are widespread.

In the cotton area, of course, labour is seasonally employed, particularly for cotton picking. The Household Composition Survey would not have detected this since it was administered in December. However, the Labour Survey, when analysed should show more clearly the seasonal variations in the employment of labour from one area to another.

The distribution of the rate for those employed in Rural Crafts (Column (m)) is markedly skewed. A very small proportion of men is involved in rural crafts in the centre and north of the Valley. In the Nsanje District, on the other hand, excluding T.A. Mbenje's area, the rates are almost seven percent for each of the remaining areas, with the exception of T.A. Ndamera's area, where the rate falls to three percent.

If we now consider column (n) of the Table which contains a summation of all the de jure rates, we see that for the SVADP Phase II area as a whole, an estimated 37 percent of men aged 15 to 49 years were engaged, at the time of the survey, either wholly or partially, in some form of off-farm money-earning activity. The high rates again occur in the south, with peaks of over 70 percent in the areas of T.A. Tengani and of the
Khuluvi Council. From column (c) of the Table, where the summation of de facto rates is given, a similar pattern emerges with the exception again of T.A. Ndamera's area. Here, the estimated rate is relatively low probably for the reasons indicated earlier.

In general, one gains the overall impression that in those areas of the south where population pressure on the land is high and where the fall in the amount of land cultivated per head since the NSSA survey of 1968/69 has been most acute, people have developed a strategy, largely on their own initiative, of exploiting as many off-farm opportunities for earning money as they can. The inference is that the land itself, despite the fact that along the edge of the Mdinde Marsh intensive double-cropping is practised, cannot fully support them. The movement from the area, indicated in the 1966 Population Census, and also detected in the SOLV Survey (Chapter 10, Section 10.5.3), may also indicate that even given this high level of off-farm, money-earning activity, net incomes are low in relation to those obtainable in other parts of the Valley.
CHAPTER TEN
POPULATION AND LAND

10.1 Introduction
In a predominantly agricultural country like Malawi an understanding of the relationship between the rate of population growth and natural resources, particularly land, is crucial.* Various estimates of the rate of growth of the national population have been made ranging from 2 percent to 3 percent per annum, though the most commonly accepted figures are 2.5 percent to 2.6 percent. Our own Survey, coming so shortly after the 1966 Census and the NSSA Survey of 1968/69 has given us an opportunity to make some estimate of the probable rate of growth of the population inhabiting the SVADP Phase II Area, both as a whole and by Traditional Authority areas, and to relate this to the availability of land.

In this Chapter we first review the evidence which we have gathered on population growth and population movements within the Lower Shire Valley. As we shall observe, whilst the rate of growth for the Valley as a whole, appears to be close to the National Average, local rates vary considerably. This variation is largely due to two factors: internal population movements within the Valley and immigration into it particularly from Mozambique. We demonstrate that this immigration is adding in the region of 0.6 percent per annum to the population. We observed in Chapter 9 that Labour Migration rates varied from area to area in relation to the availability of local economic opportunities and to the density of population. Rates of population movement also appear to show a similar relationship.

Having reviewed the evidence on population growth and movement we consider a number of general issues raised by these data notably the pressing need to increase the productivity of land given the high rate of population growth. We then review the evidence gathered during our Garden Survey which shows quite clearly that the amount of land cultivated per head has fallen in almost all areas of the Valley since the NSSA Survey. Given that output per acre, in general, remains low, we conclude that the evidence for mounting pressure on land resources is overwhelming. Finally, we consider the results of our Dietary Survey which indicate the varying seasonal pressures on food resources.

At the 1966 Census the rural population of what was to be the SVADP Phase II Area was 226,374. In Table 10.A, three estimates of the population

of the SVADP Phase II Area have been given. The first two, based on flat rate increases of 2.6 percent and 3.0 percent per annum give populations at 1972 of 264,064 and 270,302 respectively. The third, which gives an overall estimated rate of growth of 2.58 percent per annum is built up from various rates applied to the different Traditional Authority areas. The local rates have been derived from three sources:

(1) evidence from the census of sampled villages undertaken as part of the SOLV Household Composition Survey;

(2) the analysis of the responses to questions asked in the Survey about country of birth, year of arrival in the sampled village and country or district of previous residence;

(3) evidence of general levels of fertility obtained by relating the women in the sample in child bearing age to the numbers of children aged under one and from 0 - 4 years.

We do not present here the detailed evidence from our separate Survey of Fertility and Child Mortality, but state baldly that the indications are that the rate of natural increase appears to be the order to 2.0 percent per annum, the two elements largely determining this rate being a high fertility rate offset by high infant and child mortality rates. To this natural rate of increase must be added an additional increment to take into account immigration into the Valley, particularly from Mozambique. We have assumed this to be of the order of 0.6 percent per annum, for the SVADP Phase II Area as a whole, though the local rates vary considerably from almost zero to as high as 3 percent per annum. At 2.6 percent per annum, the 1966 census population will have doubled by 1994.

10.2 The 1966 Census and the SOLV Household Composition Survey, 1972

In Table 10.B, columns (a) and (b) show the 1966 and the 1972 populations of the sampled villages. In column (c) the percentage change is shown and in column (d), the rate of increase per annum, where this is positive. In columns (e) and (f) the numbers of people who settled and remained in the village between 1966 and 1972 and the numbers of children born and surviving in that period are indicated, respectively. If the number in these two columns are added to the 1966 population we can obtain some estimate, albeit minimal, of the number of people in any village who either died or emigrated between the two periods. This number, expressed as a proportion of the 1972 population is given in column (h). It is a minimal estimate because there will have been, between the two censuses, (1) children who were born and died and (2) people who immigrated.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CHIKWANA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chapangan</td>
<td>11,100</td>
<td>13,012</td>
<td>24,112</td>
<td>12,948</td>
<td>15,178</td>
</tr>
<tr>
<td>Ngabu (1)</td>
<td>32,555</td>
<td>35,201</td>
<td>67,756</td>
<td>37,975</td>
<td>41,062</td>
</tr>
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<td>Massea</td>
<td>3,365</td>
<td>3,803</td>
<td>7,168</td>
<td>3,925</td>
<td>4,436</td>
</tr>
<tr>
<td>Katunga</td>
<td>3,492</td>
<td>3,800</td>
<td>7,292</td>
<td>4,073</td>
<td>4,433</td>
</tr>
<tr>
<td>Makwira</td>
<td>10,986</td>
<td>11,979</td>
<td>22,965</td>
<td>12,815</td>
<td>13,973</td>
</tr>
<tr>
<td>SVADP II (North)</td>
<td>61,498</td>
<td>67,795</td>
<td>129,293</td>
<td>71,737</td>
<td>79,083</td>
</tr>
<tr>
<td>Kasisi (2)</td>
<td>5,574</td>
<td>6,134</td>
<td>11,708</td>
<td>6,502</td>
<td>7,155</td>
</tr>
<tr>
<td>Thomas (2)</td>
<td>5,057</td>
<td>5,450</td>
<td>10,507</td>
<td>5,899</td>
<td>6,357</td>
</tr>
<tr>
<td>TOTAL CHIKWAMA</td>
<td>72,129</td>
<td>79,379</td>
<td>151,508</td>
<td>84,138</td>
<td>92,595</td>
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<td>NSANJE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mbenje</td>
<td>6,513</td>
<td>7,113</td>
<td>13,626</td>
<td>7,597</td>
<td>85,297</td>
</tr>
<tr>
<td>Mlolo</td>
<td>10,564</td>
<td>11,628</td>
<td>22,192</td>
<td>12,323</td>
<td>13,564</td>
</tr>
<tr>
<td>Tengani</td>
<td>6,532</td>
<td>8,053</td>
<td>14,585</td>
<td>7,619</td>
<td>9,394</td>
</tr>
<tr>
<td>Khuluvi C. (3)</td>
<td>11,004</td>
<td>13,111</td>
<td>24,115</td>
<td>12,836</td>
<td>15,294</td>
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<tr>
<td>Ndamera (4)</td>
<td>10,229</td>
<td>12,334</td>
<td>22,563</td>
<td>11,932</td>
<td>14,387</td>
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<tr>
<td>TOTAL NSANJE</td>
<td>44,842</td>
<td>52,239</td>
<td>97,081</td>
<td>52,308</td>
<td>60,937</td>
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<tr>
<td>TOTAL SVADP II</td>
<td>106,340</td>
<td>120,034</td>
<td>226,374</td>
<td>124,045</td>
<td>140,019</td>
</tr>
</tbody>
</table>

(1) Includes T.A. Lundu
(2) Outside the SVADP Phase II Area. Arbitrary rates.
(3) Now defunct but retained here as a convenient grouping for comparative purposes.
(4) Includes T.A. Chimombo and T.A. Nyachikadza.
and then either died or left the village.

Considering the detailed evidence, beginning with the villages in T.A. Chapananga's area we observe that two of them, Sila Zuwavo and Chitumba, appear to have grown at a formidable rate. They are both hill villages near the western border with Mozambique and have received a high proportion of immigrants from that country. Sila Zuwavo, however, appears anomalous because the sum of immigrants to the village plus children born and surviving in the period 1966 to 1972 when added to the 1966 population is less than 1972 population. There may be two explanations for this. Either immigrants to the village have been under-enumerated in the SOLV Survey, or the village was under-enumerated during the 1966 Census. We tend to the latter alternative. Sila Zuwavo consists of clusters of hamlets spread over a wide area and it would be a relatively easy matter to miss some of these. Our enumerator reported no reluctance on the part of people to declare that they were recent immigrants and we have not met this difficulty elsewhere. Because Sila Zuwavo is anomalous we have assumed, therefore, that it has a similar pattern of growth to Chitumba, which it resembles in many of its economic and social characteristics.

Chimphepo village is situated a few miles west of Chikwawa Township and has not experienced the heavy immigration from Mozambique. In fact, it has declined in size. However, an examination of its near neighbour, Moses, also censused by SOLV, reveals that this village has grown at a rate of some 4.0 percent per annum and that 15 percent of its population has settled in the village since 1966. With this evidence and the evidence from recent migratory patterns, we have concluded that the population of T.A. Chapananga's area is growing rapidly, probably in the region of 6 percent per annum. As we shall demonstrate, most of this growth is caused by heavy immigration from Mozambique which has been at a sustained high rate since the 1966 Census and has accelerated to an even higher rate since 1970. At this rate of growth the 1966 Census population of 24,112 will have doubled by 1978.

One of the most striking features of Table 10.B concerns the villages in the former CCDF Phase I Area - Nchacha-Nzangaya, Bwemba, Ubale, Khokwa, Mbande and Nguluwe. Of these, only Khokwa and Nguluwe have gained population. The others have diminished in size, the biggest losses being sustained by Nchacha Nzangaya and Mbande. If we assume a crude death rate of the order of 2 percent per annum - i.e. 12 percent over six years - which is compatible with a rate of natural increase of from 2 percent to
2.6 percent per annum, it can be seen from column (h) of Table 10.8 that the probable loss to emigration from these villages has been considerable. Even the two villages which gained population, Khokwa and Ngulwe, also appear to have lost considerable population through emigration. Of the other villages in the former CCDP Phase I Area, the loss of population from Mbande and Nchacha Nzangaya appears to be of a high order. Mbande is something of a special case in that it has been re-located twice in its recent history and has been affected by the Sucoma development. Overall, for the cotton area, the general impression is one of low population growth counterbalanced slightly by the growth of Khokwa and Ngulwe. Significantly, both these villages are not in the heart of the cotton area and they are not on the soils of the Makande Plain. As we shall observe, this general impression is confirmed and sharpened when we consider the migratory pattern within the region as a whole. The two sets of evidence suggest a growth rate of 1 percent per annum, possibly less, with considerable movement of population out of the area. The reasons for this we consider when discussing population movements.

Turning to Nsanje District, the evidence suggests a somewhat higher rate of growth here than in the north. All save two of the sampled villages in the District show high rates of growth, with considerable immigration from Mozambique into the areas of T.A. Mloko, T.A. Mbenje and T.A. Ndamera. Whilst there is considerable population movement to the north, as we shall observe, and as is apparent from a consideration of the 1966 Census data on district of birth and present residence, this is more than balanced by the immigration from Mozambique. Here, population pressure seems considerable but ameliorated by the high labour migration rates to which attention was drawn in Chapter 9. We have assumed high growth rates for the areas of T.A. Mbenje and T.A. Mloko and a somewhat lower rate for the area of T.A. Ndamera.

Pangeti village in T.A. Tengani's area has declined rapidly, and its near neighbour, Fachere, also censused by SOLV, whilst more than three times as large, has only increased in size at the rate of 1 percent per annum since 1966 with heavy emigration and little immigration. The evidence from the patterns of migration also indicate a movement of population from Tengani of some magnitude. We have assumed, therefore, a low rate of growth of the order of 1 percent per annum.

---

<table>
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<tr>
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<td>1,203</td>
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<td>12.2</td>
<td>219</td>
<td>252</td>
<td>1,073</td>
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<td>110</td>
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<td>-</td>
<td>0</td>
<td>24</td>
<td>170</td>
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<td>423</td>
<td>188</td>
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<td>23.6</td>
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<td>245</td>
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<td>-</td>
<td>68</td>
<td>56</td>
<td>711</td>
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<td>Bwemba</td>
<td>219</td>
<td>180</td>
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<td>-</td>
<td>38</td>
<td>33</td>
<td>290</td>
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<tr>
<td>Ubale</td>
<td>346</td>
<td>341</td>
<td>-1.4</td>
<td>-</td>
<td>95</td>
<td>68</td>
<td>509</td>
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<td>738</td>
<td>488</td>
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<td>596</td>
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<td>-</td>
<td>103</td>
<td>116</td>
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<td>Mbando</td>
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<td>-</td>
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<td>236</td>
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<td>-</td>
<td>10</td>
<td>53</td>
<td>328</td>
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<td>Biyasoni</td>
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<td>5.83</td>
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<td>55</td>
<td>593</td>
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<td>Mpungasa</td>
<td>603</td>
<td>667</td>
<td>+10.6</td>
<td>1.7</td>
<td>154</td>
<td>119</td>
<td>876</td>
<td>31.3</td>
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<tr>
<td>Nguluwe I - IV</td>
<td>1,164</td>
<td>1,426</td>
<td>+22.5</td>
<td>3.44</td>
<td>404</td>
<td>302</td>
<td>1,870</td>
<td>31.1</td>
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<tr>
<td>Mwanabvumbwe</td>
<td>814</td>
<td>1,108</td>
<td>+36.1</td>
<td>5.28</td>
<td>297</td>
<td>232</td>
<td>1,343</td>
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<td>Milolo</td>
<td>1,461</td>
<td>1,602</td>
<td>+9.7</td>
<td>1.55</td>
<td>279</td>
<td>349</td>
<td>2,089</td>
<td>30.4</td>
</tr>
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<td>Pangeti</td>
<td>91</td>
<td>52</td>
<td>-42.4</td>
<td>-</td>
<td>4</td>
<td>10</td>
<td>105</td>
<td>101.9</td>
</tr>
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<td>Mphaladona</td>
<td>78</td>
<td>50</td>
<td>-35.9</td>
<td>-</td>
<td>6</td>
<td>5</td>
<td>89</td>
<td>50.0</td>
</tr>
<tr>
<td>Kamenga</td>
<td>96</td>
<td>179</td>
<td>+46.4</td>
<td>10.95</td>
<td>39</td>
<td>42</td>
<td>177</td>
<td>?(^2)</td>
</tr>
<tr>
<td>Ndamera</td>
<td>1,165</td>
<td>1,200</td>
<td>+3.0</td>
<td>0.5</td>
<td>98</td>
<td>279</td>
<td>1,542</td>
<td>28.5</td>
</tr>
<tr>
<td>Msiyankhuni</td>
<td>1,083</td>
<td>1,252</td>
<td>+15.6</td>
<td>2.45</td>
<td>149</td>
<td>354</td>
<td>1,586</td>
<td>26.7</td>
</tr>
</tbody>
</table>

\(^1\) Anomalous. See text.
\(^2\) Nguluwe I, the sample "village", has here been augmented by II, III & IV in order that a direct comparison could be made with the 1966 Census figure.
\(^3\) Expressed as proportion of 1972 population.

N.B. d.f = de facto
The two villages sampled in what was the Khuluvi Council area, Mphaladona and Kasenga, are somewhat anomalous. Kasenga presents the same difficulty experienced with Sila Zuwavo: the sum of the immigrants between 1966 and 1972 plus the children born and surviving that period when added to the 1966 population, does not equal the 1972 population. There is only a difference of two, but this would assume no adult deaths or emigration from the village over the six years. The reason for the anomaly is not readily apparent. The argument of under-enumeration at the 1966 Census is difficult to sustain because Kasenga is small and compact. The remaining argument, that the SOLV enumerator under-enumerated immigrants may provide the solution. Frankly, we are puzzled.

Mphaladona village is anomalous from a different point of view: it has been losing population rapidly. Indeed, so rapidly in fact, that we appeared in imminent danger of losing our entire sample. However, evidence from its near neighbour, Mphamba, more than four times as large, indicates a high rate of growth with considerable immigration from Mozambique. Here again, we conclude that whilst there is a considerable movement of population from the area, as indicated by an examination of the migratory patterns, this is more than offset by immigration from Mozambique.

10.3 Population Movements within the Lower Shire Valley

In SOLV's Household Composition Survey, questions were asked about country of birth, year of arrival in the sampled village and country of district of previous residence. When analysed together, the response to these questions provide considerable evidence on immigration into the valley and population movements within it. We do not have data on permanent movements from the Valley either into Mozambique or to other parts of Malawi. There is some evidence in the 1966 Census of movement of population within the Valley from Nsanje District to Chikwawa District and from the Valley to adjacent Districts such as Thyolo and Blantyre. However, for emigrants from the Valley one does not know whether they have moved permanently or whether they are simply labour migrants who will return to the Valley at some time in the future. For both migration within and from the Valley, one has no means of assessing over what time period this has occurred.

We have already given an indication in Chapter 9 of the probable magnitude of the labour migration rate for the SVADP Phase II Area as a whole (26 percent) and for the Traditional Authority Areas. However,
labour migration will not affect our consideration of the evidence of population movements since, except for Table 10.C our discussion is concerned with the de facto population only. Labour migration rates were computed from the de jure population. These various considerations should be borne in mind during the discussion.

10.4 Country of Birth

Table 10.C shows the estimated proportions of the de jure populations by country of birth for the Traditional Authority areas of the SVADP Phase II Area. It would appear that some 18 percent of the de jure population of the whole area was born in Mozambique. The highest proportion, 40 percent occurs in T.A. Chapananga's area, and the lowest in T.A. Tengani's. The areas of T.A. Ngabu (with T.A. Lundu) and T.A. Mbenje also have high proportions of 20 percent and 13 percent respectively. In no area does the proportion fall below 8 percent. The small proportions of the population born in Zambia, Rhodesia, S. Africa and other countries (notably Zaire and Tanzania) are the children and, in a few cases, the wives of returned labour migrants.

Evidence of population movements from data on country of birth, however, only provides a limited indication of immigration into the Valley. From these data we have no means of judging the current magnitude of the movements: they represent both traces of long-past migrations as well as current migrations. However, we can gain a much sharper insight into current population movements by analysing the responses to questions on country or district of previous residence and year of arrival in the sampled village. This presents a somewhat conservative view of population movement because, for example, if an immigrant from Mozambique settled in a village in T.A. Chapananga's area in 1967 and then in 1968 moved to one of the villages within the area sampled by SOLV, his last place of residence would be recorded as a village in Chief Chapananga's area and not Mozambique. This consideration applies similarly to population movements occurring between Traditional Authority areas within the Valley. This under-estimation obviously will become more severe the longer the time period considered. In addition, of course, deaths deplete the number involved in earlier movements. For these reasons we have restricted our analysis to the period from 1966 to 1972 and paid particular attention to the period from 1970 to 1972.
<table>
<thead>
<tr>
<th>TRADITIONAL AUTHORITY</th>
<th>COUNTRY OF BIRTH</th>
<th>Estimated de jure Population</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Malawi</td>
<td>Mozambique</td>
</tr>
<tr>
<td>Chapananga</td>
<td>58.4</td>
<td>40.0</td>
</tr>
<tr>
<td>Ngabu 1</td>
<td>79.7</td>
<td>19.7</td>
</tr>
<tr>
<td>Massea</td>
<td>91.9</td>
<td>5.9</td>
</tr>
<tr>
<td>Katunga</td>
<td>85.1</td>
<td>13.2</td>
</tr>
<tr>
<td>Makwira</td>
<td>89.8</td>
<td>9.5</td>
</tr>
<tr>
<td>Mbenje</td>
<td>72.4</td>
<td>26.7</td>
</tr>
<tr>
<td>Mlolo</td>
<td>87.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Tengani</td>
<td>91.9</td>
<td>8.1</td>
</tr>
<tr>
<td>Khuluvi Council</td>
<td>85.4</td>
<td>13.8</td>
</tr>
<tr>
<td>Ndamera 2</td>
<td>89.0</td>
<td>9.7</td>
</tr>
<tr>
<td>All T.A.'s</td>
<td>81.1</td>
<td>17.7</td>
</tr>
</tbody>
</table>

* = Less than 0.1 percent.

1 Also includes T.A. Lundu

2 Also includes T.A. Chimombo and T.A. Nyachikadza.
10.5 Population Migration

10.5.1 Current Migratory Patterns

We have constructed a matrix from the data we have on country or
district of previous residence and year of arrival in the sampled village.
This is presented in Table 10.D. The matrix is so arranged that the
country or district of previous residence is shown at the left of the
matrix and the district of present residence is shown at the top. The
row entries of the matrix, therefore, give the estimated numbers of people
who moved, within the selected time periods, from the country or district
at the head of the row to the district at the head of the column. To
obtain the net movements out of and into a district, shown by the row and
column totals, respectively, the internal movement within a district must
be subtracted. This is indicated by the blocks marked along the main
diagonal of the lower half of the matrix. The upper half of the matrix
refers to immigration from other countries and from other areas of Malawi;
the lower half, solely to migration within the Lower Shire Valley.

The columns for each district have three cells for each row indicating
The populations have been adjusted to the mid-years in each case so that
the estimates apply to the periods from mid-1966 to mid-1972 and from
mid-1970 to mid-1972. Adjusting the populations in this way avoids any
exaggeration of the volume of movement which would be caused by treating
data relating to almost seven calendar years (January 1966 to December 1972)
as if they related to only six years. It also enables the 1966 Census
population to be taken as a reference point.

The "districts" have been constructed by grouping together Traditional
Authority areas into geographical blocks. To simplify the presentation,
the following mnemonic device has been employed: Area CH refers to T.A.
Chapananga's area; Area NG refers to the combined areas of T.A. Ngabu,
T.A. Lundu and T.A. Massea; Area KA refers to the combined areas of
T.A. Katunga, T.A. Kasisi, T.A. Makwira and T.A. Thomas; Area ML refers to
the combined areas of T.A. Mlolo, T.A. Mbenje and T.A. Tengan; Area ND
refers to the combined areas of T.A. Ndamera, the Khuluvi Council,
T.A. Nyachikadza and T.A. Chimombo.

The grouping of the Traditional Authority areas in this way has
been done both for convenience of presentation and to highlight certain
features of the migratory pattern: a full 22 x 15 matrix with three cells
per column giving 990 cells would have produced a rather formidable table.
The blocks have some significance from both a geographical and an ecological
point of view. We are aware that this presentation may create slight distortions in one or two cases; we attempt to correct these in our discussion.

In Table 10.E the same data is presented expressed as proportions of the estimated 1972 populations of each geographical block. We note here that the weighting system we have constructed, based on our estimates of current rates of population growth will not affect at all the proportions given in the columns of the matrix. These reflect the underlying proportions in the sample and will always bear a fixed relationship to the estimated population total. The row totals of Table 10.D however, are affected by the weights used. Later we perform a sensitivity analysis by re-weighting the sample. As will be shown, the effect of altering the weights is slight.

Let us consider first the immigration into each geographical area from all sources. Considering the final column of the matrix (Table 10.E) we see, by subtracting the proportion of internally generated movement from that externally generated (21 percent - 14 percent), that the estimated rate of immigration into the Valley from all sources has been seven percent over six years or a little over one percent per annum. By far the largest source of immigration is Mozambique. Immigration from this source has added some five percent to the population over the period from 1966 to 1972 or an estimated 14,500 people. This is a formidable volume of immigration given that the rate of natural increase of the population is also high. It is noticeable too that the incidence of the immigration from Mozambique is particularly heavy in Area CH contributing here over six percent per annum to the population, the immigration rate apparently increasing over 8 times during the period from 1970 to 1972. For all areas, except Area KA, the rate has been around an average of 0.6 percent per annum over the six years, showing some acceleration during the period from 1970 to 1972, though not so marked as in Area CH.

We believe that the apparent acceleration in the rate of immigration as revealed by the data represents a real change and is not simply a function of time operating to deplete the number of immigrants who came in the period from 1966 to 1970. The rate of internal movement in Area CH appears low: only about one percent of the people changed their place of residence within the same area - over the six years. Internal movement, therefore, does not appear to be a possible source of under-estimation of the volume of immigration.

Immigration from, and emigration to Mozambique has been part of the
<table>
<thead>
<tr>
<th>Country/Area of Previous Residence</th>
<th>CH Chapamanga</th>
<th>NG Ngabu</th>
<th>KA Katunga</th>
<th>ML Mlolo</th>
<th>ND Ndamera</th>
<th>All Districts of Previous Residence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mozambique</td>
<td>653 5777 6430</td>
<td>1586 1826 3412</td>
<td>396 243 639</td>
<td>529 1860 2389</td>
<td>1072 1223 2295</td>
<td>4236 10929 15165</td>
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<tr>
<td>Other Countries</td>
<td>25 13 68</td>
<td>154 71 225</td>
<td>- 365 365</td>
<td>333 323 656</td>
<td>105 180 285</td>
<td>617 617 1234</td>
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<td>N. Region</td>
<td>- - -</td>
<td>- - -</td>
<td>- 8 8</td>
<td>- - -</td>
<td>- - -</td>
<td>- - -</td>
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<tr>
<td>C. Region</td>
<td>12 43 55</td>
<td>30 197 227</td>
<td>- - -</td>
<td>35 17 52</td>
<td>- - -</td>
<td>77 257 334</td>
</tr>
<tr>
<td>Blantyre</td>
<td>49 65 114</td>
<td>25 134 159</td>
<td>627 - 627</td>
<td>93 141 234</td>
<td>541 11 552</td>
<td>1335 351 1666</td>
</tr>
<tr>
<td>Thyolo</td>
<td>112 - 112</td>
<td>46 29 75</td>
<td>- 487 487</td>
<td>142 108 250</td>
<td>- 11 11</td>
<td>300 635 935</td>
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<tr>
<td>Elsewhere</td>
<td>172 32 204</td>
<td>10 112 122</td>
<td>- 243 243</td>
<td>7 207 214</td>
<td>15 23 38</td>
<td>204 617 821</td>
</tr>
<tr>
<td>CH Chapamanga</td>
<td>148 151 299</td>
<td>46 34 80</td>
<td>- - -</td>
<td>- 25 25</td>
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<td>194 210 404</td>
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<td>NG Ngabu etc.</td>
<td>37 11 48</td>
<td>6734 6113 12847</td>
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<td>1382 852 2234</td>
<td>7 134 141</td>
<td>10801 10639 21440</td>
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<td>KA Katunga etc.</td>
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<td>247 685 932</td>
<td>2212 1643 3855</td>
<td>129 174 303</td>
<td>7 - 7</td>
<td>2595 2502 5097</td>
</tr>
<tr>
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<td>- - -</td>
<td>910 803 1713</td>
<td>495 669 1164</td>
<td>1397 1383 2780</td>
<td>180 381 561</td>
<td>2982 3236 6218</td>
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<tr>
<td>ND Ndamera etc.</td>
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<td>467 555 1022</td>
<td>858 639 1497</td>
<td>400 431 831</td>
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<td>58730</td>
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<td>Country/Area of Previous Residence</td>
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<td>NG Ngabu Lundu Massea</td>
<td>KA Katunga Kasisi Makwira Thomas</td>
<td>ML Mliolo Mbenje Tengani</td>
<td>ND Ndamera Khuluvi Council Nyachikadza Chimombo</td>
<td>All Districts of Previous Residence</td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>----------------</td>
<td>------------------------</td>
<td>---------------------------------</td>
<td>--------------------------</td>
<td>------------------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Mozambique</td>
<td>1.9 16.9 18.8</td>
<td>2.0 2.3 4.3</td>
<td>0.7 0.4 1.1</td>
<td>0.9 3.2 4.1</td>
<td>1.9 2.1 4.0</td>
<td>1.4 3.8 5.2</td>
</tr>
<tr>
<td>Other Countries</td>
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<td>0.2 0.1 0.3</td>
<td>- 0.6 0.6</td>
<td>0.6 0.5 1.1</td>
<td>0.2 0.3 0.5</td>
<td>0.2 0.2 0.4</td>
</tr>
<tr>
<td>N. Region</td>
<td>- - -</td>
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<td>* * *</td>
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<td>* 0.1 0.2</td>
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<td>0.2 0.2 0.4</td>
<td>- * *</td>
<td>0.1 0.2 0.3</td>
</tr>
<tr>
<td>Elsewhere</td>
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<td>* * *</td>
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<td>- * *</td>
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<td>4.4 5.9 10.3</td>
<td>2.3 1.5 3.8</td>
<td>* 0.2 0.2</td>
<td>3.7 3.7 7.4</td>
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<tr>
<td>KA Katunga etc.</td>
<td>- - -</td>
<td>0.3 0.9 1.2</td>
<td>3.7 2.7 6.4</td>
<td>0.2 0.3 0.5</td>
<td>* - *</td>
<td>0.9 0.9 1.8</td>
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<td>ND Ndamera etc.</td>
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<td>8.0 6.0 14.0</td>
<td>9.6 11.4 21.0</td>
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</tbody>
</table>
history of the Lower Shire Valley for a long period. The indications are, however, that the Valley has experienced a net gain in population from this source over a considerable period. Whether the present high rate of immigration will continue into the future, seems unlikely, and the volume of immigration will probably return to its "normal" rate of around 0.5 percent per annum. Even this rate, projected into the future, and given that there is not a similar outward movement from the Valley, seems more than the diminishing natural resources can tolerate. The volume of immigration in Area CH is of particular concern, since this is one of the few remaining areas where virgin land is available in the Valley. No doubt, this has something to do with the attraction of the area for immigrants.

Considering briefly the immigration from other sources into the Valley, we see that this is of a relatively low order of magnitude. Some of this movement represents returning labour migrants, their wives and children. We also feel, judging by the evidence from the 1966 Census on district of birth and present residence, that this immigration is probably offset by an equal degree of emigration.

Turning now to consider movement within the Valley itself we see that within each area there has been a considerable volume of movement. Within Area NG 16 percent of the population changed its place of residence during the six year period, an estimated 12,800 people. Same for Area CH, which appears exceptional, all other areas show a rate of internal movement of about one percent per annum.

10.5.2 Types of Migration

There appear to be three types of migration involved in the population movements within the Valley: "normal" migration, "strategic" migration and "precipitate" migration.

Normal migration is associated with the developmental cycle of domestic groups in a particular social and ecological setting. This movement will be determined by such matters as marriage rules which determine which of a range women or men can or cannot marry and where he is normally expected to live upon marriage; inheritance and successions rules which determine who of a range of kin shall inherit property or succeed to a position; the growth in size of domestic groups in relation to locally available resources, and so forth. The operation of such factors will create a degree of movement which we would expect to be fairly constant in any particular social and ecological context. This normal rate of movement is probably reflected in the one percent of internal
movement which appears characteristic of all areas save Area MG and Area CH.

Strategic migration occurs when individuals consciously seek out new opportunities for economic, social or political advancement. The rate of strategic migration is much more difficult to determine. Probably some of the movement in Area NG during the period from 1966 to 1970 was of this kind, as people moved to take advantage of boreholes, cotton lands and so forth which came with the establishment of the CCDP. However, the movement appears to have accelerated rapidly from 1.4 percent per annum to almost 4 percent per annum which suggests that other factors are now operating. Since Area MG also shows a high outflow of population we feel that the two sets of data are not unconnected and may well reflect a build up of pressure on the land which is reflected in an increased rate both of normal migration and of strategic migration. The former adding to the high internal rate of movement and the latter leading to emigration from the area. As population pressure builds up within an area, land disputes increase which leads to tension amongst neighbours which in turn may lead to migration. Families also disperse sooner than they would have done as young adults find it increasingly difficult to find land to cultivate in their home area. Area NG which attracted population heavily in the past now appears to have reached saturation point, and this is reflected in the increasing rate of normal migration and of strategic migration.

Precipitate migration refers to the migration arising from a sudden natural or man-made disaster which affects either groups or individuals, and to which the immediate reaction is flight. It characterised the great movements of population which occurred in the Lower Shire Valley in the late thirties and early forties, occasioned by the flooding of the Elephant and Ninde Marshes. Precipitate migration is probably also a major component of the current high rate of immigration from Mozambique but elements of it are present in all areas where men either individually or in groups experience some overwhelming misfortune.

10.5.3 Net Migration

In order to assess the flow of population movement within the Lower Shire Valley, we have constructed Table 10.F. This shows the estimated net internal migration within the Valley for the period from mid-1966 to mid-1972. It has been constructed from the matrix given in Table 10.D by first subtracting the immigrants from external sources into the Valley and then subtracting the internal movement in each area from
the row and column totals. This then gives an estimate of the emigration from, and immigration to an area. In Table 10.G the same data are presented for each area expressed as proportions of their 1972 estimated populations. If we consider first the proportions given in Table 10.G their most striking feature is the high rate of emigration from Area NG and Area ND and the relatively high rate of immigration into Area KA. Here we must caution that the actual immigration we have detected is into the areas of T.A. Katunga and T.A. Makwira although we have detected emigration in our sample villages, from all four Traditional Authority areas. Removing the areas of T.A. Kasisi and T.A. Thomas would have the effect of somewhat increasing the proportionate net gain but of lowering the volume.

The movement from the south of Nsanje District (Area ND) is not unexpected, given its already high density of population, and the evidence of movement contained in the 1966 Census. As can be seen from Table 10.D the flow has been largely directed northwards to Area NG and Area KA.

From Area NG there appears to have been a movement of population northwards and eastwards producing a net loss of population from internal migration of the order of one percent per annum. It is significant that emigration from Areas NG and ND appear to be increasing. As we shall indicate in our later discussion of the amount of land cultivated per head, there is a general indication that pressure on land is increasing. Movements from these areas, as we have indicated, are probably part of a strategic migration in search of economic opportunities.

It is interesting that the movement into Area CH appears slight and there is a very slight loss of population. To some extent this is probably in part a reflection of the fact that two of our sampled villages were remote, situated over to the western border, but even in the two villages near Chikwawa Township we have detected little immigration from the rest of the Valley. In the past, the attraction of virgin land to cultivate was probably offset by the remoteness of the area and its general lack of facilities. The position is changing and the area may become more attractive to immigrants, although the high volume of immigration from Mozambique must be rapidly taking up whatever untapped reserves of land remain. The low rate of internal migration in the area probably reflects the low normal rate of migration characteristic of a situation in which reserves of land are still available. This view appears to be confirmed by the data from our Garden Survey: the villages of Sila
TABLE 10.F: Estimated Net Internal Migration, 1966 - 1972 by Area

<table>
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<tr>
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<th>ND</th>
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<td>Ndamera</td>
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<td>Makwira</td>
<td>Thomas</td>
<td>Tengani</td>
<td>Nyachikadza</td>
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<td>70-72</td>
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<td>-57</td>
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* = Less than 0.1 percent.
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<td>66-72</td>
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<td>TABLE 10.I: Estimated Net Internal Migration Plus Immigration from External Sources by Area 1966-1972, Expressed as a Proportion of the Estimated 1972 Population for Each Area</td>
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<td>17.3</td>
<td>20.3</td>
<td>-0.7</td>
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</table>
and Chitumba show no apparent change in the amount cultivated per head since the NSSA Survey of 1968/69.

In Table 10.4 we have presented the net internal migration plus the immigration from external sources. The same data are presented in Table 10.1 expressed as proportions of the estimated 1972 populations of each area. The addition of the immigration from external sources produce some change in the general position. The slight net loss from Area CH jumps to a high net gain of the order of 20 percent, 17 percent being gained in the period 1970-1972. In Area NG a slight net loss is still recorded showing that the addition to the population of immigration from Mozambique of one percent per annum is more than offset by emigration from the area. Area ND now shows a very slight gain whilst Area ML which showed a slight net loss from internal migration for the six year period now shows a net gain of the order of one percent per annum.

10.5.4 Sensitivity Analysis

In order to test the effect of our system of weighting, based on our estimates of current rates of population growth, upon the general pattern of population movements which emerge from the data, we have performed a sensitivity analysis by re-weighting the whole of the sample using the second set of weights given in Table 1.5 which are based on an assumed flat rate increase in the population since 1966 of three percent per annum. The re-weighted data are presented in Tables 10.J and K and Tables 10.L and M. This exercise demonstrates quite clearly that the general pattern which emerges is unaffected by the weighting. The population of Area NG shows a slight net gain over the six year period when the immigration from external sources is included, but still shows a net loss of five percent over the same period when the effect of the external immigration is suppressed.

Our general conclusion from the evidence presented on population growth and movements is that whilst the growth rate of the population of the Lower Shire Valley is close to the National average of 2.6 percent per annum there are considerable and significant variations in the rate of growth from area to area. These variations are largely caused by different rates of immigration and emigration from one area to another which reflect the response of people to changes in the local availability of resources and economic opportunities. In general, we would argue that the evidence indicates a movement away from areas of high population pressure or of low economic opportunity and is part of what we have termed a strategic migratory movement. To this must be added the high and apparently increasing rate of precipitate immigration from Mozambique.
TABLE 10.J: Estimated Net Internal Migration by Area 1966-1972 Assuming a Rate of Increase of 3 percent per annum for Each Area

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<th>NG Ngabu Lundo Massea</th>
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<th>ML Mlolo Mbenje Tengani</th>
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<td></td>
<td>66-70 70-72</td>
<td>66-70 70-72 66-72</td>
<td>66-70 70-72 66-72</td>
<td>66-70 70-72 66-72</td>
<td>66-70 70-72 66-72</td>
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<tr>
<td>Immigrants</td>
<td>31 9 40</td>
<td>1877 2335 4212</td>
<td>4186 5069 9255</td>
<td>1939 1458 3397</td>
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<td>Emigrants</td>
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<td>414 943 1357</td>
<td>1662 1910 3572</td>
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<td>3772 4126 7898</td>
<td>277 -452 -175</td>
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<th>ML Mlolo Mbenje Tengani</th>
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* = Less than 0.1 percent.
### TABLE 10.L: Estimated Net Internal Migration Plus Immigration From External Sources, 1966-1972, by Area Assuming a Rate of Increase of 3 percent per annum for Each Area

<table>
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<tr>
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<tr>
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### TABLE 10.M: Estimated Net Internal Migration Plus Immigration from External Sources, 1966-1972, by Area as a Proportion of the 1972 Population for Each Assuming a Rate of Increase of 3 percent per annum for Each Area

<table>
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<td></td>
<td></td>
<td></td>
<td>Thomas</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Immigrants</td>
<td>66-70</td>
<td>70-72</td>
<td>66-72</td>
<td>66-70</td>
<td>70-72</td>
<td>66-72</td>
<td>66-70</td>
<td>70-72</td>
<td>66-72</td>
<td>66-70</td>
</tr>
<tr>
<td></td>
<td>2.8</td>
<td>17.3</td>
<td>20.1</td>
<td>4.4</td>
<td>5.6</td>
<td>10.0</td>
<td>8.4</td>
<td>10.3</td>
<td>18.7</td>
<td>5.1</td>
</tr>
<tr>
<td></td>
<td>0.2</td>
<td>0.2</td>
<td>0.4</td>
<td>4.7</td>
<td>5.2</td>
<td>9.9</td>
<td>0.7</td>
<td>1.5</td>
<td>2.2</td>
<td>2.8</td>
</tr>
<tr>
<td>Net Migration</td>
<td>2.6</td>
<td>17.1</td>
<td>19.7</td>
<td>-0.3</td>
<td>0.4</td>
<td>0.1</td>
<td>7.7</td>
<td>8.8</td>
<td>16.5</td>
<td>2.3</td>
</tr>
</tbody>
</table>

* = Less than 0.1 percent.
10.6 Land Resources per Household and per Person

Perhaps the major reason for selecting the strategy of resurveying the 1968/69 NSSA villages has been to test the hypothesis that the land area farmed per person has declined. At the outset this plan seemed excellent in principle, but as the Survey progressed doubts increased as to whether the hypothesis could be tested satisfactorily. These doubts arose on the following grounds:

(1) In the NSSA a team comprising six members was responsible for the garden measurement of 10 to 15 households in each of 33 to 35 villages in the period December 1968 to April 1969. By contrast the present survey required one man, who actually lived in the village, to measure the gardens of 20 to 30 households only in that village, a task which on average took six months to complete satisfactorily. As a result of the relatively higher labour input and greater familiarity with villages in the present survey it is probable that more comprehensive coverage has been achieved. In view of this it would have been no surprise to find that higher acreages were indicated for 1972/73 than for 1968/69 despite a true underlying reduction in acreage.

(2) Another difficulty concerns fallow land. Very clear instructions were issued in this Survey that the fallow acreage should be measured in order to achieve an estimate of total cultivable land. In the NSSA no crop code was explicitly assigned to fallow. There was however an all zero crop code which might (in the absence of the original instructions) be interpreted as being fallow. Whatever the land use covered by the zeroes code the area represented by it is proportionately less than the fallow acreage measured this year. This might be a reflection of the difference in seasons, 1968/69 having been very good agriculturally whereas the 1972/73 rains have been poor. However it is possible that the current survey has achieved a more thorough measure of fallow land, and that a comparison of total measured acreages in 1968/69 and 1972/3 will tend to underestimate any reduction per head. It has therefore been deemed prudent in the ensuing comparisons to distinguish cultivated from cultivable land, where cultivated acreage equals cultivable acreage minus fallow acreage.

(3) A further problem concerns the definition of a household for the purposes of identifying the gardens to be measured. The NSSA used the definition of "people eating from a common pot". This is rather
loose and a tighter definition (see Appendix III, Section) has been used by SOLV. What difference this may make is unknown, but to eliminate any possible bias all acreage comparisons are made on the per person as well as per household basis.

(4) There is also the possibility that the cumulative sampling errors or the two surveys (other than those associated with the measurement of fallow land) are large relative to the underlying changes have occurred, and that they will obscure these changes.

(5) Special factors have influenced the land/person relationship in some villages. Mbande village has been resited. The Shire River level may have changed, affecting the area of cultivable land in villages at the edges of the Elephant and Ndinde Marshes, such as Mpingasa and Ndamera. There are large differences in the population changes between villages, and it need not necessarily be true that the total acreage of land associated with villages has adjusted along with the total population. A full catalogue of these special factors is not practicable here.

All of these problems generated grave doubts as to whether the acreage comparison exercise would yield any worthwhile results. In the event the exercise appears to have worked moderately well and the results are discussed below.

The NSSA measured acreages in the wet season and it is assumed that they failed to measure dry season gardens which would have been under water at the time of the Survey. Therefore the dry season dinha gardens measured in the SOLV "New Garden Survey", mounted in July 1973, have been omitted from the 1972/73 acreage. The resulting comparative data are presented in Table 10.N.

If one considers the number of villages in which acreage has declined the picture is one of overall reduction in acreage per household and per person. The former is estimated to have increased in 6 of the 20 villages and decreased in 13, while the latter has increased in 7 and decreased in 13.

However, the magnitude of several of the increased acreages is such that straight (unweighted) averages do not show an unequivocal picture of shrinkage. Indeed on a per household basis the straight averages show an increase of 2.60 and 1.15 percent in the cultivable and cultivated acreage in the Lower Shire Valley. It is however land per person which is the key measure for policy purposes and on this basis the straight averages demonstrate the expected picture of decline by -4.45 and -6.30
### TABLE 10.N: Changes in Wet Season Acreage in the Lower Shire Valley Between 1968/69 and 1972/73

<table>
<thead>
<tr>
<th></th>
<th>Cultivable Acreage Per Household</th>
<th>Cultivated Acreage Per Household</th>
<th>Cultivable Acreage Per Person</th>
<th>Cultivated Acreage Per Person</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NSSA</td>
<td>SOLV</td>
<td>% CHANGE</td>
<td>NSSA</td>
</tr>
<tr>
<td><strong>N. W. Chaparanje</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sila</td>
<td>3.39</td>
<td>3.37</td>
<td>-2</td>
<td>3.39</td>
</tr>
<tr>
<td>Chithumba</td>
<td>4.08</td>
<td>3.48</td>
<td>-15</td>
<td>4.08</td>
</tr>
<tr>
<td><strong>W. Bank Chikwawa</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chimphepo</td>
<td>4.65</td>
<td>4.43</td>
<td>-15</td>
<td>4.51</td>
</tr>
<tr>
<td>Byasoni</td>
<td>4.47</td>
<td>3.83</td>
<td>-14</td>
<td>4.46</td>
</tr>
<tr>
<td>Mbanda</td>
<td>4.02</td>
<td>3.60</td>
<td>-10</td>
<td>4.02</td>
</tr>
<tr>
<td>Nchacha NZ</td>
<td>2.31</td>
<td>4.59</td>
<td>99</td>
<td>2.31</td>
</tr>
<tr>
<td>Bwemba</td>
<td>3.13</td>
<td>4.53</td>
<td>45</td>
<td>3.13</td>
</tr>
<tr>
<td>Rabu</td>
<td>6.60</td>
<td>5.95</td>
<td>-10</td>
<td>6.60</td>
</tr>
<tr>
<td>Ubale</td>
<td>6.81</td>
<td>6.41</td>
<td>-6</td>
<td>6.81</td>
</tr>
<tr>
<td>Khokwa</td>
<td>4.99</td>
<td>4.99</td>
<td>0</td>
<td>4.99</td>
</tr>
<tr>
<td><strong>E. Bank Chikwawa</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kaputeni</td>
<td>3.36</td>
<td>1.90</td>
<td>-43</td>
<td>3.29</td>
</tr>
<tr>
<td>Mpingasa</td>
<td>2.46</td>
<td>2.94</td>
<td>20</td>
<td>2.27</td>
</tr>
<tr>
<td><strong>E. Bank Nsanje</strong></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>Mlolo</td>
<td>2.48</td>
<td>2.25</td>
<td>-9</td>
<td>1.96</td>
</tr>
<tr>
<td>Mwanabvumbe</td>
<td>1.45</td>
<td>1.38</td>
<td>-5</td>
<td>1.45</td>
</tr>
<tr>
<td><strong>Rest Nsanje</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ngulwe</td>
<td>3.78</td>
<td>6.53</td>
<td>73</td>
<td>3.78</td>
</tr>
<tr>
<td>Pungotii</td>
<td>4.24</td>
<td>4.36</td>
<td>3</td>
<td>4.17</td>
</tr>
<tr>
<td>Kasenga</td>
<td>2.90</td>
<td>1.91</td>
<td>40</td>
<td>2.90</td>
</tr>
<tr>
<td>Mphaladona</td>
<td>4.08</td>
<td>3.41</td>
<td>-16</td>
<td>4.08</td>
</tr>
<tr>
<td>Ndamara</td>
<td>4.03</td>
<td>4.72</td>
<td>17</td>
<td>4.03</td>
</tr>
<tr>
<td>Meyankhuni</td>
<td>3.24</td>
<td>2.41</td>
<td>-26</td>
<td>3.25</td>
</tr>
<tr>
<td><strong>Average Acreage Change</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unweighted - LSV</td>
<td>2.60</td>
<td>1.25</td>
<td></td>
<td>2.60</td>
</tr>
<tr>
<td>Weighted - LSV</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted - Chikwawa</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weighted - Nsanje</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes:**
1. In calculating the acreage per person for SOLV labour migrants, visitors and temporary labourers, polygamous males were counted with a weight of number of wives in the village/total wives.
2. Cultivated acreage = Cultivable acreage minus fallow acreage.
3. The weights used in calculating average percentage acreage changes are those in columns 5 to 7 of Table I.B.
4. NSSA acreages were obtained by reworking the original data held on cards at the National Statistical Office, Zomba.
percent respectively in cultivable and cultivated acreage.

However it is not strictly appropriate to produce estimates of acreage changed by straight averaging of the percentage changes in all villages. Each village represents a different number of households, and this should be reflected in the use of different village weights applied to each separate village result to produce an overall weighted average. The correct weights for this purpose were presented in Table 1.B, columns 5 to 7, and the outcome of employing these is shown at the foot of Table 10.N.

The weighted average acreage changes for the Lower Shire Valley are all negative. It is estimated that cultivable and cultivated acreages decreased from 1968/69 to 1972/73 by -0.58 and -1.82 percent per household, and by -8.33 and -9.44 percent per person.

These overall weighted averages conceal major differences in the changing man/land ratios in the two major administrative subdivisions of the region, Chikwawa and Nsanje. As Table 10.N shows the acreage changes in Chikwawa appear to have been small both per household and per person. In Nsanje the picture is radically different; although acreage per household has not declined much there does appear to have been a massive reduction in acreage per person of approximately 18 percent in four years. On the face of it this might appear rather high; it certainly exceeds the -12.2 percent change which would have been expected with fixed land resources and the estimated population growth rate for Nsanje of 2.97. While it is therefore possible that 18 percent overstates the reduction in the man/land ratio the difference between 18 and 12.2 percent could possible be explained by the degradation of some soils by erosion and by the encroachment of the increasing cattle population onto arable land.

The relative picture of rapid reduction in the man/land ratio in Nsanje with only a small decrease in Chikwawa is what might have been expected; although the fall may be overstated in the former and understated in the latter. Certainly in Nsanje there has been virtually no surplus land for some time, and therefore the high rate of population growth in Nsanje has resulted in a sharp fall in the amount of arable land per person. This poses a serious problem which can only grow worse, and it is not surprising that the employment patterns illustrated in Chapter 9 indicate high levels of adult male labour migration and involvement in rural crafts in Nsanje. We even suspect that the average acreage reduction in Nsanje has been underestimated, because there are serious reservations about the results for Nguluwe. It is hard to accept that in this village the cultivated acreage per person can have increased by
39 percent in four years during which the village population has substantially increased; the increase was 22.5 percent from mid-1966 to mid-1972. It is suspected that this anomaly may be a manifestation of the anticipated underenumeration by NSSA in 1968/69.

In Chikwawa there has been, and to a lesser extent still is surplus agricultural land. This has apparently enabled the population of this area to expand without forcing much reduction in the arable land per person. Nevertheless, there is a suspicion that the acreage decline in this area is also underestimated for this part of the region. In this case the doubts focus on the results for Nchacha Nzangaya and Bwemba; although the increases in cultivated acreage per person (of 23 and 37 percent respectively) could just conceivably be feasible in view of the decline in population of these villages. Despite this there is a suspicion of underenumeration in 1968/69, a suspicion strongly reinforced by the comparatively small average holdings for these villages as measured by the NSSA. If these doubts are correct the estimated average acreage decline in the Lower Shire Valley is too low.

Whatever the doubts about the acreage change results for Bwemba and Nchacha, or indeed other villages, the results for Nguluwe in Nsanje are definitely judged to be wrong. For this reason Nguluwe is omitted from the ensuing brief application of Student's "t" test, used to examine the hypothesis that the average acreage reduction is significantly negative.

Some of the very large increases in acreage per household shown in Table 10.N, such as those at Ngamera, Nchacha and Bwemba have been largely due to increases in household size - this may be due to differences in the NSSA and SOLV definitions of a household. Since it is necessary to control for such possible changes in definitions and since also it is acreage per person which is ultimately of greatest significance only acreages per person will by analysed further.*

* For the purposes of defining household size for the SOLV Survey we have used that definition which appears likely to fit most closely to that used by NSSA. That is, a household is composed of those people who normally eat and live as members of it. This includes permanent residents, temporary absentees who are close family members, and permanent labourers. Where a family member is a polygynous male he has only been counted with a valency equal to the number of wives living in the village divided by his total number of wives.
Application of the 't' test to acreage per person changes in the 19 villages remaining after the exclusion of Nguluwe produces the following results.

TABLE 10.0: Acreage Change 1968/69 to 1972/73: A Statistical Test

<table>
<thead>
<tr>
<th></th>
<th>Unweighted Average</th>
<th>Standard Error of the Average</th>
<th>'t' Value</th>
<th>Significance Level* (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower Shire Valley:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultivable Acreage/person</td>
<td>-6.68</td>
<td>5.20</td>
<td>-1.28</td>
<td>85</td>
</tr>
<tr>
<td>Cultivated Acreage/person</td>
<td>-8.63</td>
<td>5.47</td>
<td>-1.57</td>
<td>90</td>
</tr>
<tr>
<td>Nsanje:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultivable Acreage/person</td>
<td>-16.71</td>
<td>9.15</td>
<td>-1.83</td>
<td>90</td>
</tr>
<tr>
<td>Cultivated Acreage/person</td>
<td>-18.71</td>
<td>9.89</td>
<td>-1.89</td>
<td>95</td>
</tr>
<tr>
<td>Chikwawa:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cultivable Acreage/person</td>
<td>-0.83</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
</tr>
<tr>
<td>Cultivated Acreage/person</td>
<td>-2.75</td>
<td>nc</td>
<td>nc</td>
<td>nc</td>
</tr>
</tbody>
</table>

* A one-tailed test has been used.

nc = not calculated since quite clearly the average percentage acreage reductions in Chikwawa are not statistically less than zero.

The main feature of these results is that average acreage reductions for the Lower Shire Valley as whole and Nsanje district are statistically significantly less than zero – levels of significance in excess of 90 percent are accepted as providing strong statistical confirmation of a hypothesis. The implication is that there are no longer large tracts of unused cultivable land. It is true that in some areas there is surplus land, and it is interesting to note that the Table 10.0 results roughly fit the known distribution of such land, thus lending weight to the validity of the Garden Survey findings. In particular it will be noted that in the hill areas of N.W. Chapananga there appears to have been little or no change in the land/man ratio. This fits the facts that there are still areas of virgin land around Sila but more particularly Chithumba, although these are steadily being cleared. However the basic distinction concerning available land resources is between the extreme shortage in Nsanje and the slow increase in pressure in Chikwawa which will certainly be felt more in the near future. This distinction is again amply reinforced by the results shown in Table 10.0; and it will be noted that the unweighted percentage changes presented in this table are very similar to the corresponding weighted figures in Table 10.0.
It thus seems reasonable to conclude that the land/man ratio for the Valley as a whole has declined by between 8 and 9 percent over the four years 1968/69 to 1972/73. Quite appropriately the absolute annual rate of this decline, between 2 and 2.2 percent, is less than the estimated population growth rate of 2.58 percent. It is nevertheless a truly alarming statistic which indicates a serious erosion of the resource base of smallholder agriculture. If the situation in the Valley as a whole is worrying that in Nsanje seems alarming with a likely reduction of acreage per person of the order of 4 percent per annum. To preserve, let alone, raise the living standards of small farmers in these conditions calls for continuing and accelerated efforts to intensify land use by promoting the rapid adoption of land augmenting inputs such as irrigation water, improved seed, fertilizer and insecticides. Even this would not seem likely to solve the problems of Nsanje, and there additional efforts to boost non-farm employment might be useful, possibly through rural craft training.

10.7 Some Results of a Dietary Survey

One expected manifestation of population pressure on the land would be pressure on food supplies in the interharvest period. It was therefore decided to supplement the investigation recorded in the CCDP Farm Survey 1971/72* with a more detailed investigation of eating habits during the period from 1st December 1972 to 5th April 1973. This period was chosen to cover the main time of food supply stress through to the commencement of the harvest of 1972/73 wet season food crops.

This Dietary Survey has been based upon the daily interview of 10 households in each of the 20 villages in the main sample. Information was collected each evening about the main foods eaten at the mid-day and evening meals, and about the way in which these foods were obtained e.g. home grown, bought, gathered etc.

The results obtained appear sufficiently interesting to warrant a very brief presentation here. It is apparent that there was a period in which food supplies were short. It also emerges that this was overcome by adjustments to diet and adjustments in the food purchasing pattern. The problem was seemingly not overcome by going without meals, since the number of meals missed shows no relationship with time.

What are possibly the most interesting results are given in Table 10.P. Because of the remoteness from sources of fresh fish and because of the comparative absence of livestock in the hills of west

Chapananga the data for the two villages Chithumba and Sila Zuwawo are shown separately from the rest. Data for all the other villages, with the exception of Mbande, Mseyankhuni and Nchacha/Nzangaya, are combined together. These three villages have been omitted because enumeration is considered to have been inadequate or incomplete.

**TABLE 10.P: Percentage of meals consumed by Origin and Type of Food Consumed, by Period**

<table>
<thead>
<tr>
<th></th>
<th>Staple Food</th>
<th>Stable Food</th>
<th>Relish</th>
<th>Meat &amp; Fish</th>
<th>Relish Gathered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Home-grown</td>
<td>Bought</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sila/Chithumba</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Dec. - 28 Dec.</td>
<td>62</td>
<td>37</td>
<td>4</td>
<td>9</td>
<td>87</td>
</tr>
<tr>
<td>29 Dec. - 25 Jan.</td>
<td>47</td>
<td>53</td>
<td>3</td>
<td>4</td>
<td>95</td>
</tr>
<tr>
<td>26 Jan. - 22 Feb.</td>
<td>45</td>
<td>55</td>
<td>4</td>
<td>4</td>
<td>94</td>
</tr>
<tr>
<td>23 Feb. - 22 Mar.</td>
<td>82</td>
<td>17</td>
<td>3</td>
<td>9</td>
<td>93</td>
</tr>
<tr>
<td>23 Mar. - 4 April</td>
<td>98</td>
<td>0</td>
<td>less than 1</td>
<td>4</td>
<td>96</td>
</tr>
<tr>
<td><strong>Other 15 Villages</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Dec. - 28 Dec.</td>
<td>53</td>
<td>42</td>
<td>41</td>
<td>37</td>
<td>36</td>
</tr>
<tr>
<td>29 Dec. - 25 Jan.</td>
<td>50</td>
<td>46</td>
<td>29</td>
<td>36</td>
<td>47</td>
</tr>
<tr>
<td>26 Jan. - 22 Feb.</td>
<td>38</td>
<td>57</td>
<td>26</td>
<td>26</td>
<td>61</td>
</tr>
<tr>
<td>23 Feb. - 22 Mar.</td>
<td>51</td>
<td>41</td>
<td>24</td>
<td>22</td>
<td>56</td>
</tr>
<tr>
<td>23 Mar. - 4 April</td>
<td>77</td>
<td>19</td>
<td>20</td>
<td>26</td>
<td>65</td>
</tr>
</tbody>
</table>

Note: The proportion of staple bought plus that home grown is usually less than 100, because staple is sometimes given or even gathered.

A basic pattern of food purchasing and dietary habits emerges from the data in Table 10.P. There appears to have been a period starting before December and continuing approximately until the end of February in which home-grown supplies of staple food became increasingly scarce. During this time, the proportion of staple food requirements which was bought increased steadily and the home-grown fraction shrunk correspondingly. This stress appears to have terminated abruptly at the end of February, after which there was a sharp reduction in the proportion of bought staples and a rise in the proportion grown by the consuming household. This turning point coincides with the ripening of maize from the 1972/73 wet season crop.
It is also interesting to note that, for the main body of villages, it appears to have been necessary to reduce purchases of relish from December to February in order to be able to purchase the necessary amounts of staple foodstuffs. Associated with the reduction in the number of meals for which relish was purchased was a reduction in the number of meals at which meat or fish were eaten. Doubtless this is because most households do not supply their own meat and fish. Thus there was a switch from animal and fish to vegetable protein, which is reflected in the proportion of meals for which the relish was gathered. It had been intended to reserve use of the term 'gathered' for non-cultivated sources of food, but in practice enumerators seem to have employed to include anything not taken out of storage: thus it probably includes maize picked green. However, to some extent growth in this category does reflect an increased dietary dependence upon such vegetables as wild okra and water lily bulbs during the period of shortage.

In summary, the solution to the food supply problem in the two or three months preceding the main maize harvest is that

(a) the deficiency in home grown staple food supply is made good by increasing staple purchases,
(b) this is facilitated by decreasing purchases of relish, and
(c) the cut-back in expenditure on relish involves reduced consumption of meat and fish with the substitution of vegetable protein sources.
Some reform of the system of land tenure now prevailing in the Lower Shire Valley is contemplated as part of Phase II of the SVADP.*

The necessity for reform is usually expressed in terms of achieving three objectives which, collectively, are envisaged as leading to increased agricultural productivity through the more efficient distribution and use of land. The intermediate goals for achieving this ultimate objective are (i) the consolidation of scattered holdings; (ii) the provision of a secure title to land; (iii) the creation of a market value for land.

In this chapter we discuss these goals in relation to the prevailing systems of land tenure. The basic principles which underlie the systems of land tenure are relatively simple. However, in any particular local context they operate in conjunction with ecological, demographic, historical and sociological factors to produce considerable complexity. We begin by considering briefly political and administrative arrangements at the national and local levels which are relevant to an understanding of the system of land tenure. We then construct a simple typology based on a demographic continuum ranging from low to high density of settlement. This typology enables us to indicate how the system of land tenure has been adapted in various areas in response to increasing population pressure. We then consider factors of social organisation and structure which determine the composition of local land-holding groups. Finally, we discuss the possibilities for tenurial reform.

11.1 National and Local Government in relation to Land Tenure.

In Malawi, the State defines certain land as being held under customary tenure. Such land may not be bought or sold. Under the Land Act the State also has the right to intervene to acquire land held under customary tenure where this is deemed to be in the national interest. The Act provides procedures for the payment of compensation in such cases. In the Lower Shire Valley, the State has intervened, for example, to provide land for the SVADP headquarters and staff housing, to make land available for SUCOMA and the Muona Rice Project, and so forth.

At the local level, the State regulates the use and distribution of land through the hierarchy of local administration which ranges from the

District Commissioner, through the Traditional Authorities and Group Village Headmen to the Administrative Village Headmen. In the formal structure of the local administration disputes over the allocation of land are raised first with an Administrative Village Headman. If a dispute is not capable of settlement at this level, it is then raised with a Group Village Headman or, frequently, taken directly to the relevant Traditional Authority. If the Traditional Authority cannot settle the case, it is taken before the District Commissioner for final adjudication. This formal structure developed essentially during the Colonial Period and, with some modification, has been incorporated into the modern state.

The role of the State and of Local Government in the allocation of land, however, is only one aspect of the current system of land tenure. There are other structures which must be explored to gain an understanding of how land is actually allocated at the local level.

11.2 Estates of Administration.

In any part of the Lower Shire Valley where people now live and cultivate one can obtain accounts of how the land was settled and distributed. In long-settled areas, these accounts, supported by elaborate genealogies, may reach back into the nineteenth century or even earlier and are of some complexity. In more recently settled areas the accounts are simpler. In general, these accounts trace the devolution of responsibility for the allocation of land through various intermediaries from the first settler and clearer of the bush to the most recently established village or ward headman. In general, but not invariably, the devolution of the responsibility for the allocation of land is closely associated with the devolution of political and administrative responsibility proceeding from the Traditional Authority, through the Group Village Headman, to the Village Headman, then to the Ward or Hamlet Heads. In some areas, there may be several intermediaries identified between a Traditional Authority and a particular Village or Ward Headman. This situation will occur, for example, where new villages have been established as off-shoots of an older village and then each has undergone further fission and subdivision. Or it may occur where a group of immigrants has moved into an area and wishes to establish a new village or village ward (section), rather than members of the group attaching themselves as individuals to existing wards. The Village Headman of the original village will have
allocated land to the Headman of the new village who in turn will have
allocated land to the offshoots of these villages. Often, the Headman
of a long-established village that has given rise to a series of new
villages is recognised as a Group Village Headman and thus has a formal
position in the hierarchy of local Government but this may not always
be the case.

The devolution of the responsibility for the allocation of land
from one person to another always gives the former some minimum of
political influence over the latter because the giver of land always
retains a residual interest in the land. Once established by the granting
of land, this political relationship persists between the successors to
the original parties. Gluckman has referred to the various levels
defined in terms of the giving and receiving of land as "estates of adminis-
tration". In general, the holder of an estate of administration will be
consulted should a land dispute arise among those to whom he or his
ancestor allocated land. He also retains a reversionary right to the land
which he or his ancestor allocated. Land once given outright cannot be
reclaimed from the receiver, but should those who received the land, or
their descendants, subsequently leave it, the giver, or his descendant,
has a right to reclaim the land and to allocate it again.

11.3 Administrative Villages, Wards and Hamlets.

Administrative Villages are always associated with a defined area
of land whose boundaries - rivers and permanent natural features - are
well known. All who live and cultivate within these boundaries fall
under the jurisdiction of the Village Headman. If the Administrative
Village is not internally sub-divided into wards or hamlets, it will be
the basic unit of land holding. However, frequently, Administrative
Villages are internally sub-divided into wards or hamlets, each with a
head. Whilst the members of a ward may not live in sets of dwellings
which are completely spatially discrete from members of other wards, their
ward affiliation is known. In other cases, the wards may constitute
completely separate parts of the village. Where they are separated by
some distance they form independent hamlets.

Where the village is divided into wards, the land of the village
will be divided among them. It is as a ward member than an adult acquires
a right to cultivate sufficient for himself and his dependants. In such
cases it is the ward which constitutes the basic unit of land holding.

* M. Gluckman, The Ideas in Barotse Jurisprudence, Yale University Press,
Whilst all adults are viewed as having a general and inalienable right to land for themselves and their dependants this is only exercised as a member of a ward community.

11.4 Types of Fragmentation.

The land allocated to a ward may be in one clearly defined block but often it consists of a number of blocks, particularly where there are marked contrasts in soil types and where it may be desirable to have access to land of each type. In addition, because wards through time may grow in size differentially, readjustments may occur in the land held by a ward. Negotiations among Ward Heads, in conjunction with the Village Headman, may serve to even out inequalities which occur. Wards whose populations are growing in size may be allowed new blocks of land or they may be allowed to take over parts of blocks previously allocated to other wards. Often these are some distance from the original holdings. In a long-established village, therefore, the land of a ward seldom consists of a discrete, contiguous block. These two factors, the need to have access to land of different soil types and the readjustment of holdings between wards, lead to one type of fragmentation.

A second type of fragmentation occurs when virgin land is being opened up for cultivation. If there is much virgin land available a man is free to open up land, within the ward boundaries, wherever he wishes provided that he does not infringe the rights of others. He may open up, therefore, a number of gardens in different locations, attempting to select, by the use of grass and tree indicators in conjunction with soil colour and texture, the land of the best quality. Parts of his total holding, therefore, may be widely dispersed.

The practice of borrowing land leads to a third type of fragmentation. The borrowing of land is widespread and occurs when a family is growing in size and needs additional land or where a family needs access to land of another soil type to grow a particular crop. Borrowing is a private arrangement between two individuals and the parties to the arrangement need not necessarily be members of the same ward or, for that matter, of the same village. Generally, the Ward Head, Village Headman or other elders are notified in order that they may witness the exchange. No payment is made by the borrower to the lender. Occasionally, at the end of the period of borrowing a small gift may be given to the lender but this is not obligatory. Borrowing may be on a short or long-term basis. Occasionally, when the original witnesses to the transaction and the lender have died or moved
away, the borrowed land may pass under the complete control of the
borrower who may then reallocate it without reference to anyone save
the Village or Ward Headman.

A fourth type of fragmentation may occur when the head of a
household dies. His successor may act as the guardian of the widow
and her children and may take over responsibility for the allocation
of land among them. He may also cultivate part of the holding of his
deceased kinsman himself whilst still maintaining his own holding which
may be in another village some miles away.

A similar type of fragmentation occurs in certain cases of polygyny.
In general, among the patrilineal people of the Valley, when a man takes
another wife she comes to live at his village (although occasionally,
his wives may live in different wards). Among the matrilineal people,
however, one finds that because marriage is initially uxorilocal and a
man is expected to live and work for a period at his wife's parents'
village, a polygynist may have wives distributed over a number of villages
scattered over a considerable distance. Each wife will have her own
gardens. From the point of view of management, therefore, the total
holding of a Circulatory Husband is fragmented.

A fifth type of fragmentation arises when the density of population
is such that no free land is available. In this case when a landholder
dies and has no successor, or when someone moves away from a ward, the
Ward Head may reallocate the land to a family in need whose members may
have previously petitioned him for additional land. In this case, the
allocated plot may be some distance away from the family's main holding.
Similarly, when a newcomer petitions for land when it is scarce, he may
be allocated small plots scattered throughout the ward. This type of
fragmentation is found particularly in parts of Nsanje South where popu-
lation density is high.

Of these types of fragmentation, the first four are either normal
features of the system of agriculture or arise from normal procedures
occurring in the social organisation. Only the fifth type of fragmentation,
arising in conditions of scarce land and high population density, can be
considered abnormal.

11.5 Land Tenure and Population Density.

The system of land tenure has been adapted to accommodate situations
in which land is scarce and where the system of agriculture has been
modified. Four types of situation are considered ranging from conditions of low to high population densities.

**Type I : Virgin land available, low population density.**

In this situation, confined largely to the area of the T.A. Chapananga and parts of the Western Escarpment, a right to cultivate is established by a ward member clearing the bush. If there is much virgin land available this may be done without the Ward or Village Headman's formal consent although their right to intervene should a dispute arise is acknowledged. Cultivators feel no constraints on the expansion of their holdings and often refer to them as having no formal boundaries. Land is opened up and the holding expanded year by year. After from three to five years depending on the soil type, the first area of the holding to have been cultivated will be allowed to revert to fallow and a new area will be cleared to replace it. Rights to fallow are not clearly defined and, in general, since there is so much virgin land available, no one is particularly interested in either retaining or obtaining rights to fallowed land.

**Type II : Virgin land available, moderate population density.**

As the density of population increases and the risk of one cultivator expanding his holding and coming into contact with another increases, the Ward or Village Headman may direct that a holding may only be expanded in a particular direction and may begin to direct newcomers only to open new gardens in particular areas. However, rights in fallow still remain largely undefined.

**Type III : Virgin land available, high population density.**

With increased density of population and the possibilities for the expansion of a holding becoming limited, the Ward or Village Headman allocates the remaining virgin land among the residents of the ward or village. Definite boundaries of holdings begin to emerge and any household is able to indicate what parts of the village or ward land - cultivated, virgin or fallow - it actually holds. Rights in fallow now become more sharply defined. This is because the short-cycle fallow of three to four years duration becomes an essential feature of the agricultural system. Land is fallowed when certain grass and weed indicators appear and yields have begun to fall. The fallowed land is then left until certain grass types begin to establish themselves again and grow with vigour, before it is re-cultivated. This type of situation occurs particularly along the
western fringes of the SVADP Phase I area, towards the Western Escarpment.

Type IV: No virgin land available, high density of population.

The short-cycle fallow is now central in the agricultural system and rights in fallow are precisely defined. As the population density increases still further, the Village or Ward Headman may be accorded the right to allocate any uncultivated land should there be a family in need. This situation is typical of parts of southern Nsanje District where population densities are high. Should a man be a labour migrant, for example, and should his gardens have been left uncultivated for some reason, the Village Headman may feel it just, after sending a warning to the migrant, to reallocate the land. In addition, the Village Headman may solicit from others holders small areas of land for a family in a particular need.

We observe, therefore, that changes occur in the degree of specificity of land rights as one moves from situation of low to situations of high density of population. One of the most significant qualitative changes occur when all virgin land is taken up and thus the long-cycle fallow is no longer possible. Here we find that fallow land becomes crucially important to the maintenance of the agricultural system and therefore rights in fallow become precisely defined.

11.6 Land Tenure and high water table land.

So far, we have considered changes in the system of land tenure in response to changes in population density in relation to low water table, rain-fed, land. Where there is access to high water table land which can be exploited for double cropping we find that rights to gardens on such lands are always more precisely defined. If we consider first, high water table land which is not deeply flooded, we find that in general, gardens are much smaller than on low water table land, often of only a fraction of an acre. The gardens are often regular in shape with precise boundaries usually marked by perennial reed grasses. Since such gardens have been regularly cultivated without being fallowed for long periods they often have complex tenurial histories.

A careful examination of these histories reveals that a considerable number of people may have a residual interest in such gardens which they express in terms of genealogical connections to present or earlier cultivators. Should a plot fall vacant then those with such residual interests
will press their claims arguing in terms of the nearness of their kinship to a previous cultivator. One does not usually find such complex tenurial histories in relation to gardens on low water table land, except in areas with acute land shortage.

Where there is high water table land which is subject to irregular deep flooding and intermittent cultivation, such as the land immediately adjacent to the Shire River in the Ndinde Marsh, procedures have been developed for distributing this land as it becomes available. The problem is that on land which is deeply flooded for considerable periods, boundary markers are obliterated. Consequently, if a 'free-for-all' situation were allowed to develop there would be frequent disputes. Consequently, a village committee, or a special councillor, or the Village Headman and the Branch Chairman of the MCP - the procedure varying from one area to another - meet with villagers as the flood recedes and arrange for the equitable distribution of the land.

11.7 Grazing Rights.

Where cattle densities are low, cattle are allowed to forage wherever grazing is available. The only principle applied being that cattle must not damage standing crops. Once crops are harvested cattle are allowed to roam through gardens and to graze on the stover. However, where cattle densities are high near the river, the rights of cultivators of high water table land and those of cattle owners may come into conflict. Grazing areas still remain communal, usually but not always associated with a single village, but one may find that certain herds are normally expected to use one grazing area, whilst other herds are allocated another. This avoids competition for grazing and also minimizes the risk of fights between bulls. It is possible that out of this kind of situation a movement for enclosure may develop among some large cattle owners. We know of one case in T.A. Mlolo's area on the edge of the Elephant Marsh where a cattle owner has enclosed a small area of land with wire fencing. He did this after frequent quarrels with neighbouring cultivators over damage done to their gardens by his cattle and also to separate his own herd for other cattle after he had sustained heavy losses from disease. We know that there are other cattle men in the area who have similar problems and this development appears to be one which is likely to spread. If it is to be successful such cattle men will need
credit facilities for fencing and the movement will have to be closely associated with grass-land development.

11.8 Land Tenure and Social Structure.

We have so far considered the basic principles which underlie the system of land tenure and how these become modified as population and cattle densities increase. These principles apply throughout the Valley, whatever the modes of descent, succession and inheritance. However, we must consider briefly variations which occur in the operation of these principles due to processes occurring in the social system.

11.8.1 Modes of descent.

There are in the Valley two basic modes of reckoning descent, matrilineal and patrilineal. They are each associated with rules and processes which lead to the formation of different types of local grouping and organization. The matrilineal form of organisation is confined largely to the north of a line drawn East-West across the Valley through the confluence of the Mwanza and Shire rivers. On the East Bank there appears to be a transition zone extending from Kaputoni Village to somewhere north of Mpingasa where matrilineally and patrilineally organised people live side by side in the same villages. On the West Bank, a similar transition zone appears to occur, of which Mbande Village is a part. We have not fully established its southern limit, but it is probably north of Nchalo. In addition to the transition zones, matrilineally organized people are found in scattered pockets throughout the Valley south of the Mwanza-Shire confluence. These are in the main the kin of Mang'anja headmen. One sometimes finds that whilst villages in the south often consist predominantly of patrilineally organized peoples, usually immigrants or the descendants of immigrants from the Zambezi Valley, the headmanship is still retained by a small, matrilineally organized group of Mang'anja who are conceived of as "the owners of the land".

11.8.2 Matrilineal Organization.

The effects of the operation of matrilineal modes of succession inheritance and marriage, are to produce local groups with a characteristic social structure. The clearest examples of this which we have found occur in the village of the north-west of T.A. Chapananga's area. Here, one finds that the core of the village structure consists of a shallow matrilineal descent group, usually the descendants of an ancestress some three or four
generations removed from the eldest living. The descent group is internally segmented into smaller groups by reference to more recent ancestresses. Frequently, the segments are spatially segmented into wards or hamlets. Each segment has a warden responsible for the welfare of its members. The smallest unit is, prototypically, a warden, his unmarried brothers, his sisters, married and unmarried, and his sisters children. Such a unit may be termed a sorority group. The wardenship of a sorority group passes from a man to his brothers in turn and then to his sisters' sons, beginning with the eldest sister's eldest son. The warden of a sorority group is responsible for the allocation of land among his wards.

Because marriage is initially uxorilocal and a man should on marriage leave his own village and go to work for some years in the fields of his wife's mother, a man may obtain his first access to land through his wife. Since marriage among matrilineally organised people is reputed to be unstable, this has given rise to the myth, so elaborated in folk-lore, of the son-in-law under matriliney who is at the beck and call of his wife's kin and who maintains a precarious foothold in his wife's village, dependent on her goodwill and that of her kin, and on the continuing stability of his marriage. This myth whilst it expresses an ideal-typical situation under matriliney should not be confused with reality.

Marriage under matriliney in the Lower Shire Valley is neither more or less stable than under patriliney according to a provisional assessment of our data on marriage stability. Under both types of organization divorce is relatively frequent and about a third of all marriages end in divorce. Furthermore, the proportion of men under matriliney who actually leave their home villages upon marriage is much smaller than is supposed. This is because in the normal development of a matrilineally organised village a number of "strangers" matrilineal descent groups become incorporated into it. These attached descent groups either develop from the descendents of wives of past wardens of sorority groups of the core matrilineal descent group (such wardens are allowed to marry virilocally) or from immigrants who have settled in the village. Through time, the proportion of the village population who are members of attached descent groups comes to outnumber the members of the core matrilineal descent group. Frequently, the core group in a long-established village contribute
less than 20% of its population. Since marriage is permitted with a
cross-cousin - a mother's brother's or father's sister's daughter
real or classificatory - and with a woman from an unrelated family or
descent group in a village, there is frequently a number of suitable
marriage partners from which a man can choose within his own village.
In addition, it should be emphasised that under matriliney the sorority
group is a relatively enduring unit, more stable than the nuclear family.
Within this group, a man has undisputable rights to land.

Matrilineally organised villages are subject to regular processes
of segmentation and fission. These processes are set in motion partly
in relation to competition for land resources and partly in relation to
competition within descent groups for the position of warden. Each man
ultimately hopes to be able to form his own hamlet or village and to do
this he must gain control over, and have the support of, his sisters
and other women of the matrilineal group. Each matrilineally organised
village, therefore, eventually gives rise to a series of new villages.

11.8.3. Patrilineal Organization.

In long-established patrilineally organized villages the population
is likely to consist of some members of a number of shallow patrilineal
descent groups. A patrilineal descent group consists of those who claim
descent through males from an ancestor two or three generations removed
from the oldest living. In some of the old Mang'anja villages in the
south of the valley, where there may still be a matrilineally organised
core group, patrilineal descent groups and immigrant families eventually
become attached to this through marriage. The members of a patrilineal
descent group do not all reside together. Women are dispersed through
marriage, since marriage here is virilocal. In addition, there are
processes occurring within the patrilineal group in relation to competition
for resources and for the headship of the group which lead to its segmen-
tation and eventual fission.

Particularly in the Phase I area of the SWADP villages are very
heterogeneous in their composition. There may be fragments of patri-
lineal descent groups, but these will be among families unrelated to
each other or to the Ward or Village Headman who have migrated from other
parts of the Shire Valley or from the Zambezi Valley. In the south, too,
because of land pressure, groups can no longer segment and divide land
resources among the segments. When disputes arise and land is scarce,
people tend to move away to seek other opportunities, in families rather than in descent groups. It is only the mass migration engendered by the flooding of the marshes in the late thirties and early forties which appear to have led to substantial segments of descent groups moving en bloc to seek new land and establish new villages.

This widespread movement of individuals and families rather than segments of descent groups tends to convey the impression, reported in an earlier study of the SVADP Phase I area*, that there is a "break down" of kinship organisation and a much greater emphasis on the individual nuclear family as the basic unit of organisation. Whilst there are processes occurring which have tended to disperse descent groups and weaken the bonds of kinship among its members, shallow descent groups still have some significance even if their members are quite widely dispersed. In addition, some years after the establishment of a new village, its population stabilises and there is a tendency for descent groups to emerge as more firmly structured and organised residential groups. However, this situation can only develop where land is relatively plentiful and the members of descent groups can take up land rather than move elsewhere. Such situations are relatively rare in the Valley south of the Mwanza-Shire confluence.

The head of a patrilineal descent group is responsible for the well-being of its members and takes a particular interest in members' marriages and in the care of the widows and children of deceased male members of the group. Thus, he may well come to be involved in the distribution of land among such widows and children. It may happen therefore, that the head of a descent group may intervene in a land dispute many miles away from the village in which he is living should this involve the interests of one of his wards.

In concluding this brief outline of the relationship between features of social structure and organization and the system of land tenure, it must be emphasised that neither under matriliney or patriliney is the descent group a land holding corporation. There is no conception here of "lineage land" as found in some other parts of Africa. Members of descent groups hold land basically as individual members of a ward or village. It is residence and use of land within a defined residential unit which predominantly determines rights to land and not membership of a kinship group. A stranger who is admitted to a village or ward community

as a permanent resident is just as secure in his rights to the land he cultivates as is a member of the Village or Ward Headman's descent group.

11.9 The Reform of Land Tenure.

Reform of land tenure is often mooted as a universal panacea for many of the ills of peasant agriculture. Frequently such arguments for reform are based on a mistaken view of the casual connection between tenurial reform and the adoption of new agricultural techniques. Historically, it would appear that innovations in agricultural techniques occur first, these then produce concomitant changes in social organisation and structure which, in turn, lead to modifications in tenurial arrangements. Outside of special settlement and irrigation schemes where organisational, tenurial and technological changes have been introduced simultaneously, we know of no scheme for the reform of land tenure which per se has produced a radical change in agricultural practice.

Kenyan experience is often cited in confirmation of the view that tenurial change produces a change in agricultural practices but a careful examination of the data currently available* reveals that this is by no means unequivocally the case.

The position in Kenya appears to be that in areas where innovations in agricultural practice had already become widespread, changes in social structure and organisation had begun to occur and the system of land tenure was already beginning to be adapted to accommodate these changes. The reform of land tenure thus appears to have formalised what was already present in embryo and accelerated changes already in progress. Elsewhere, where these processes had not occurred, the indications are that whilst de jure land was consolidated and individual title registered at considerable inconvenience and cost, little or no change occurred in agricultural practices. Furthermore, the de facto situation prior to tenurial reform rapidly began to reassert itself.

11.9.1 Consolidation.

We have argued that except in the case of high densities of population and acute land shortage, fragmentation of holdings is a normal feature of the present system of agriculture in the Shire Valley. In general, fragmentation stems from the necessity for people to have access to different soil types and from the practice of borrowing land. The borrowing of land can be related both to this necessity and also to the

need to readjust the size of the land holding of a family at different points in its life cycle.

Consolidation would probably be easiest in areas of relatively homogeneous soil type, such as the black cotton soils of the SVADP Phase I area. Here, one could possibly take the ward or the hamlet as the basic unit and, having defined an area, consolidate holdings within it. However, given the high mobility of people arising from such structural processes as the segmentation and fission of descent groups, and their personal desires to seek marriage partners, to avoid quarrelsome neighbours, to seek new economic opportunities and so forth, it would seem likely that within a relatively short time the de facto situation would soon revert to the position prior to consolidation.

11.9.2. Individual Title.

Presuming that consolidation had been attempted, there appear to be two alternative methods of proceeding to the registration and granting of individual title to land. These are (i) the granting of title to the consolidated equivalent of existing holdings or (ii) the granting of individual title to consolidated holdings of an "economic" size. Each alternative has a number of consequences, the evaluation of which depends essentially on the type of society one wishes to see emerge in the Lower Shire Valley.

The first alternative is the simplest procedure to implement and, in the short run, has few immediate consequences. In the long-run, however, one could envisage a situation developing in which there were a few relatively large land holders - "Yeoman farmers" - and many others with either no holdings, or holdings so small that they could not subsist except either by working for the Yeoman farmers, or by seeking off-farm employment locally, or by migrating to seek work elsewhere in Malawi or abroad. Through time, as Yeoman farmers expanded their holdings through purchase, and the remaining holdings could not support the expanding population, a landless class would emerge. If this situation developed the critical issue would appear to be how and where members of this class would be employed? Given that a mass movement of population from the land to the towns would not be in Malawi's interests and that the amount of labour employed by the Yeoman farmers would be unlikely to equal the numbers displaced from the land, local off-farm wage employment or labour migration abroad would appear to be the only alternatives. Opportunities
for work abroad appear to be likely to decline in the future, so that
the success of a scheme based on the granting of title to consolidate
existing sized holdings would seem to depend, in the long run, on a
considerable expansion in local opportunities for off-farm wage employ-
ment. Failure to provide such opportunities would almost certainly
lead to the failure of such a scheme and for strong pressures for the
status quo before its implementation to be restored.

The second alternative, the granting of title to "economic" sized
holdings raises immediately the issue of what constitutes an "economic"
holding? This is notoriously difficult to determine satisfactorily.
Presumably, the definition of an "economic" holding, given some,
income target, would vary from one area to another according to such
factors as soil type, rainfall and the type of agriculture practised.

If an "economic" size of holding were determined for each area
then an immediate decision would have to be made as to whether or not
those holdings larger than the "economic" size should be reduced.
Dependent on the number of such holdings, this decision would affect
the number of landless after allocation. Clearly, such a decision would
depend on the long-run objectives of the policy of tenurial reform. If
it were hoped that ultimately the more successful farmers would acquire
the holdings of the less successful, then one would decide, presumably,
to permit holdings to be registered which were larger than the "economic"
holding. However, from the perspective of the population at large,
such a decision would no doubt appear inequitable.

The granting of title to land in terms of an "economic" holding
appears likely, in the short run, to cause more dislocation and produce
more landless than the granting of title on the basis of the existing
size of consolidated holdings. This is simply because for much of the
Valley it would seem unlikely that there is the land available to form
"economic" holdings, even if these were defined very conservatively,
without dispossessing many who are at present cultivating. The need,
therefore, to provide an immediate expansion in sources of off-farm
employment would seem crucial to success if this alternative were
contemplated. Otherwise, de facto fractionalisation of holdings would
occur nullifying the effects of consolidation and the granting of title.

In summary, therefore, the two alternatives would appear to differ
in their immediate consequences. Granting of title on the basis of the
existing consolidated holding size would produce few immediate effects.
The redistribution of land through sale and the creation of a landless
class would occur gradually although these processes could be accelerated
by the provision of attractive opportunities for off-farm wage employment.
The granting of title in terms of an "economic" holding would be likely
to produce immediate dislocation, the magnitude of which would depend on
the size of the "economic" holding in relation to the density of population
in a given area and the amount of labour which the system of agriculture
could absorb. It would appear likely that an immediate expansion in
opportunities for off-farm wage employment would be required.

Whilst we have discussed in abstract some of the possible conse-
quences of the two alternative methods of implementing tenural reform,
we consider that in the present social and economic climate of the Lower
Shire Valley, neither is capable of successful implementation on any
scale. As we argue in the following sections, certain fundamental changes
appear necessary in agricultural practice, in the complex of social
institutions intimately associated with land and, hence, in people's
attitude towards land, before tenural reform can be successfully
implemented.

11.9.3. Individual Title and Security of Tenure.

The granting of individual title to land, it is often argued, gives
security of tenure to a farmer and encourages him to invest in his holding
without the fear that someone will arbitrarily deprive him of it. However,
as we have indicated, once a person is a member of a village or ward
community and is allocated land to cultivate he is secure in his right.
We know of many cases where people have been cultivating the same holding
for thirty years or more. Only if a person moves from the community and
ceases to cultivate his holding do his rights lapse. The land then
usually reverts to the ward or Village Headman for reallocation.

The significance of the granting of individual title to land lies
not in the increase in security of tenure but the possibilities it provides
for the sale of an identifiable area of land. At the present time we know
of no cases in the Lower Shire Valley where either the renting or sale
of land has occurred under customary tenure. We have noted a small number
of cases where compensation has been paid for housing of a substantial
kind within a village, but this is a different matter. Land sale is an
alien concept in the present social environment for two reasons. Firstly,
throughout the Colonial Period to the present day, land sales have been
prevented by law from occurring in areas where land is held under customary tenure. Clearly in the early Colonial Period this law protected the local population from exploitation. However, in some measure, it has served to prevent any change occurring. In other parts of Africa, particularly in West Africa*, where no such law was enacted, land sales occurred very early in the Colonial Period, first among chiefs and then later among the general population. Secondly, the sale of land would strike at the root of the present social, political and administrative organisation at the local level. As we indicated earlier in our discussion of estates of administration, any local area can be viewed in terms of the rights and obligations holding between groups and individuals in terms of the giving and receiving of land. One important aspect of this is that the hierarchy of estates of administration to a considerable extent follows closely the formal structure of the hierarchy of Local Government administration from the Administrative Village Headman through the Group Village Headman to the Traditional Authority. The authority of these office holders stems in part from their right to allocate land. They have, therefore, a vested interest in preserving the status quo. If individual title were to be allocated by the Administration, it would destroy a fundamental aspect of the relationship between a villager and these office holders. If land were sold to anyone who could pay the price it would remove the right of one of these office holders to determine who should be part of his domain. The basis of their authority, as it is conceptualized at the local level, would be severely weakened. If a move toward the granting of individual title on any scale were contemplated, therefore, thought would have to be given to the development of new political and administrative structures at the local level. Already we have observed that in a very few villages, the Branch Chairman of the MCP is becoming of significance in the settlement of land disputes. Unit Area Committees, linked to village committees might also provide the basis of an administrative structure.

11.10 The Possibilities for Limited Tenurial Reform.

Whilst the weight of evidence appears to us to militate against the possibility of successfully implementing large-scale reform of the system of land tenure, there are possibilities for experimenting with reform on a more limited basis and we feel that these should be attempted.

* See, for example, Polly Hill, Migrant Cocoa-Farmers of Southern Ghana, Cambridge University Press, 1963.
In Chapter 13 we discuss the possibilities of undertaking small-scale irrigation and water-control schemes in suitable areas throughout the Valley. Such schemes would not only introduce the benefits of intensive agriculture to a wide population but could also be coupled with some tenurial reform. As we have indicated, in communities living on the edge of the Nsinde Marsh, rights in holdings on high water table land are quite sharply defined. Boundaries are marked and known precisely and in some areas where large herds of cattle are also kept, simple fences are erected to protect gardens during cultivation. Institutional procedures have also been developed to deal with the allocation of land, particularly that subject to intermittent deep flooding. It would seem therefore that given some scheme of water control one could experiment in these areas with consolidation and possibly move even to the granting of individual title.

With irrigation schemes, the problems and somewhat more complex. In large irrigation schemes in Malawi, a form of leasehold, after a probationary period, has been issued to farmers. This has been done because of the need to exercise relatively strict control over the management of holdings to ensure an adequate return given the relatively high capital and operating costs of such schemes. We envisage much smaller and less costly schemes which would probably not require such firm control. Here it would be worthwhile to experiment with other forms of tenure. Leasehold tenure would probably not be acceptable to many of the Valley's population at the present time, given that it contains an element of insecurity.

We have indicated that in some areas where there are large numbers of cattle procedures have been developed for allocating grazing areas to particular herds. We have also commented on one case which came to our attention where a large cattle owner on his own initiative had fenced a large area of land. There are others with similar ideas. As we have noted, there seem to be distinct possibilities for formalizing such arrangements among progressive cattle farmers and moving towards enclosure with grass-land management. The introduction of stall-feeding schemes in Phase II of the SVADP would also seem to offer distinct possibilities for consolidation, enclosure and possibly registration of title.

Finally, there are a number of large cotton farmers for whom consolidation and, possibly, registration of title might offer distinct advantages. A number of these large cattle farmers have diversified their interests by
• investing in transport, stores, grinding mills and so forth. Their
sons, and other members of their families, are frequently employed
full-time in managing such off-farm enterprises. The danger of
fractionisation of such large holdings seems therefore to be much
less of a possibility.

Apart from the cases we have discussed, however, we feel that
the reform of the system of land tenure on any large scale should
not be attempted until intensive agriculture has been more widely
adopted and until people themselves begin to appreciate the need for
reform. We surmise that when these circumstances arise, the local
system of land tenure will itself have been adapted to accommodate
whatever new systems of agriculture and new forms of social organisation
have emerged.
CHAPTER TWELVE

SYSTEMS OF LAND USE

12.1 Introduction.

The village sample employed in this Survey has covered most types of ecological situation found in the Lower Shire Valley and thus provides detailed information concerning the different cropping systems practiced there.

The major cropping systems found differ in four principal dimensions. These are a) the extent to which multiple cropping is practiced, b) the proportion of cultivated acreage which is dimba land, that is land with the water table close to the surface, c) the mix of crops produced, and d) the average cultivated acreage per person. A fundamental link exists between these four in that over most of the region the extent of dimba land affects the worthwhileness of planting second crops in the dry (May to October) season plus the types of crop which can be planted, and these jointly determine the minimum size of a viable holding.

Examination of the major land use systems has implications insofar as quantitative information about them has not before been made available systematically, although the 1968/69 NSSA survey collected some of the necessary data for this to be done. Such an examination also helps to explain the marked differences between villages and areas in their land endowment per head. It turns out that there is an inverse relationship between acreage per person and the proportion of dimba land. This highlights the point which has been made by Ester Boserup* that land resources should be measured in terms of area weighted by intensity of cropping and not simply in terms of area alone. To extend this further land resources should ideally be assessed in terms of area weighted by productive potential, where productive potential is defined in terms of the average value of output which might be expected under the optimal cropping scheme. No attempt will in fact be made to compare the land resources of different areas on this basis, but it is clearly apparent that the population carrying capacity of the land in the villages is closely related to its average productivity.

For the purposes of considering land use in the 20 survey villages

five groups of villages are defined:

1) Sila Zuwawo and Chithumba are situated in the hills of N.W. Chapanda and have a considerably different cropping system from any other villages in the survey.

2) There is the group of Chikwawa villages to the west of the River Shire which grow substantial acreages of cotton. This includes Chimphepo, Bijasoni, Mbande, Nchacha Nzangaya, Swemba, Ubale, Khokwa and Rabu.

3) The villages of Kaputeni, Mpingasa and Mlolo on the East Bank of the Shire all have access to extensive dimba areas. Kaputeni has access to the delta of the Mwanepeni River, and the other two villages are situated on the edge of the Elephant Marsh.

4) The Nsanje A group includes those Nsanje villages with access to a reasonable area of dimba land. They are Kasengi, Mphaladona and Ndamera.

5) Nguluwe, Mwanabhumbwe, Pangeti and Mswankhuni are the remaining Nsanje villages and are grouped into Nsanje B. This is a miscellaneous collection of widely dispersed villages which do not fit clearly into the other groups. Admittedly Nguluwe has many characteristics in common with the Group 2 villages, and is closer to the southernmost members of that group than to any of the villages in Group 5 (See Figure I.A) for a map showing the location of all villages).

12.2 Acreage Cultivated in the Dry (Winter) Season.

Data on the winter season cropped acreage is derived from the Garden Replanting and New Garden surveys. Unfortunately these were mounted at the end of the Survey when interest by enumerators was flagging. Consequently there are doubts as to whether the work was properly completed in a number of villages; the main doubt being that forms were returned stating that plots had not been replanted or that no new gardens were recorded when in fact this was not the case.

Another difficulty which arose from the shortage of time was that it was not possible for enumerators to remeasure replanted areas in those cases where previously measured plots were only being partially cultivated in July and August. Instead enumerators were asked to estimate the fraction of
the plot which had been replanted. This element of approximation means
that winter cultivated acreages are not as reliably measured as the
summer (wet) season acreage.

Again because of the time constraint it was not possible to wait
until all the winter acreage had been planted or replanted, and enumerators
were asked to record cases where cultivation was intended. This is
not an ideal solution as some gardens which it was intended to plant
may in fact never have been planted. On the other hand at Pangeti water
was still covering areas which it was intended should be planted with
sweet potatoes, but because of the water it was not possible to measure
the acreage of intended plantings. The same problem may have also
occurred elsewhere.

There are thus a number of qualifications about the accuracy of
measurement of the winter crop acreage, and on balance these tend to
point to underestimation in some places. The results can only be taken
as providing a preliminary view of the position, and further detailed
investigation would seem to be required.

With these qualifications out of the way it is possible to consider
the dry season cropping patterns that emerge. The data presented in
Table 12.A are in terms of percentages of the wet season cultivated acreage.
The actual acreage data are presented in Appendix V.

1. N.W. Chapananga.

From the data it appears that the acreage cultivated in winter
is over 20 percent of that in the summer. Most of this is accounted
for by pigeon peas which develop underneath the maize which is
harvested in March and early April. Since the pigeon peas had not
been harvested by the end of August this system of cultivation must
be classed as one of double cropping, especially since the pigeon
peas appeared to the eye to be likely to yield well and cannot therefore
be written off as unimportant.

It should be noted that in addition to the 16 percent of land
on which pigeon peas was found as a major underplanted crop, it was also
found in a minor way on 59 percent of the land at Sila and 45 percent
of that at Chithumba.

These two villages in N.W.Chapananga are the only ones in the
sample of 20 villages where this double cropping with pigeon peas
after maize and groundnuts has been found, and it seems to be
characteristic of the area. Cassava is also found interspersed
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<thead>
<tr>
<th>N.W. Chapenanga</th>
<th>Wet Season Cultivated Acreage Acres/Person</th>
<th>Total Dimba Acreage (1)</th>
<th>Total Cultivated Acreage in Winter (2)</th>
<th>Replanted Acreage in Winter (3)</th>
<th>Winter Acreage of Newly Cultivated land</th>
<th>Pigeon Pea Acreage Major crop only (4)</th>
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<tr>
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<td>(6)</td>
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<tr>
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<td>4 (6)</td>
<td>-</td>
<td>4 (6)</td>
<td>-</td>
</tr>
<tr>
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<td>0.48</td>
<td>3</td>
<td>5 (5)</td>
<td>-</td>
<td>5 (5) (7)</td>
<td>-</td>
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</tbody>
</table>

(1) Acreage from Garden Replanting Survey plus that from New Garden Survey.

(2) Cultivated Winter Acreage = Replanted Acreage + Planted after Fallow + Borrowed for Winter + Ac. with Pigeon Peas Undersown as a Major Crop.

(3) Where enumerators recorded that a garden had been partially replanted without estimating the fraction it was assumed that one quarter of the area was replanted.

(4) Pigeon Peas was undersown as a minor crop on 59 percent of the Sila acreage and 43 percent of that at Chithumba.

(5) Thought to be overestimated - enumerator failed in some cases to indicate the fraction of the plots replanted.

(6) Acreage almost certainly underestimated for reasons given in the text.

(7) Scaled up by a factor equal to the total sample population of households in the main Garden Survey divided by the number of households recorded in the Garden Replanting and New Garden surveys.
among the other crops. The winter cropping pattern is also more varied than elsewhere; in addition to pigeon peas mixtures of beans, tomatoes, maize and pumpkins were being cultivated in July and August.

2. W. Bank Chikwawa

Of the eight villages in this group only Ubale has an appreciable acreage of dimba land. Thus nearly all of the replanted acreage is munda land, that is where the water table is not close to the surface.

Taking the group as a whole the dry season cropping acreage appears to be well under 10 percent of that in the wet season, and in four of the villages the proportion has been negligible, although there are doubts about the enumeration at Bijasoni and Mbande. It appears that a slightly higher level of replanting is possible in the villages on the Makande Plain than in those on the lighter Tumali Soils (Bijasoni, Mbande and Nchacha). Associated with this division is the fact that only maize was being cultivated in the four northern villages in July-August, while plots with sweet potatoes were recorded in all the four southern villages, plus one plot of rice at Ubale. A further associated feature is that the total cultivated acreage per person in the wet season in the four southern villages averages approximately 20 percent more than in the northern villages.

Thus maize is the predominant winter crop in this area, and it is almost exclusively planted after a summer crop of maize. Very little was planted after cotton which substantiates the argument in Chapter 6 that the harvesting period of cotton is too long to favour double cropping. In the absence of yield studies on the winter acreage it is impossible to shake off the feeling that much of the winter maize in this the main cotton growing area is speculatively planted, and that the majority of plots are likely to fail. That is, the winter crop does not appear to have an important role in this area.

3. East Bank

The situation in these three E.Bank villages is strikingly different from that in the West Bank Chikwawa, for here dimba land is approximately 50 percent of the total summer season cultivated acreage, and this is associated with a dry season cultivated acreage

* Chimphepo although in the north is close to the Mwanza River which accounts for the relatively high replanting rate there. Khokwa is in the southern group of villages, but unlike them it is at the base of the Western Hills and not on the Makande Plain.
which is equivalent to more than 40 percent of that cultivated in the main growing season.

This double cropping on the E.Bank exploits the proximity of the water table to the surface, and the winter crop must be seen as making a major contribution to the livelihood of the area. It also goes a long way to explain why the population to land ratio should be so much higher in this area than in areas where only one crop per year is grown.

The main winter crop is again maize, but in contrast with the West Bank it is grown in a variety of mixtures. Pure crop maize accounted for only 50 percent of the winter acreage at Kaputeni, 42 percent at Mpingasa and 30 percent at Mlolo. Maize with beans was grown on the remaining land at Kaputeni, and on 36 percent of the acreage at Mpingasa. A small winter acreage of maize with sweet potatoes was recorded at both Mlolo and Mpingasa on wetter land following either rice or sweet potatoes. Sweet Potatoes are in fact a major winter crop at the two last mentioned villages, being grown in pure or mixed stands on 20 percent of the winter acreage at Mpingasa and 31 percent at Mlolo.

Because of the Muona Rice Scheme at Mlolo rice is grown again in the winter after the summer rice crop. Our sample shows this to have been practiced on 30 percent of the land under winter cultivation.

From the evidence it can be stated that the winter crop is of considerable importance to the economy of the East Bank area. Because the yields from dimba gardens are generally much higher than those from munda gardens, and as also most of the 50 percent of total acreage which is dimba land is exploited in the winter season, it is possible that winter crop production could exceed, say, 40 percent of the level of summer season production. The veracity of this can only be established by a survey of yields and acreages conducted in the dry season.

4. Nsanje A.

The winter cropping pattern in these three villages is a scaled down version of that in the E.Bank villages. Dimba land is equivalent to approximately 20 percent of the wet season cultivated acreage and this is also the approximate figure for the winter planted acreage. The dry season cropping system here
is less varied than on the E. Bank with pure maize accounting for 81 percent of the sampled winter acreage at Kasenga, 98 percent at Ndamera and 1 percent at Mphaladona. The remainder of the winter crop in these villages is either sweet potatoes or sweet potatoes with maize. These winter crops are apparently a vital part of the agricultural system in this area, and at Kasenga, which has the highest proportion of dimba land, the winter dimba crop is probably the key which explains the low acreage of land per person.

5. Nsanje B.

This assortment of villages share the characteristic of having negligible dimba acreages, and very little of the replanted winter acreage at Mwanabvumbe and Nguluwe the only villages with any appreciable winter cultivation is on this type of land. One cannot help feeling that the winter crop in both these villages is a gamble with only a small probability of success. At Mwanabvumbe this gamble is presumably dictated by the fact that the very small acreage available for wet season cropping is unable to provide sufficient food to support the population, especially in a poor year such as 1972/73. Thus it is necessary to try and augment food supplies by dry season cropping on munda land.

At Nguluwe there is appreciably more land per head than at Mwanabvumbe, but average maize yields there in 1972/73 have been the lowest of any of the sampled villages. Indeed with an average yield from 26 sample plots of only 52 pounds of maize per acre, and with total crop failure having occurred in 70 percent of these plots, it is not surprising that a gamble has been taken on the winter crop. Given the low winter cultivated acreage in the other two villages in this group, Pangeti and Mnyankhani, it would appear that multiple cropping in the Nsanje B villages is of relatively little importance.

12.3 Crops Grown in the Wet Season.

Difficulties arise in comparing the cropping patterns of the different groups of villages due to the practice of mixed cultivation. The principal difficulty arises from the virtual impossibility of establishing the proportions of the different crops in a mixed stand. If this were attempted, should it be done on the basis of the numbers of plants or on the value of
the output of the separate crops? Further difficulties arise where, as in N.W. Chapananga maize is underplanted with pigeon peas and groundnuts. According to the returns maize is the major wet season crop, the pigeon peas ripen as a winter crop, and the groundnuts appear to be a relatively minor crop. In these circumstances we have decided to treat major crop maize as if it were a pure crop - relative yield data for Sila and Chithumba support the validity of this (see Section 12.3 below).

The existence of mixed cropping also makes time comparison of cropping systems very difficult. For example the crop codes of the NSSA survey fail to distinguish major crops from scattered plantings. Hence a very high proportion of the 1968/69 acreage surveyed by the NSSA was of mixed crops. Because in this Survey the occasional pumpkin, tomato or groundnut plant is not considered in classifying land use we obtain a much higher figure for the proportion of pure cropping than that obtained by the NSSA. This may be a reflection of an underlying change in husbandry, but almost certainly the largest element in the apparent massive change to pure cropping since 1968/69 must be due to the treatment of scattered plantings.

Within the limitations imposed by the existence of mixed cropping Table 12.B attempts to portray the main differences by area in cropping patterns.

1. N.W. Chapananga.

Almost all the summer season cultivated land in this area has maize as the major crop with pigeon peas, groundnuts and sometimes cassara planted underneath it. At Chithumba over 90 percent of the land which did not carry maize as the major crop was planted primarily to groundnuts. This is the only village in the sample in which major crop groundnuts achieved such importance, covering 22 percent of the cultivated land. At Sila groundnuts were in general only grown as a minor component of a mixture.

Thus the basic summer cropping system in this area is a simple one based upon maize and groundnuts, although it should be mentioned that citrus and other fruit trees are found in relative abundance.

2. West Bank Chikwawa.

As is obvious from the data this is the main cotton growing area, and with the exception of Chimphepo which is right on the fringe, all the villages lie within what was the CCDP Phase 1 area.
<table>
<thead>
<tr>
<th></th>
<th>Cotton Sprayed Pure</th>
<th>Cotton Un-sprayed Pure</th>
<th>Total Cotton Including Mixtures</th>
<th>Maize Pure</th>
<th>Total Maize including mixtures</th>
<th>Rice Pure</th>
<th>Bullrush Millet including mixtures</th>
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<td>96</td>
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<td>-</td>
<td>-</td>
<td>88</td>
<td>91</td>
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</table>
On a straight average basis 50 percent of the land in this area was growing cotton in 1972/73, 46 percent growing a pure stand, the remainder producing cotton mixtures mainly with maize. Of the land under pure cotton 61 percent was sprayed with insecticide to some extent while 39 percent was recorded as not having been sprayed at all.

Maize either pure or mixed with other cereals, particularly bullrush millet, was grown on most of the acreage not supporting cotton. Most of the small remaining acreage was sown to pure bullrush millet.

The summer cropping system in the West Bank Chikwawa area seems therefore to involve the planting of almost equal acreages of cotton and maize with small acreages of bullrush millet.

3. E.Bank.

The three villages classed in this group are presented in Table 12.B in order from north to south. It thus appears that on moving from north to south the acreage of cotton declines and rice progressively takes over as the main cash crop. It is true that at the southernmost of these villages, Mlolo, there is the Muona Rice Scheme which provides one explanation of the high rice acreage in this village; but even after allowing for this the stated geographical progression seems to hold. The combined acreage of cotton and rice is between 35 and 40 percent of the cultivated acreage in each of these villages.

Rice assumes a more important role in this group of villages than in any other. This with maize grown on dimba land adds up to a highly labour intensive system of cereal production on the dimba land, supported by extensive cotton and cereal production on the drier land.

4. Nsanje A.

This is the only group of villages other than 3 with an appreciable acreage of dimba land. Consequently rice growing is found, but this is concentrated at Kasenga which has the highest proportion of dimba land.

The crops grown here in the wet season are almost exclusively cereals. For most of the land not planted to rice is sown to maize and bullrush millet planted separately or mixed together. Interestingly it appears that there is a change in the typical cereal mix on moving
from north to south of the Valley; bulrush millet becomes a progressively more important crop as one moves south.
Certainly this crop has been found more extensively in Nsanje than elsewhere.

The only small areas of non-cereal summer season crops found in this area were groundnuts, of major importance on four percent of the cultivated land at Mphaladona, and sweet potatoes on three percent of the acreage at Nsamera.

5. **Nsanje B.**

In terms of the proportions of the major crops there is not a great deal of homogeneity within this group. Nguluwe for example has the cropping characteristics of the West Bank Chikwawa area to which it is adjacent. There was no rice or sweet potatoes found at this village and the acreage is split between cotton and cereals - a high proportion of the cereal is bulrush millet.

The system at Pangeti is a southerly modification of the Nguluwe pattern with a smaller acreage of cotton and maize, but a larger acreage of bulrush millet.

Mwanabvumbe and Msyankhuni, the two remaining villages, are both poor agriculturally with very low cultivated acreages per person and very little *dimba* acreage. Almost all their land is devoted to the production of the basic food crop, maize.

12.4 **Maize Yields.**

In the context of examining land use systems in the region it is worth briefly mentioning the variations in maize yields associated with the different systems; maize being the only crop found in all the sample villages.

As indicated by Table 12.C, maize yields have been found to be highest in the N.W. Chapananga area, with average yields in excess of 1,000 pounds per acre in the poor 1972/73 season. This yield level has been achieved in maize crops which have been extensively underplanted with pigeon peas and groundnuts. It would appear that the competition of these crops with maize does not seriously affect yields of the latter. In fact the nitrogen fixing properties of the *undersown* legumes may well contribute substantially to these relatively high maize yields.

In West Bank Chikwawa maize yields in the 1972/73 season have been
Table 12.C 1972/73 Maize Yields in the Lower Shire Valley.

<table>
<thead>
<tr>
<th></th>
<th>Number of Plots with non-zero yield</th>
<th>Average Yield of Plots with non-zero yield (lbs/ac)</th>
<th>Number of plots harvested by farmer</th>
<th>Number of plots with zero yield</th>
<th>Average Maize Yield (lbs/ac)</th>
</tr>
</thead>
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<tr>
<td>N.W. Chapananga</td>
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<tr>
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<td>-</td>
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<td>W. Bank Chikwawa</td>
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</table>

Notes: (1) Yield results at Mbande and Msyankhuni have been abandoned because they are deemed unreliable, those for Pangeti were not collected because of enumerator problems.

(2) In calculating average maize yields, plots harvested by farmers are assumed to have yields equal to the average of those with non-zero yields.
very poor. If one were to take out Chimpheso, which is situated north of the Mwanza River in Chapananga, and Khokwa which is at the base of the Western Hills, then the average maize yield recorded in this area was only 261 pounds per acre. Maize yields in this the central part of the Valley have been not only lower than in Chapananga (which is at higher altitude), but also appear to have been lower than on the East Bank and also possibly Nsanje A. This is not surprising in view of the higher proportion of dimba land in the latter two areas.

Although yields on the East Bank and Nsanje A were clearly not exceptional, those at Mlolo have only been exceeded by yields at Sila. At Kasenga the (three recorded) dimba gardens appear to have produced relatively high yields, but the average yield there was depressed by a high failure rate in the mundu gardens.

The overall picture is of maize yields decreasing as one moves down from the hills towards the valley floor. However better yields can be obtained at low altitude in those places where subsurface water can be easily exploited.

It should be noted that there is an inevitable inverse relationship between yields and production risk, where risk is measured by the ratio of the number of plots which produced nothing to the total plots sampled. Thus villages with low yields in plots which produce something are those which also tend to have a high proportion of plots which failed entirely e.g. Nchacha, Ubale and Nguluwe.

One thing that Table 12.C brings out fairly clearly in the high risk of dry land farming on the valley floor, that is excepting N.W. Chapananga. On the East Bank with the highest proportion of dimba acreage only 1 out of 33 plots is recorded as having failed. In the remaining areas including Nsanje A which have smaller dimba acreages the failure rate was appreciably higher. Despite the fact that the failure rate in Nsanje A was just higher than that in West Bank Chikwawa it does appear possible to conclude that agricultural risks are less where subsoil water is available.
CHAPTER THIRTEEN

SUMMARY - THE POLICY IMPLICATIONS FOR AGRICULTURAL DEVELOPMENT

PLANNING OF THE OBSERVED CONSTRAINTS

It is accepted that the Lower Shire Valley is a difficult area from the point of view of agricultural development. The climate is harsh with high temperatures and comparatively low rainfall, and the population faces health and nutritional hazards. Most of these difficulties are well known, but the present Survey has been able to provide additional insights into them, and it is worth attempting to review what appear to us to be the main constraints upon agricultural development in the area, and the implications of these for the evolution of planning strategy.

The climate presents the major obstacle to agricultural progress. Because of high temperatures evapotranspiration is high relative to the rainfall, so that where agriculture depends solely upon precipitation as the source of water supply there is a high risk of crop failure. This is manifest both in the total failure of individual plots, which has been commented upon in Chapters 6 and 12 (although lack of water is not the only cause of failure - livestock damage and even water-logging in chamba gardens have been recorded as causes of failure), and in generally low crop yields. Reports about the area suggest that in the majority of years the rainfall has been inadequate in quantity or badly distributed in time for the purely rainfed cultivation of cotton and cereal food crops. There have been few years in which the weather has been considered satisfactory. In view of this it can be asserted that water supply and water resource management are at the heart of the Lower Shire Valley's agricultural problems. It is hardly surprising therefore that in the past a number of major studies were commissioned to examine irrigation potential in the area. Amongst these was one which presented a 45 year plan for incorporating most of the Valley's arable land into irrigation schemes.* Whilst it seems to be accepted that the economic


Other studies of irrigation in the Lower Shire Valley include:
rationale for this plan was inadequate, it is difficult not to feel that the basic line of reasoning is correct in that improving water supplies to arable land is the main route to achieving a stable, highly productive system of agriculture in the Lower Shire area. It seems to be the only way that the high risk element can be removed from local agriculture, since improved seed and fertilizer do not usually perform much better than local crop varieties when water availability is inadequate.

It is certainly notable that the major irrigated agricultural development to date has been highly successful. The extent of the success of the Sucoma irrigated sugar estate at Nchalo has been commented upon in some detail in Chapter 8. The much smaller irrigated scheme for rice at Muona also appears to have been successful, at least when viewed from the local farmers' point of view; farmers are able to achieve high yields of summer rice of the order of 4,000 pounds per acre, and to supplement this by growing a winter crop of rice, or maize.

The other main problem for agricultural development in the area is not an agronomic one (although it requires an agronomic solution) and is that of increasing population pressure. It has been estimated in Chapter 10 that there has been a sharp reduction in the average acreage of cultivated land per person, primarily in the southern half of the Valley. The local population try to alleviate this pressure by seeking non-farm employment in quite large numbers (see Chapter 11) and by migrating to seek land in less crowded areas. It seems unlikely that the growth in non-agricultural employment both domestically and abroad for Malawians will be sufficient to absorb the annual increase in working population until a further 15 to 20 years have elapsed. Thus increasing numbers of people will have to rely directly upon agriculture for their survival. This entails a continued decline in the average cultivated acreage per person. Since in the Lower Shire Valley the average acreage of cultivated land per capita in the wet season is estimated to have been only 0.76 acres in 1972/73, further progressive reductions in the land/man ratio are going to produce serious hardship unless land productivity can be greatly enhanced. As already stated this will be difficult with rainfed agriculture, and the solution appears to be to increase the irrigated acreage and to stabilise potential arable land in the two large marshes for agricultural use. It should be noted that the Lockwood Survey Corporation Report (Op. Cit.) identified 40,600 acres in the Elephant Marsh and 20,600 in the Ndinga Marsh as being suitable for reclamation and irrigation, which are large areas in comparison to that
already farmed in the Valley as a whole. It is not however necessarily suggested that major irrigation and poldering works be started forthwith. If a policy of caution is deemed advisable, it would appear to us feasible that some relatively inexpensive small pumped irrigation and marsh reclamation schemes would be practicable. The agricultural and economic potential of such developments is to some extent demonstrated by the cropping systems practiced already by villagers with land at the edge of the two marshes. In these areas two crops a year can be obtained by exploiting subsurface water supplies. In addition, as the waters of the marshes recede in the dry season, areas of newly exposed land are also intensively cultivated by local farmers. The productivity of these areas of more intensive agriculture is evident from their higher population carrying capacity. All this is suggestive for development policy, the implication being that there is great potential both for extending the areas in the marshes which are agriculturally exploited, and in devoting resources to improving crop husbandry in such areas of ample water supply.

To the extent that the various technical studies cited above have classified soils and examined the engineering problems there would seem to be a sound technical basis on which to start a programme of more fully exploiting local water supplies for agricultural use. More information will of course be required about the scale, distribution and methods of agriculture practiced in the marshes, since the suggested strategy is basically one of extending the areas which can be cultivated with improved versions of current local methods. It is not proposed however that all irrigation development should be confined to currently grown small-holder crops, for as already discussed in Chapter 8 it is felt that the development of small-holder irrigated sugar schemes holds considerable immediate promise. There is also the possibility of small-holder cocoa development and this is likely to fit well into the pattern of small scattered irrigation development which is proposed below.

It may be felt that a strategy of comparatively small-scale irrigation development is incompatible with sugar production, because of the acceptance of the view that sugar refining can only be economic on a very large scale. This assumption does not however appear to be necessarily valid. A paper by M.K. Garg at the recent Appropriate Technology Conference at
Edinburgh University* indicates that an intermediate scale technology for refining sugar has recently been developed in India. The plant involved operates on 100 tonnes of cane per day, which is approximately equivalent to 2 acres of sugarcane. In a processing year of 240 days duration such a plant would require only 480 acres of sugar to keep it fully employed. The technical and economic feasibilities (it has a comparatively low capital cost) of the method are claimed to have been demonstrated, and it is now extensively employed in India, and is being adopted by Pakistan and Ghana. In view of the claims made by Garg, this method of sugar refining clearly bears examination, as it could have major implications for development in the Lower Shire Valley and elsewhere in Malawi.

The adoption of such technology would mean that small-scale projects could be developed at a number of different sites. Such sites could be located close to consuming centres thus reducing transport costs and reducing the demands for new large scale infrastructure development. Social dislocation would be minimised, and, although land reorganisation would be needed, it might not prove necessary to remove many farm families from areas where they now live. Such schemes could be managed by Malawians thus reducing the foreign exchange costs of having expatriate technical and management personnel. Only careful study of the small-scale plant will confirm this, but it is also possible that such a technology will require a lower foreign exchange cost per unit of capacity, and that there will be an increase in the potential for local industry to supply some of the necessary capital inputs.

Implementation of the irrigation proposals of the various surveys which have been conducted hitherto seems to have been hampered by the combination of the large scale of engineering works proposed and uncertainty about the economic prospects of the crops upon which project assessments were based. In the case of the Lockwood Survey Corporation Report (Op. Cit.) proposals these doubts were evidently justified in view of the problems currently being experienced in disposing of Malawi's rice crop, and of the central place of rice in their proposals.

One way of overcoming the hazards of large-scale in irrigation and reclamation works would be to think in terms of smaller piecemeal developments. This would have the advantages of cutting down the economic risk, and of reducing the difficulties of finding sufficient numbers of suitable small-holders to farm the new settlements. But, perhaps more

importantly, it opens up the possibility of finding schemes which require only a minimum of costly engineering investment which can proceed with simple improvements to natural drainage systems and the construction of earth drains or levees for flood control.

An additional advantage of small-scale irrigation, flood and water control schemes of this type is the possibility which they present for controlled settlement and the opportunities they provide for introducing more of the population, spread over a considerable area of the Valley, to the direct benefit of intensive agriculture. However, considerable thought will have to be given to the form of land tenure to be associated with this type of development. Water and flood control schemes in the Nsanje area probably would not present too much of a problem. As indicated in Chapter II, institutional arrangements have been developed here to deal with the allocation of dimba gardens. It would not seem difficult to adapt such existing institutions and possibly move quite quickly to the registration of these well-defined holdings. Irrigation, however, does present more of a problem. In general, in Malawi, a form of individual leasehold, after a probationary period, is granted to farmers in irrigation schemes. This is because of the need to ensure high standards of management given the high capital and operating costs. We are doubtful whether this form of tenure would be acceptable to many people in the Valley at present. The position might appear more favourable to them if arrangements could be made for the sale of leases or for the payment of compensation for work put into a holding, should a farmer either want, or be asked to leave. At present, there are people in the Valley who consider current arrangements when such circumstances arise to be somewhat arbitrary, and who are uneasy about the degree of freedom of choice which they might have to surrender should they commit themselves to such a scheme.

The problem of suitable crops in small-scale water supplied schemes is a more difficult one, but it does appear that attitudes to this question have in the past been rather inflexible. In a world of rapidly changing markets it is difficult to forecast with any precision what crop prices and demand will be. (But as stated above both sugar and cocoa appear to be prospects for development). Primary commodity markets since the beginning of 1972 have shown just how rapidly dramatic price changes can occur. In such circumstances it is likely that the best crop production mix will be continuously changing. This means that inflexible targets for particular crops established at the outset of development projects are likely to be unhelpful. If changes in market conditions dictate
adjustments in the crop mix then it is in Malawi's interest to allow such changes to occur. This requires an increased sensitivity in ADMARC's producer pricing policies so that changes in international market prices are more readily reflected in prices to growers. It also requires that the retail prices of domestically processed agricultural products should be adjusted in line with international commodity prices unless there is to be subsidisation of consumers by producers and distortion of the production pattern.

Careful scrutiny of the crop pricing policy might also help increase the attractiveness of smallholder agriculture if it leads to increased producer prices. The analysis presented in Chapter 6 and the study of crop yields in the Lower Shire Valley has indicated that rain-fed smallholder agriculture there is not presently highly attractive; returns per labour-day in agriculture are perhaps only just about equivalent to the minimum daily rate for registered adult employment. This leads to a situation in which it appears that a family's optimal strategy is to send at least one adult (preferably male) to seek off-farm employment, even if this means adopting a less intensive production system on the family holding with consequently lower land productivity. Given this situation, and also the evidence (see Chapter 7) of high response elasticities of agricultural production to prices, it would appear that the prospects for the rapid development of smallholder cash crop production would be greatly improved by raising crop prices even if this necessitates reducing the taxation of smallholder production and the raising of development capital from other sources.*

There are also other grounds for directing attention towards the mechanisms for setting producer prices. The basic system is to announce crop prices for specified grades in advance of harvest. These prices have tended to move slowly upwards with time and rarely downwards, so that it may be inferred that a policy of price stabilisation has been pursued. However in the case of cotton the large variability in the proportion of high grade cotton has meant that average producer prices have fluctuated appreciably and have not been stabilised by official policy. Not only have producer prices not been stabilised but producer revenues have almost certainly been destabilised in the absence of any sensitivity of official prices to changes in supply. This insensitivity in official prices almost

* It should be noted in passing that increasing the area of irrigated land will also increase the attractiveness of smallholder agriculture by enabling increased productivity per acre and per man.
certainly contributed to the great slump in cotton production between 1964/65 and 1967/68. Consequently, it would seem worthwhile to review attitudes to the policy of crop price and revenue stabilisation, and to lay down formal decision rules for price setting which reflect official policy on both stabilisation and crop taxation. One specific proposal in this connection is that consideration could be given to activating the stabilisation fund to make corrective upward adjustments of producer cotton prices when it is predicted, before cotton buying starts, that crop yields and quality will be poor.

Historically, as we observed in Chapter 3, the traditional system of agriculture in the Lower Shire Valley developed in relation to the river and the marshes. Access to land where the water table was high and where double-cropping was possible was an essential aspect of the system and served to cushion the population against the uncertainties of rainfed agriculture which have always been present. The floods of the late thirties and early forties, when the Elephant and Ndinde marshes greatly expanded to permanently cover considerable areas of land previously intensively cultivated, forced some thousands of people away from the river. Perforce, they had to adapt themselves to rainfed agriculture in an ecological setting which was not favourable to it. The growing of grain staples became precarious and agricultural practices appear to have deteriorated. The position was exacerbated by growing population pressure. But for cotton, a drought resistant crop, it is doubtful if a viable system of agriculture could have developed, certainly not one which supports the present population densities. Cotton has therefore come to occupy a central place in the agricultural system which has developed away from the river, particularly in the area of West Bank Chikwawa. At present, there seem few alternatives to it.

Those alternatives which have been canvassed, such as stall-feeding of cattle and cashew nuts, appear only suitable either for a relatively highly motivated section of the population, who are likely to a minority, or for particular ecological areas. They do not seem to be innovations which at present are capable of exploitation by the mass of the population. For the foreseeable future, therefore, the continued development of cotton production with emphasis on improved and cheaper forms of insect control and better husbandry practices seems the optimal strategy to pursue throughout most of the Chikwawa District.
It should be noted, however, from the evidence presented in Chapter 6, section 3, that cotton production has not shown the same tendency to increase in the main areas of population as it has in the northern areas of Chikwawa where pressure on the land is not so great. This evidence might be interpreted as indicating that in some areas, such as the former CCDP South, cotton production is already approaching its ceiling under the prevailing technology. The proximity of a possible limit has been another factor conditioning our conclusion that an increased emphasis on water-control schemes is desirable.

It has also been suggested that a reform of the present system of land tenure would have beneficial effects on agricultural productivity. Apart from settlement and irrigation schemes, the possibilities for large-scale reform in the system of land tenure seem limited. There might be some short-run advantages in certain areas for some form of consolidation, possibly using the ward or hamlet as a basis (rather than the Administrative Village). But given the population pressure, the relatively high mobility of people, the need to have access to different soil types, and the need to make adjustments in the land held by a family as its composition changes, it seems highly likely that de facto the present position would rapidly be re-established. Unless a very large proportion of the population was involved in a radical change in the prevailing system of agriculture and land use, large-scale consolidation would not appear to show any long term advantages in relation to the costs involved in implementing it.

For the large cotton farmers, for those who may become involved in the stall feeding scheme and, possibly, for some of the more progressive cattle owners, consolidation with the granting of individual title might possess some advantages. But these only represent a minority of the population, albeit a significant one. Experience elsewhere suggests that the reform of land tenure can only be successfully implemented where more intensive forms of agriculture have already been widely adopted and where the people themselves have already perceived that reform is desirable. This is not yet the position in the Valley. The most successful reforms of land tenure appear to be those which have formalised processes of adaptation and change which were already present. We know of no case where land reform per se has produced a radical change in the system of agriculture.

While intensification of agricultural production and exploitation of the fishery will probably be the main means of alleviating mounting
population pressure our Survey suggests that crafts and other forms of rural employment could play a significant role in the areas prosperity, as well as damping down the normal tendencies of people to drift to urban areas in search of employment.

It is evident from the data presented in Chapter 9 that a large proportion of adult males have already sought employment off their own holdings. Some 16 percent of adult males aged between 15 and 49 are estimated to have some form of (at least part-time) local non-agricultural employment, and an additional 25 percent of the same age group are estimated to have migrated from the region in search of employment. Thus a large proportion of adult males have already moved into employment other than primary agricultural production; possibly a surprisingly high proportion to those versed in the usual assumption that an area at such an early stage of development as the Lower Shire Valley might expect to have between 80 and 90 percent of its workforce in agriculture. What is perhaps more significant is that 16 percent of adult males and 2 percent of females are engaged in rural crafts and other forms of rural employment. This shows an entrepreneurial spirit by the local populace which could be harnessed and encouraged by training and promotion schemes for small-scale craft industry. In a sense this is already accepted policy insofar as the Ivory Coast kiln is being actively promoted for fish curing. Such official encouragement might productively be extended to schemes for improving the skills of carpenters, potters, builders, mechanics and the like. As a corollary to this it can be said that failure to recognise the extent of rural craft occupation could lead to the development of small urban industries such as ceramics which could put more people out of work in rural areas than people in work in urban areas.

It has become apparent in the course of the Survey that strengthening procedures for the economic evaluation of projects in the area is both desirable and possible. Chapter 4 of this Report has explored the economics of the most common rainfed crop enterprises. This attempt is viewed as providing a basis upon which a more refined and detailed system of enterprise accounting can be based, and a useful planning tool developed. In addition it has become clear that no specific methodology for evaluating development projects has been applied, and that this deficiency has led to a situation of inadequate knowledge about the progress which has been made. It is advisable that a procedure for evaluation be carefully
specified in advance of the inauguration of each project so that appropriate control data is available from the outset. Such a procedure would specify what the required indicators of progress were to be, how they should be calculated and what data would be required for their construction.

At the same time attention could also be given to the monitoring of social changes produced by the projects. This aspect of evaluation is frequently ignored partly because of the supposed difficulties of measurement. However, there is a variety of relatively objective indicators such as labour migration and spatial mobility rates, rates of polygyny and divorce, and measures of farm and household composition, in addition to the standard demographic measures, which can be applied to gauge underlying social processes. Using such indicators, the degree of success in achieving the social objectives of development policy, where these have been clearly formulated, could be monitored.

In addition to the main conclusions above there are a number of supplementary ones. At a practical level it is argued that it would be economically advantageous to discontinue the free distribution of cotton seed; and that it would be possible for ADMARC to raise producer cotton prices sufficiently to fully compensate growers for the cost of buying their seed and yet still leave itself with extra profit.

It is also suggested that the system of land compensation inherited from the Colonial era should be overhauled so as to pay some compensation for the loss of future earnings by the land's customary tenure operator, and to more realistically reflect the true opportunity cost of each parcel of land.
APPENDIX I

RESEARCH STRATEGY

A strategy of research was devised which involved pursuing five independent lines of enquiry: (a) an examination of existing time-series data relating to the economy of the Lower Shire Valley; (b) the collection and construction of "economic standards" for key agricultural activities in the Valley and applying them to explain smallholder agricultural practice; (c) the compiling of case-studies of different forms of economic and social organization; (d) the examination of archival material for the period 1904 to 1969 for general indications of social and economic change; (e) a survey of economic and social behaviour at the village level.

Items (a) to (d) are self explanatory and reference is made to their rationale and the research methodology employed where they occur in the body of the report. The village survey, however, requires detailed consideration. It was a complex operation, it consumed a great deal of our time and resources and, because some of our significant conclusions concerning such matters as population growth rates, acreages and yields have been derived from it, an examination of its scope and reliability is essential.

1.1 The Village Survey.

Broadly, the village survey was designed to provide data for three distinct but interrelated exercises: (i) the measurement of economic and social change in the recent past; (ii) the assessment of the impact of those development projects already inaugurated on the economic and social life of the area; (iii) the future planning of development.

In order to obtain data in a form which would enable these exercises to be undertaken three considerations had to be borne in mind in relation to the survey: (i) it had to be sufficiently comprehensive to cover the whole of the SVADP Phase II area and, whilst basically diagnostic in intent, it had to provide reasonably reliable statistics for planning purposes; (ii) if comparisons over time were to be made in relation to key variables such as levels of wealth, acreages and population, it had to be related to some previous survey of comparable scope; (iii) it had to be tailored to the management and manpower resources which could be mobilised.
Two alternatives confronted us at the outset. We could either design a survey which would be extensive in its spatial scope but limited in its range of enquiry and which would depend upon a small mobile team of interviewers, or we could design one which would involve a larger, stationary team working intensively. We chose the latter alternative for a number of reasons. Firstly, it was clear that some data would have to be collected from households on a daily basis throughout the survey period. In addition, we wished to observe people's behaviour as they moved through the cropping cycle. Secondly, since the survey had multiple objectives a survey schedule designed to cover them all would have been an unwieldy instrument to administer. It seemed more desirable to keep each interview to a relatively short period but to increase the number of interviews per interviewee with a reasonable interval between one interview and the next. It also seemed likely, and to some extent this had proved so in practice, that the validity of the responses would be improved as villagers' familiarity with, and confidence in, the enumerator increased. Finally, there are good sociological grounds for arguing that for purposes broader than the estimation of population, acreages and yields, the farming household taken out of its economic and social context is not an adequate unit for analysis. We desired to take the individual as a member of a household, to see the household in relation to other households and to the village as a whole, and to see the village as part of wider economic, ecological and social systems. For these reasons, therefore, we decided to take the village as our principal sampling unit and to station an enumerator in each sampled village.

1.2 Previous Surveys.

In searching for surveys of the area of comparable scope, which it might have been possible to replicate at least in part, two surveys came to light - the Sample Survey of Agricultural Small Holdings (SASH) conducted in 1967, and the National Sample Survey of Agriculture (NSSA) of 1968/69. Initially, we favoured replicating SASH since, among other considerations, it was conducted before most of the major development projects in the valley began. However, it was essential that the original survey data be available for extraction village by village: the published report, containing gross data on a regional basis, was not adequate for our purposes. Unfortunately, the SASH computer cards could not be found whilst those for NSSA were still available. We decided, therefore, to replicate some of the essential features of the NSSA survey but with considerable
augmentation to cover additional areas of economic and social behaviour.

I.2.1 The NSSA Survey.

NSSA was based on a multi-stratified random sample with the enumeration areas of the 1966 Population Census providing the basic sampling universe. The various stratifications were so arranged as to give good geographical coverage and to provide an adequate sampling density for the selected Natural Areas which formed one of the major stratification factors. The details of the NSSA sampling frame are given in Appendix IV. Unfortunately, as indicated there, the details of the stratification procedure used for the Chikwawa and Nsanje District appear to be no longer available. In addition, for some of our purposes, the stratification of the data in terms of the three selected Natural Areas which lie in the Valley versus the remainder of the Districts, is not particularly suitable or very illuminating. We have devised a system of weighting based upon Traditional Authority areas, in some cases taken singly, in some cases grouped. The details of the weighting system are given in Appendix IV.

I.3 Selection of the Sample.

For the Chikwawa and Nsanje Districts 30 villages were sampled by NSSA. These are listed in Table I.A. As is indicated in the table two of these villages lay outside the SVADP Phase II area and were thus eliminated. Two had been relocated because of the development of various projects, notably SUICOMA. In addition, given that we considered our resources would allow a team of 20 enumerators to be mobilised, including eight the CCDP Evaluation Unit had generously offered, six further villages had to be eliminated by random selection. Since the sampling density of NSSA in the CCDP (South) Phase I area was relatively high it was here that the choice was made, and of the eleven villages falling within it five were randomly selected. Thus, a main sample for SOLV of 20 villages was obtained. The geographical coverage of the sample is reasonably good as can be seen from Figure I.A. and all the principal ecological areas of the valley are represented. Table I.B. indicates the villages which were sampled and the Traditional Authorities in which they lie. In the table the sample villages have been grouped in the way in which the weights have been applied and the weights are indicated. Because some of the villages were small in size and would not provide a sufficient work load for an
FIGURE I-A THE SAMPLE OF 20 VILLAGES IN THE LOWER SHIRE VALLEY

- Sample Village
- Reference location
- Road
- River
- Border
Table I.A  A Comparison of the NSSA and SOLV Samples.

<table>
<thead>
<tr>
<th>Traditional Authority</th>
<th>Villages Sampled by NSSA 1968/69</th>
<th>SOLV 1972</th>
<th>Reason for Exclusion</th>
<th>Reference Number 1966 Census</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chapananga</td>
<td>Sila Zuwawo</td>
<td>I</td>
<td></td>
<td>2203072</td>
</tr>
<tr>
<td></td>
<td>Chimphepo</td>
<td>I</td>
<td></td>
<td>2203016</td>
</tr>
<tr>
<td></td>
<td>Chithumba</td>
<td>I</td>
<td></td>
<td>2203018</td>
</tr>
<tr>
<td>Lundu</td>
<td>Kadinga</td>
<td>E</td>
<td>Relocated</td>
<td>2202009</td>
</tr>
<tr>
<td>Ngabu</td>
<td>Nchacha Nzangaya</td>
<td>I</td>
<td></td>
<td>2201092</td>
</tr>
<tr>
<td></td>
<td>Bwemba</td>
<td>I</td>
<td></td>
<td>2201002</td>
</tr>
<tr>
<td></td>
<td>Ubale</td>
<td>I</td>
<td></td>
<td>2201063</td>
</tr>
<tr>
<td></td>
<td>Khokwa</td>
<td>I</td>
<td></td>
<td>2201026</td>
</tr>
<tr>
<td></td>
<td>Rabu</td>
<td>I</td>
<td></td>
<td>2201057</td>
</tr>
<tr>
<td></td>
<td>Mphungu</td>
<td>E</td>
<td>High sampling</td>
<td>2201058</td>
</tr>
<tr>
<td></td>
<td>Saopa</td>
<td>E</td>
<td>Density in</td>
<td>2201043</td>
</tr>
<tr>
<td></td>
<td>Mphamba</td>
<td>E</td>
<td>CCDP Phase I Area</td>
<td>2201054</td>
</tr>
<tr>
<td></td>
<td>Nkwangwa</td>
<td>E</td>
<td></td>
<td>2201067</td>
</tr>
<tr>
<td></td>
<td>Nyambilo</td>
<td>E</td>
<td></td>
<td>2201025</td>
</tr>
<tr>
<td></td>
<td>Konzere</td>
<td>E</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Masseu</td>
<td>Mbande</td>
<td>I</td>
<td></td>
<td>2204010</td>
</tr>
<tr>
<td>Katunga</td>
<td>Biyasoni Matekenya</td>
<td>I</td>
<td></td>
<td>2205026</td>
</tr>
<tr>
<td></td>
<td>Kaputeni</td>
<td>I</td>
<td></td>
<td>2205006</td>
</tr>
<tr>
<td>Mukwira</td>
<td>Mpingasa</td>
<td>I</td>
<td></td>
<td>2207030</td>
</tr>
<tr>
<td>Mbenje</td>
<td>Nguluwe</td>
<td>I</td>
<td></td>
<td>2306022</td>
</tr>
<tr>
<td>Kasisi Thomas</td>
<td>Mphatika</td>
<td>E</td>
<td>Outside SVADP</td>
<td>2206016</td>
</tr>
<tr>
<td></td>
<td>Puteni</td>
<td>E</td>
<td>Phase II area</td>
<td>2208040</td>
</tr>
<tr>
<td>Tenganzi</td>
<td>Pangeti</td>
<td>I</td>
<td>Relocated</td>
<td>2305036</td>
</tr>
<tr>
<td></td>
<td>Kamanga</td>
<td>E</td>
<td></td>
<td>2305034</td>
</tr>
<tr>
<td>Mlolo</td>
<td>Mlolo</td>
<td>I</td>
<td></td>
<td>2307001</td>
</tr>
<tr>
<td></td>
<td>Mwanabvumbwe</td>
<td>I</td>
<td></td>
<td>2307026</td>
</tr>
<tr>
<td>Khulubvi C.</td>
<td>Kasenga</td>
<td>I</td>
<td></td>
<td>2304052</td>
</tr>
<tr>
<td></td>
<td>Mphaladona</td>
<td>I</td>
<td></td>
<td>2304028</td>
</tr>
<tr>
<td>Ndamera</td>
<td>Ndamera</td>
<td>I</td>
<td></td>
<td>2301001</td>
</tr>
<tr>
<td></td>
<td>Msiyankhuni</td>
<td>I</td>
<td></td>
<td>2301049</td>
</tr>
</tbody>
</table>
Table I.B. The Villages of the SOLV Sample by Traditional Authority with Sampling Weights Indicated.

<table>
<thead>
<tr>
<th>Traditional Authority</th>
<th>Sampled Village</th>
<th>De Facto Population 1972</th>
<th>No. of Households</th>
<th>Weights for Means Relating to Households</th>
<th>Weights for Population Totals by assumed Rates of Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Grouped Village Weights</td>
<td>District Weights</td>
</tr>
<tr>
<td>Chapananga</td>
<td>Sila Z.</td>
<td>1,203</td>
<td>293</td>
<td>0.5204</td>
<td>0.3232</td>
</tr>
<tr>
<td></td>
<td>Chimphepo</td>
<td>110</td>
<td>27</td>
<td>0.0480</td>
<td>0.0788</td>
</tr>
<tr>
<td></td>
<td>Chithumba</td>
<td>1,000</td>
<td>243</td>
<td>0.4316</td>
<td>0.0520</td>
</tr>
<tr>
<td>Ngabu (1)</td>
<td>Nchacha Nz.</td>
<td>245</td>
<td>56</td>
<td>0.0830</td>
<td>0.4081</td>
</tr>
<tr>
<td></td>
<td>Bwemba</td>
<td>180</td>
<td>37</td>
<td>0.0830</td>
<td>0.4081</td>
</tr>
<tr>
<td></td>
<td>Ubale</td>
<td>341</td>
<td>59</td>
<td>0.6315</td>
<td>0.4081</td>
</tr>
<tr>
<td></td>
<td>Khokwa</td>
<td>2,442</td>
<td>449</td>
<td>0.1547</td>
<td>0.4081</td>
</tr>
<tr>
<td></td>
<td>Rabu</td>
<td>596</td>
<td>110</td>
<td>0.0830</td>
<td>0.4081</td>
</tr>
<tr>
<td>Massea</td>
<td>Mbande</td>
<td>587</td>
<td>140</td>
<td>1.000</td>
<td>0.0804</td>
</tr>
<tr>
<td>Katunga</td>
<td>Biyasoni M.</td>
<td>420</td>
<td>104</td>
<td>0.6582</td>
<td>0.0907</td>
</tr>
<tr>
<td></td>
<td>Kaputeni</td>
<td>236</td>
<td>54</td>
<td>0.3418</td>
<td>0.0907</td>
</tr>
<tr>
<td>Makwira</td>
<td>Mpingasa</td>
<td>667</td>
<td>170</td>
<td>1.0000</td>
<td>0.0782</td>
</tr>
<tr>
<td></td>
<td>Mwana bwunciwe</td>
<td>1,108</td>
<td>273</td>
<td>0.4239</td>
<td>0.4753</td>
</tr>
<tr>
<td>Mloolo</td>
<td>Mloolo</td>
<td>1,602</td>
<td>371</td>
<td>0.5761</td>
<td>0.4753</td>
</tr>
<tr>
<td></td>
<td>Mwana bwunciwe</td>
<td>1,108</td>
<td>273</td>
<td>0.4239</td>
<td>0.4753</td>
</tr>
<tr>
<td>Tengani</td>
<td>Pangeti</td>
<td>52</td>
<td>16</td>
<td>1.0000</td>
<td>0.0118</td>
</tr>
<tr>
<td>Khulubvi C.</td>
<td>Mphaladona</td>
<td>50</td>
<td>15</td>
<td>0.2344</td>
<td>0.0472</td>
</tr>
<tr>
<td></td>
<td>Kasenga</td>
<td>179</td>
<td>49</td>
<td>0.7656</td>
<td>0.472</td>
</tr>
<tr>
<td>Ndamera (2)</td>
<td>Ndamera</td>
<td>1,200</td>
<td>266</td>
<td>0.5067</td>
<td>0.3875</td>
</tr>
<tr>
<td></td>
<td>Msiyankhuni</td>
<td>1,252</td>
<td>259</td>
<td>0.4933</td>
<td>0.3875</td>
</tr>
</tbody>
</table>

(1) WEIGHTS include T.A. Lundu
(2) WEIGHTS include T.A. Chimombo and T.A. Nyachikadza
enumerator, the sample was augmented by adding a number of other villages. These were immediately adjacent to the smaller sampled villages. In some cases, it was clear that there had been a movement of population from some of the smaller villages to adjacent larger ones. The additional villages selected are shown in the Table I.C. For purposes of estimation, only the random sample of 20 villages is considered. For diagnostic purposes however, we have used the augmented sample. Where this is done, it is made clear in the Report.

I.4 The Selection and Training of Enumerators.

Parallel in time with the selection of the sample, enumerators were recruited and trained. From a large body of applicants 25 men were selected after a personal interview and a searching written test of their mathematical, linguistic and logical abilities. These were then given a fortnight's intensive course in a variety of Survey techniques at the CCDP training centre at Ngabu. As well as class-room work, various field exercises were arranged. These, conducted in a near-by village, included exercises in garden measurement and the administration of a number of the actual schedules to be used in the Survey. The performance of the enumerators under field conditions was carefully observed. Tests were administered after each set of exercises and on the basis of these and our records of the enumerators' fieldwork, 12 enumerators, two supervisors and four office staff were recruited. Later, as the survey progressed and it became necessary to establish a second office in Blantyre, two more men and a typist were recruited.

The educational qualifications of the selected enumerators were relatively high, most having G.C.E. or M.C.E. Half came from the Lower Shire Valley, all spoke Chewa as a first language and a third were bilingual in both Chewa and Sena. They ranged in age from 19 to 26.

Two months later, after the enumerators had gained some field experience, they all attended a further training course designed to improve their techniques of garden measurement and the laying of yield sub-plots and to introduce them to the remainder of the survey schedules. The eight CCDP enumerators and their two supervisors, all of whom had experience of previous surveys, participated in this course.

In the first three months of the Survey a number of enumerators left the team to take up permanent employment or to undertake further education. Fortunately we were able to replace them by men of similar calibre. We arranged that before an enumerator left a village his successor spent some
### Table I.C. Sampled Villages, and number Households Sampled Per Village.

<table>
<thead>
<tr>
<th>Traditional Authority</th>
<th>Sampled Village</th>
<th>Number of Households Sampled</th>
<th>Village by which augmented</th>
<th>Number of Households Sampled</th>
<th>Combined Sample of Households</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chpanangha</td>
<td>Sila Z.</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Chimphepo</td>
<td>15</td>
<td>Moses</td>
<td>15</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Chithumba</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Ngabu</td>
<td>Nchacha Nz.</td>
<td>20</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Bwemba</td>
<td>20</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Ubale</td>
<td>20</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Khokwa</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Rabu</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Massea</td>
<td>Mbande</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Katunga</td>
<td>Biyasoni</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Kaputeni</td>
<td>20</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Makwira</td>
<td>Mpingsasa</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Mbenje</td>
<td>Nguluwe (I)</td>
<td>30</td>
<td>Nguluwe (II) (III) (IV)</td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Mlolo</td>
<td>Mlolo</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Mwanabvmbwe</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td>Tengani</td>
<td>Pangeti</td>
<td>10</td>
<td>Kachere</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Khulubvi C.</td>
<td>Mphaladona</td>
<td>10</td>
<td>Mphamba</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>Kasenga</td>
<td>20</td>
<td></td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Ndamera</td>
<td>Ndamera</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>Msiyankhuni</td>
<td>30</td>
<td></td>
<td></td>
<td>30</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>495</strong></td>
<td></td>
<td></td>
<td><strong>35</strong></td>
<td><strong>530</strong></td>
</tr>
</tbody>
</table>

* Sections II, III and IV were completely surveyed in the Household Composition Survey to obtain details of total village population, but were not studied in any of the other surveys.
time working with him.

I.5 Installing the Enumerator.

Whilst the first training period was in progress, local government officials, party leaders and Traditional Authorities were advised of the aims and objectives of SOLV and of the villages which had been selected for survey. In each of the villages the Village Headman was then approached. A meeting (in some cases several) was arranged attended by the Village Headman, his principal advisers and other senior men at which the objectives of the survey were explained. A circular printed in Chiewa outlining the aims of the survey was also distributed. Initially, all village headmen were somewhat sceptical of our stated purposes and all expressed concern that we might have some ulterior motive in wishing to survey their village and their fields. This reaction was not unexpected and after a deal of discussion and after references to the earlier Population Census and NSSA surveys all the headman and their advisers agreed to the survey proceeding. In each village arrangements were made for housing for an enumerator. Once each enumerator had been equipped, housed and installed in a village, the survey proper began. The list of schedules presented and exercises undertaken in the village survey is set out in the flow chart (Figure I.B).

I.6 Identification of Village and Section Boundaries.

The first exercise undertaken in a village, preparatory to the listing of all household heads, was the identification of the boundaries of the village and of its internal sub-divisions. It must be noted here, that the sample consisted of administrative villages. Some of these could be readily defined in a sociological sense as village communities, but others had more diffuse social structures and consisted of a number of dispersed hamlets possibly also with some scattered single homesteads. In some areas, particularly in the hill villages of north-west Chikwawa and south-west Nsanje, the administrative villages comprised clusters of hamlets dispersed over a radius of three of four miles. However, all were located within a definable area of land. It appears characteristic of this region, unlike many other parts of Central and East-Africa, that the boundaries of the village land are precisely defined. We make this point, because, despite our comment that a few villages consisted of widely scattered hamlets, it is clear that all who build and cultivate within the boundaries of the
Figure I.B. Flow Chart Indicating Surveys Undertaken in Sampled Villages.

NSSA 1968: 30 Villages

SOLV 72/73: 20 Villages

Household Listing

Sample of 20/30 Households per Village

Household Composition All Households

Family and Marriage All Ever Married

Fertility and Child Mortality All Females Aged 15

Spatial Mobility All Aged 15

Labour Migration All Ever Employed 15

Wealth Survey All Household Heads

Labour Survey All Household Heads

Garden Survey All Plot Holders

Garden Replanting Survey

New Garden Identification

Occupational Prestige All Aged 15

Attitude Survey All Aged 15

Sub-Sample of 10 Households per Village

Income and Savings Daily All Household Heads

Expenditure Daily All Household Heads

Dietary Survey Daily All Household Heads

Labour Survey Weekly All Household Heads

Yield Survey All Plot Holders in Sub-Sample

Sucoma Labour Survey 5% Random Sample
village land are considered to be members of the village and to come under the Village Headman's jurisdiction. Once the boundaries of the village had been determined by the enumerator in conjunction with the Village Headman, and any wards or hamlets it contained identified together with their respective heads, there was no difficulty, except in a very small number of cases, in identifying the village population. The small number of cases where difficulties arose were basically of two types. The first, was where members of another village had built within the boundaries of the sampled village but were cultivating land outside its boundaries. In this case, they were not included as members of the village population. The second type was where members of another village had both built and were cultivating within the land area of a sampled village and yet were not recognized by the Village Headman and villagers as part of the village. In these cases there was usually some land dispute in progress. Whilst on strictly sociological grounds one could make out a strong case for excluding such intruders we nevertheless included them in our population counts since one of our principal objectives was to relate a defined population to a defined area of land.

Once the village and its various sections had been identified each enumerator prepared a sketch map relating the distribution of the village population to the principal topographical features and to the village boundaries.

1.7 The Identification and Listing of Households.

After a sketch map had been prepared the enumerator accompanied by the field supervisor, the Village Headman, and where appropriate the Section Head, identified each household, allocated an identification number to it and, with the Household Head's permission chalked this number in a prominent place on his dwelling. Other dwellings associated with the household were given an alphabetical index. Each Household Head's name was recorded and the sample number and the number of dwellings for each household were listed. Using the definition given in Appendix IV the enumerators experienced no difficulty in identifying households. Each enumerator was instructed to proceed with the listing exercise in as geographically rational a manner as possible so that if necessary the procedure could be checked.

1.8. Selection of Samples and Sub-samples of Households.

When the listing of all households was completed in a village, random
numbers were used to select a sample of 20 or 30 households according to the total number of households it contained. We had been advised that for garden survey work a sample of 15 households from each village would be adequate to give reasonably reliable estimates but we were unsure of the ranges of variances in relation to our other exercises and it seemed advisable to err on the safe side. In addition, we had to provide a reasonable work load for each enumerator. Rather than operate with a uniform sampling fraction which would have produced absurdly small samples in some villages and unduly large ones in others, we compromised by randomly sampling 20 households from villages with less than 100 households, and 30 households from villages with 100 households or more. Once the sample of 20/30 households had been drawn - and this was done by the survey leaders in the presence of the Village Headmen - a further sub-sample of 10 households was defined. With three exceptions, this sub-sample was the first ten households drawn in the larger sample. Of the three exceptions, two, Sila Zuwavo and Nsiyankuni, are both hill villages consisting of widely scattered hamlets and one, Mlolo, is a large village on the east bank with dispersed sections. Since the 10 households were to be interviewed each evening, it was important that they should lie within a reasonable distance of the enumerator's house. The enumerators were each equipped with a bicycle but, in parts of the hill villages, much work had to be done on foot. In the case of these three villages, therefore, the first ten households from the sample of 20/30 within a reasonable distance from the enumerator's house were selected. We have no grounds for supposing that this has led to any significant bias. Table I.C. gives the sample size for each sampled village.

1.9 Survey Exercises Undertaken.

After the household listing, the first major exercise was a complete census of all the households in the village. Every member of the household was listed and for each member details of age, sex, marital status, education, wage employment, ethnic group, religion, country of birth, district of previous residence and relationship to the household head were recorded. In addition details of major crops grown and number of livestock kept by the household were also recorded. Careful enquiry was made as to the resident status of each member of the household, and any members visiting or away at work, either locally or further a field, were also
recorded. This was done to enable us in analysis to define both a de jure and a de facto population, and to enable us also to take into account labour migrants working abroad and permanent labourers who sometimes form part of a household. We identified seven resident statuses: Permanent, Temporarily Absent, Permanent Labour, Temporary Labour, Labour Migrant, and Circulating Husband. The full definitions of these statuses are given in Appendix IV. Copies of the Household Composition Schedule together with other schedules administered, all instructions and related documents, have been filed with the National Statistical Office, the Shire Valley Agricultural Development Project and the Malawi National Archives.

Whilst the Household Composition Schedule was being administered the daily interviews of the sub-sample of 10 households were begun. Initially, this consisted of the recording of the incomes and expenditures of each member of the household together with a dietary survey which established the types and origin of food consumed at the two main meals. In March, 1973, the dietary survey was discontinued and a labour survey instituted on a weekly basis. In this survey details of labour hired or offered for hire by any household member were recorded.

Once the Household Composition Survey had been completed – in most villages this was by the end of November 1972 – the next survey was launched. Thereafter surveys were mounted every five to eight weeks. The central column of the flow chart (Figure I.B) shows approximately the order in which the surveys were administered and the samples to which they relate. Two surveys, however, spanned a considerable period of time; these are the Garden Survey and the laying of yield sub-plots. The Garden Survey was begun in January 1972 and continued until July. At the same time, in the gardens of the sub-sample of households, yield sub-plots, suitably equipped with warning markers, were layed.

Excluding the survey of a five per cent sample of the Sucoma labour force, undertaken in July 1973, and the Household Composition Survey already referred to, 16 separate surveys were undertaken in the villages. The Household Composition Survey, as indicated, covered all the households of a village. Eleven surveys were administered to the sample of 20/30 households and five surveys were administered to the sub-sample of 10 households. A list of the surveys undertaken, with the exception of the Household Composition Survey already referred to, is now given together with brief comments on their content.
I.10 Surveys Administered to the Sub-Sample of Ten Households.

(1) Income and Savings Survey
At daily interviews, usually in the evening, all incomes received by members of the household in that day were recorded, together with any savings, and were classified according to a number of categories.

(2) Expenditure Survey
All expenditures by household members were recorded daily and classified. Both the income, savings and expenditure surveys continued throughout the period from October 1972 to July 1973.

(3) Dietary Survey
At daily interviews, in the evening, usually at the same time as the questions about income, savings and expenditure were asked, information was collected on the two main meals eaten by the household. Staples and relishes were listed and classified as to origin. This survey continued from December 1972 until April 1973. It was hoped to detect any shifts in the origin of staples and relishes as the households moved through the usual period of shortage immediately before the new harvest. Once crops were being harvested and food was relatively plentiful again, the survey was discontinued.

(4) Labour Survey
This was begun, somewhat belatedly in March 1973. For the members of each household details of labour hired of labour supplied according to rates of pay, tasks and origin were recorded (See also (11) below).

(5) Yield Survey
A yield sub-plot of one ninetieth of an acre was laid in each plot of the gardens of each household according to standard procedures. At harvest time this was harvested by the enumerator and the yield recorded. Separate yield schedules were completed for each of the major crops giving relevant agronomic information. For minor crops a briefer, all-purpose schedule, was completed. Special precautions were taken to ensure that
each crop harvested was treated according to a standard procedure before it was weighed.

I.11 Surveys Administered to the Sample of 20/30 Households.

(6) Family and Marriage Survey

All persons who had ever been married in the sampled households were interviewed. The schedule was designed to elicit information about marital histories, and to detect any changes which may have occurred (1) in the structure and composition of the family through time; (2) in the conjugal and jural stability of marriage; (3) in the incidence of polygyny; (4) in the amount and nature of the resources needed to establish a family.

(7) Fertility and Child Mortality Survey

All women of reproductive age were interviewed and fertility histories were collected. A special effort was made to record the present age or the age at death of all children under ten, and to record the present age or age at death of all infants born in the twelve months immediately preceding the interview. With these data reproduction rates and infant and child mortality rates have been determined.

(8) Spatial Mobility Survey

This was administered to all aged 15 and over in the sampled households. Early in our work it became apparent that migration within the Lower Shire Valley and between it and Mozambique occurred on a considerable scale and was characteristic of at least some members of the population. To examine the course of this and to gauge its consequences, complete migration histories were collected in which details of migration from one place to another were recorded along with the reasons for migration.

(9) Labour Migration Survey

This was directed to all aged 15 and over who had ever sought wage employment (or been self-employed) outside the village. Complete labour histories were
collected along with such details as occupation, place of employment, period employed, and reasons for leaving or returning to the village.

(10) **Wealth Survey.**

All household heads were asked if they possessed any of a number of items which were chosen as indicators of wealth and style of life.

(11) **Labour Survey**

A retrospective survey, administered in March 1973 and designed to elicit the same information as for (4) above, but for the six months immediately preceding the interview.

(12) **Garden Survey.**

All gardens, whether fallow or cultivated, over which members of a household held cultivation rights were identified and where the gardens were internally sub-divided, the separate plots were identified. Each garden and its associated plots were surveyed by standard procedures using prismatic compasses and tapes. A sketch map was prepared for each garden and all measurements and the mean magnetic bearings were then fed into a computer which calculated the garden area, the plot areas and the closing error. Closing errors of up to 5 percent were accepted, between 5-10 percent they were adjusted by computer and above 10 percent they were rejected and the garden and plots remeasured.

For each plot, a schedule was completed in which details of its tenurial and agronomic history were recorded.

(13) **Garden Replanting Survey**

Double cropping systems of some complexity are found in certain areas of the Lower Shire Valley, particularly along the edge of the Elephant and Ndinde Marshes, and simpler systems occur elsewhere. The Garden Replanting Survey, launched after the main harvest, was designed to check on the extent of double cropping. It involved the enumerator revisiting each garden and plot which had been
identified during the Garden Survey in order to ascertain if replanting had occurred, with what crop and over what area. For cotton, enquiries were also made at the same time as to whether the cultivator owned or had borrowed a sprayer and the number of sprays which had been applied.

(14) **New Garden Identification Schedule.**

This was closely associated with the Garden Replanting Survey. As the two great marshes dry out around their peripheries, new gardens are prepared. The Garden Survey was likely to have missed many of these since at the time it was administered much land was still under water. Enumerators checked with each household to see what new gardens had been prepared and planted. Where any were identified, they were measured.

(15) **Occupational Prestige Survey.**

This was administered in July, towards the end of the Survey period, to all members of sampled households aged 15 and over. It contained a representative list, randomly arranged, of occupations normally undertaken by people in the Lower Shire Valley together with a number of key occupations, such as farming, agricultural advisory services, and other occupations connected with agriculture, about which information was particularly sought. Each person interviewed was asked to rank, according to the degree of prestige which they supposed people accorded them, each of 24 occupations on a five point scale ranging from 'very high' to 'very low', and to give their reasons for the ranking. These data when analysed along a number of different dimensions should enable some assessment to be made of people's general attitudes towards particular occupations.

(16) **Attitude Survey.**

Administered at the same time as the occupational prestige Survey, this survey explored people's attitudes to land and agriculture along several
different dimensions. A number of statements were listed in Chewa and as each was read to the interviewee he was asked to express the extent of his agreement or disagreement on a five-point scale ranging from "very strongly agree" to "very strongly disagree". Care was taken with key statements to have them presented to the interviewee in at least two different forms at different points in the interview, to check the validity of the responses.

I.12 Survey Control Procedures.

In a survey of this scale and complexity it is absolutely crucial to have rigorous checking and control procedures. The flow chart (Figure I. c) indicates the basic pattern of the control system adopted. SOLV employed 2 field supervisors who worked outside the CCDP Phase I area. One stationed at Chikwawa, supervised five villages in the north of the valley ranging from Sila Zuwavo in the far north-west of Chapananga to Mpingasa mid-way along the east bank of the Shire on the edge of the Elephant Marsh. The other supervisor, stationed at Nsanje, covered the seven villages in the south of the valley from T.A. Mlolo's village on the east bank of Shire to Msiyankhuni, adjacent to Lulwe Mission, in the extreme south-west. The two CCDP supervisor's operated from Ngabu, one covering four villages in the north of the Phase I area, the other covering four in the south. The two SOLV supervisors were equipped with motorcycles, the CCDP supervisors with Land Rovers. In the first two months of the survey, enumerators were visited almost twice a week. As the survey proceeded, enumerators were visited regularly about every ten days and, in addition, unannounced visits were made randomly by the Project leaders every two to three weeks.

The field supervisors checked the work of each enumerator and rejected any schedule that was incomplete or appeared to contain an error. The schedules were then forwarded in batches to the field headquarters at Ngabu where each batch was examined by a checker for errors and omissions. In addition as the survey progressed, earlier schedules were checked against later schedules to see if the information they each contained was mutually consistent. If a schedule contained an error it was returned via the field supervisor to the enumerator, with a note attached indicating the error or omission. If a schedule appeared adequate it was checked against a
Figure I.C. Flow Chart Indicating Data Processing and Checking Procedures.
control sheet and filed for coding. The office supervisor held master control sheets showing at any one moment, which surveys were being undertaken by which enumerators, which schedules had been completed, which were outstanding and which had been returned for "call-backs".

I.13 Coding Procedures.

When the coding of a survey began, the progress of the coders was monitored carefully during the first two weeks of coding when errors were expected to be high. During this period the work of each coder was examined in detail. In the case of the coding of the Household Composition Survey, random batches of code sheets were examined, persistent errors noted and the coders advised. For the smaller surveys, each code sheet was checked for coding errors and the errors corrected.

During the coding process, coders sometimes came across undetected errors in schedules, often of a subtle nature. These were scrutinised and where necessary the schedules returned for "call backs". When a survey had been completely checked and coded it was forwarded to SOLV's Blantyre headquarters for final processing. The code sheets were sent, in the case of the Household Composition Survey, to the National Statistical Office, and in the case of the smaller surveys, to the Data Processing Centre of the Department of Posts and Telecommunications for the information they contained to be punched onto computer cards and the punching verified.

Finally, a separate and extensive test programme was written for the set of computer cards for each survey, and run on the computer at Malawi Railways headquarters at Limbe. The test programmes not only examined each column of each card to see if it contained values which lay within an acceptable range, but performed a series of separate logic checks which involved a searching examination of the internal consistency of the information on each card. If a card passed the logic tests the information it contained was written onto magnetic tape. If it failed the logic checks the computer printed out the information which the card contained and indicated the nature of the error. The printed list of rejected cards was then used to identify the schedules from which the original information had been coded. These were scrutinised, the information recoded and the various processes repeated. These final testing procedures are rigorous, expensive and time consuming. On the first test of the 17,000 computer cards for the Household Composition Survey, some 10 percent were rejected. Nevertheless, we feel that the effort involved in obtaining as accurate a
transcription as possible of information from the survey schedules to the magnetic tape, has proved eminently worthwhile. The final discernible error rate for the Household Composition survey is of the order of 0.1 of 1 percent.

I.14 The Analysis of the Survey Data.

For each survey, the data it contains has been coded so that it may be analysed either separately as a self contained exercise, or inter-related with data from other surveys. Each household in the sample of 20/30 households drawn from each sampled village is identified by a sample number which it retains for all surveys. Similarly within the sampled households, each individual aged 15 and over has an identification number. It will be possible, therefore, to analyse the complete data from all the surveys in terms of both the attributes of households and the attributes of individual household members. For each sampled household, and for each individual aged 15 and over within a household, economic and social profiles of considerable complexity can be constructed from the data. The data therefore offer the possibility of analysing by multivariate techniques the social factors, both contemporary and historical, which relate to present economic behaviour. In brief, and at the risk of over simplification, it would appear that we may be able to indicate from these data, what are the relevant economic and social factors, given a particular ecological and historical context, which operate to produce a particular type of economic behaviour. This is an exciting prospect which, as far as we are aware, has not been attempted on this scale previously. However, it is not one which we have attempted in this report.

Our first priority has been to make available data relevant to an understanding of current economic issues and for immediate planning purposes. We have therefore confined ourselves, as far as the survey data are concerned, to straightforward tabular analysis working largely with totals, means, percentages, and rates. We have computed no error statistics. Even to do this has strained the available computer resources to the limit. To carry the analysis further requires time and above all access to much greater computing capacity and resources.

It is our intention, however, to proceed with the more complex and demanding analysis in the United Kingdom and to make available the results in a supplementary report. Therefore the data drawn from the surveys which is presented here, should be seen as providing a reasonably reliable
macroscopic view of significant aspects of economic and social characteristics of the population of the Lower Shire Valley, and treated as a prelude to a more detailed and penetrating analysis.
APPENDIX II

ESTIMATING LABOUR REQUIREMENTS AND GROSS MARGINS PER ACRE FOR
MAJOR RAINFED CROPS IN THE LOWER SHIRE

II.1 Introduction

An attempt is made to estimate labour requirements and gross
margins per acre for the major rainfed crops of the Lower Shire Valley.
Rainfed crops in the area depend mainly upon labour and land with very
few other inputs, not even fertilizer. There is one exception to this
and that is cotton where it is sprayed with insecticide. For this
reason sprayed and unsprayed cotton are treated as two separate crops.
Three other crops are considered, and these are maize, rainfed rice
and groundnuts.

Estimated labour inputs and gross margins are obtained not by
direct observation but by synthesis from data collected by others. For
this reason the data sources are cited in the next section before the
estimates are presented with their accompanying assumptions.

II.2 Data Sources

1. Agro-Economic Survey (AES) - Ministry of Agriculture and Resources
   (MARN)
   All reports have been examined but the following have been drawn
   upon extensively including parts of the draft of the 11th Report:
   10th Report, Malimba Groundnut Growers in Nsanje South, M.A.N.R.
     Zomba, October 1972.

   An Economic Study of Small-holder Rice Production 1971/72,
   August, 1972.
   Also from private communication with the Economist, M.W. Felton,
   concerning the results of the 1972/73 Survey.

   in Malawi, School of Agriculture, Aberdeen, Misc, Publication
   No. 11, 1970.

4. Central Lakeshore Development Project (CRLDP), Salima Project Staff
made available a mimeographed sheet containing estimates of labour requirements by yield and task for crops incorporated into farm plans. The information in a letter from G. D. Horspool at Chitedze Research Station was also made available.


6. John Farrington is currently collecting data for a thesis to be submitted at Reading University. His work includes measuring the number of days worked and working day length for various crop tasks performed on settlement schemes in Malawi. He is also measuring work rates for tasks such as cotton picking. He has very generously made his findings available by private communication to be employed here.


8. Malawi Government, Lower Shire Valley Agricultural Development Project Phase II, Planning document prepared by MANR, Zomba, March 1972. This is referred to simply as 'Phase II' in the text.


II.3 Labour Requirements for Rainfed Crops

Labour requirements are estimated below for five major rainfed crops. In each case these are calculated for four different yield levels per acre using the assumption that a single production system is used. That is, it is assumed that yields vary solely as a result of uncontrollable factors such as weather and disease incidence. Thus labour requirements per acre are the same for all pre-harvest activities, and vary solely according to the effects of yield upon harvest and post-harvest tasks.

As far as possible it is the average production systems likely to be employed by Lower River farmers which are considered. These are not the systems employed by the best, most efficient farmers, for this would not serve the purpose of analysing the economic choices of the average farmer.
In order to be able to estimate labour requirements by yield, separate estimates are made for each task. To facilitate easy modification of our estimates, using information not available to us, the assumptions and data that have been used are set out in full below. All data sources cited for a particular crop relate specifically to the labour requirements of that crop and are not general requirements for the task averaged over all crops.

All the labour requirement estimates are expressed in terms of labour-days rather than hours. This permits allowance to be made for the fact that the hours worked at some tasks appear on average to exceed those worked at others. Quite what determines these differences is not at first sight clear, for as Farrington's data in Table II.A suggest it does not appear simply to be the physical difficulty of the task. This probably plays a part, but other factors such as pressure of work at the relevant part of the crop cycle are also likely to influence working day length. It also appears from the data in Table II.A that the average length of working day in the Lower Shire may be less than on the Central Lakeshore, possibly because of the more extreme climate and higher disease incidence in the former.

The impression gained from the data in Table II.A is that the length of the working day varies from 4 to 8 hours depending on the task. Agro-Economic Survey results show a much lower number of hours spent working per day, typically 2½ to 3½ hours. However since these AES averages are calculated for all days, not just working days, rigid application of the implied work rates would probably lead to underestimation of working time available. However for planning purposes it might lead to overestimation if it were assumed that a person would work for seven days per week at the daily rate of hours implied by Table II.A.

Except where specifically stated no attempt has been made to refine the data further by giving weights of less than one to work done by women and children to convert it to man equivalents. Most of the work is done by adults and Farrington's preliminary work suggests that the length of day does not vary greatly by sex. In addition the majority of field tasks do not appear to be predominantly performed by one sex or the other. Furthermore the sex weights would need to be varied by task since males are not more productive than females at all jobs. Since present data seem inadequate to devise a fully adequate set of sex-age weights this has not been attempted here. Hence the discussion is couched in terms of labour-days rather than man-days.
TABLE II.A: Hours of Work per Working Day in Malawi, by Agricultural Task

<table>
<thead>
<tr>
<th>Operation</th>
<th>von Rumker's Data by Village</th>
<th>Farrington's Data*</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mtambo</td>
<td>Chimbala</td>
</tr>
<tr>
<td>General</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cutting trees</td>
<td>4.6</td>
<td>5.1</td>
</tr>
<tr>
<td>Grass/bush clearing</td>
<td>4.5</td>
<td>4.9</td>
</tr>
<tr>
<td>Ridging</td>
<td>4.5</td>
<td>5.1</td>
</tr>
<tr>
<td>Planting</td>
<td>5.2</td>
<td>6.4</td>
</tr>
<tr>
<td>Weeding/Thinning</td>
<td>6.3</td>
<td>6.9</td>
</tr>
<tr>
<td>Cotton</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picking</td>
<td>6.1</td>
<td>6.7</td>
</tr>
<tr>
<td>Grading</td>
<td>8.2</td>
<td>8.4</td>
</tr>
<tr>
<td>Uprooting/burning</td>
<td>5.6</td>
<td>6.4</td>
</tr>
<tr>
<td>Groundnuts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digging/stripping</td>
<td>4.9</td>
<td>5.8</td>
</tr>
<tr>
<td>Shelling</td>
<td>4.2</td>
<td>4.0</td>
</tr>
<tr>
<td>Maize</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Removing cobs</td>
<td>6.7</td>
<td>7.3</td>
</tr>
<tr>
<td>Transporting to store</td>
<td>5.7</td>
<td>6.9</td>
</tr>
</tbody>
</table>

* Farrington's data on cotton are collected from Mangulenje Settlement Scheme in the Lower Shire.

II.3.1 Sprayed Cotton—Labour Requirements per Acre (Labour Days)

<table>
<thead>
<tr>
<th>Operation</th>
<th>600</th>
<th>800</th>
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<th>1,200</th>
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</thead>
<tbody>
<tr>
<td>Land Preparation $^1$</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Planting/Supplying $^2$</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Thinning $^3$</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Weeding $^4$</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Spraying $^5$</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Picking $^6$</td>
<td>30</td>
<td>40</td>
<td>50</td>
<td>60</td>
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<tr>
<td>Grading $^7$</td>
<td>12</td>
<td>16</td>
<td>20</td>
<td>24</td>
</tr>
<tr>
<td>Uprooting $^8$</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Burning/Clearing $^9$</td>
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<td>3</td>
</tr>
<tr>
<td>Marketing $^{10}$</td>
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<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Miscellaneous $^{11}$</td>
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<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total $^{12}$</td>
<td>107</td>
<td>122</td>
<td>136</td>
<td>151</td>
</tr>
</tbody>
</table>
1 Land Preparation

NB.  (i) This includes hoeing, ridging and making planting holes.
(ii) The working day is assumed to average 5 hours.

Sources:
(a) Catt - 20 man days per acre.
(b) CRLDP - 12 man days for levelling and land preparation.
(c) Farrington - settlers at Mangulenje (in the Lower River) and Malomba observed to use an average of approximately 140 hours per acre on ridging alone, which is equivalent to 28 labour days.
(d) Horspool - hired labour at Chitedze took 12 to 16 days at 8 hours per day to ridge 1 acre.
(e) A.E.S. (Ngabu) - 15 hours clearing plus 36 hours other land preparation for sprayed cotton - equivalent to 10 labour days.

Since the CCDP Farm Survey 1971/72 reports that 80 percent of cotton spraying farmers ridge their gardens it will be assumed that ridging is part of the normal production system for this crop. It is therefore assumed that an average of 20 man days are required for land preparation.

2 Planting/Supplying

NB.  (i) This includes placing seeds in planting holes, and replanting seed in gaps in the germinated crop.
(ii) A 6 hour working day is assumed.

Sources:
(a) Catt - 7 man-days.
(b) CRLDP - 4 man-days.
(c) AES (Ngabu) - 34 labour hours per acre, equivalent to 6 days.
(d) Farrington - 20 hours planting plus 15 hours supplying at Mangulenje, equivalent to 6 days. Supplying time may be unusually high in 1972/73 because of low rainfall and poor germination.

It is assumed that 5 labour-days are required for this task.

3 Weeding

NB.  (i) A 5 hour working day is assumed.

Sources:
(a) Catt - 45 man-days
(b) CRLDP - assume from 10 to 17 man days depending upon yield.
Since CRLDP assume a 7\(\frac{1}{2}\) hour man-day this is equivalent to from 15 to 26 labour-days.

(c) AES (Ngabu) - on average 85 labour hours per acre, equivalent to 17 labour-days.

(d) Farrington - 80 hours per acre at Mangulenje in 1972/73 a year of not particularly strong weed growth. Equivalent to 16 labour-days.

It is assumed that 20 labour-days are required.

5 Spraying

NB. (i) This is defined to include time spent carrying water.

(ii) Assume a 5 hour day.

Sources:

(a) Catt - 9 man-days.

(b) CRLDP - 7 or 8 man-days.

(c) AES (Ngabu) - 37 hours equivalent to 7 days.

(d) Farrington (Mangulenje) - 1.21 spraying hours plus 0.92 water carrying hours per acre per spray.

He is convinced that these preliminary figures underestimate labour requirements. Boreholes at Mangulenje are on average closer to fields than in the average village.

It is assumed that one spraying takes 1 labour-day. In line with the finding of the CCDP Farm Survey 1971/72 that the average number of sprays per registered spraying farmer was 7.7, it is assumed that 8 spraying are done on average.

6 Picking

Sources:

(a) Catt - 54 man-days.

(b) CRLDP - assume a picking rate varying from 20 to 35 pounds of cotton per day depending upon yield. There appears little basis for assuming that higher yields lead to improved picking efficiency on this scale.

(c) AES (Ngabu) - 190 hours equivalent to 42 labour days at 4.5 hours per day.

(d) Farrington (Mangulenje) - the average picking rate appears not to exceed 5 pounds per hour. The average length of picking day is 4.5 hours, which suggests that approximately 22.5 pounds of cotton are picked in an average day. This work rate was recorded for a group largely composed of Malawi Young Pioneer Settlers who tend to work more efficiently than average villagers.
In view of the last remark on Farrington's data it appears that our assumption of 20 pounds of cotton picked per day is not likely to be an underestimate.

7 Grading

Sources:
(a) Catt - 5 days.
(b) CRLDP - assume rates varying from 50 to 65 pounds per day dependent upon yield. It is very difficult to see why grading rates should vary with yield.
(c) Farrington (Mangulenje) - Preliminary data suggest that the average grading rate in 1973 for late picked cotton is unlikely to exceed 30 pounds per day. As the cotton being graded was of poor quality this grading rate is likely to be less than is normal for all cotton.

A grading rate of 50 pounds per labour-day is assumed.

8 Uprooting

Sources:
(a) Catt - 13 man-days although this presumably includes clearing and burning.
(b) CRLDP - 3 man-days.

It is assumed that 3 labour-days are required.

9 Burning/Clearing

CRLDP assume that 3 days are required, and that figure is used here.

10 Marketing

CRLDP assume that this requires from 2 to 4 days depending upon yield.

It is arbitrarily assumed that it requires 1 labour day to market 300 pounds of cotton.

11 Miscellaneous

There are various small jobs including collecting seed or insecticide, pest scouting and so on. CRLDP assume that these jobs require 2 man-days and the same figure is employed here.

12 Total Labour-Days per Acre

Sources:
(a) Catt - 153 man-days.
(b) Johnson - 128 days for 1200 pounds yield. The assumptions
of working day length are unspecified, as they are also for Catt.

(c) CRLDP - 93 days for 750 pounds, 107 days for 1,000 and 116 days for 1,200 pounds. These are based on a 7½ hour man-day, which is clearly too high according to both von Rumker's and Farrington's work. Moreover these estimates are based on low ridging times and high cotton picking rates.

(d) AES (Ngabu) - 397 hours per acre of sprayed cotton equivalent to 80 labour days at 5 hours per day. This estimate excludes grading, marketing and miscellaneous time. Given that (a) the ratio of after harvest work to fieldwork was estimated by AES at 11.2 to 27.5 for cotton and maize, and (b) that the start of the Survey was delayed slightly possibly eliminating some garden preparation work, the AES data seem consistent with our estimate of 107 labour-days for an 800 pounds crop.

(e) Phase II - 127 man-days.

All in all the final estimates derived above seem to be compatible with data from the other sources.

II.3.2 Unsprayed Cotton - Labour Requirements per Acre (Labour-Days)

<table>
<thead>
<tr>
<th>Operation</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Preparation</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Planting/Supplying</td>
<td>5</td>
<td>5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Thinning</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Weeding</td>
<td>15</td>
<td>15</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Picking</td>
<td>10</td>
<td>15</td>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>Grading</td>
<td>4</td>
<td>6</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Uprooting</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Burning/Clearing</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Marketing</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>55</td>
<td>62</td>
<td>69</td>
<td>76</td>
</tr>
</tbody>
</table>

1 All these job requirements and work rates are assumed to be exactly the same as for sprayed cotton.
2 Land Preparation

The CCDF Farm Survey 1971/72 reports that only 40 percent of non-spraying farmers ridge their gardens as opposed to 80 percent of spraying farmers. Moreover the non-sprayers for this calculation included what are now termed non-recorded sprayers, that is farmers who hire sprayers and buy insecticide from registered spraying farmers. Hence it is likely that the proportion of gardens ridged by farmers who apply no insecticide is less than 40 percent. It is therefore assumed that the typical non-spraying farmers spends less time on ridging and land preparation than spraying farmers, so that 10 labour-days are assumed to be required.

3 Weeding

The non-spraying system of cotton growing almost certainly involves less careful attention to weeding. It is therefore assumed that 15 labour-days are required as against 20 for the spraying farmer.

4 Miscellaneous

Since the non-spraying farmer does not have to scout for pests it will be assumed that miscellaneous tasks require only 1 labour-day.

II.3.3 Maize - Labour Requirements per Acre (labour-days)

<table>
<thead>
<tr>
<th>Operation</th>
<th>Yield (lbs/acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500</td>
</tr>
<tr>
<td>Land Preparation</td>
<td>6</td>
</tr>
<tr>
<td>Planting/Supplying</td>
<td>3</td>
</tr>
<tr>
<td>Thinning</td>
<td>1</td>
</tr>
<tr>
<td>Weeding</td>
<td>15</td>
</tr>
<tr>
<td>Harvesting</td>
<td>3</td>
</tr>
<tr>
<td>Transport</td>
<td>1</td>
</tr>
<tr>
<td>Shelling</td>
<td>3</td>
</tr>
<tr>
<td>Uprooting/Burning</td>
<td>2</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>35</td>
</tr>
</tbody>
</table>
1 Land Preparation

NB.  (i) This is defined to include clearing weeds, hoeing and making planting holes. Ridging is not part of the maize growing system of the Lower River – the CCDP 1971/72 Farm Survey records that 24 percent of cotton spraying and only 5 percent of non-spraying farmers ridged their maize gardens.

(ii) A labour-day is assumed to be 5 hours.

Sources:
(a) Catt - 13 man-days.
(b) AES (Ngabu) - 29 hours, equivalent to 6 labour-days.
(c) AES (Mbawa 1969/70) - 21 hours equivalent to 4 days.
(d) CRLDP - assume 6 days for ridging following 6 days of post-harvest levelling in a high output system with yields ranging from 1400 to 4000 pounds.

It is assumed that 6 labour-days are required for land preparation.

2 Planting/Supplying

NB.  (i) Assume a 6 hour labour-day.

Sources:
(a) Catt - 3.5 man-days.
(b) AES (Ngabu) - 22 hours, equivalent to 4 labour-days.
(c) AES (Mbawa 1969/70) - 18 hours, equivalent to 3 days.
(d) AES (Chilwa) - 20 hours, equivalent to 3 days.
(e) CRLDP - assume 3 days.

It is assumed that 4 man-days are needed.

3 Thinning

CRLDP assume that 3 man-days are required for fertilized high yielding maize.

It is assumed that 1 labour-day is required with the low plant populations of the Lower Shire.

4 Weeding

NB.  (i) A 5 hour labour-day is assumed.

Sources:
(a) Catt - 17.5 days.
(b) AES - 82, 114 and 70 hours per acre respectively from Ngabu, Chilwa and Mbawa (1969/70).

These are equivalent to 16, 23 and 14 labour-days.
(c) CRLDP - assume that 1400 pound crop requires 12 man days
and larger crops 16.
It is assumed that weeding requires 15 labour-days.

5 Harvesting

NB. (i) A 5 hour labour-day is assumed.

Sources:
(a) Catt - 10.5 days, but this appears to cover all operations including shelling and transport from the field.
(b) AES - 80, 33 and 24 hours respectively at Ngabu, Chilwa and Mbawa (1969/70). Equivalent to 20, 7 and 5 days.
(c) CRLDP - assume 7 man-days to harvest 1400 pounds. Their assumed harvesting rate is based upon a picking rate of 6 cobs per minute with 15,000 plants carrying 1½ cobs each. Both the number of plants and cobs is higher than commonly found in the Lower River.

It appears reasonable to assume a harvesting rate equivalent to 200 pounds of grain per labour-day.

6 Field Transport

CRLDP assume that 400 pounds can be carried to the store in 1 day. The same figure is used here.

7 Shelling

CRLDP assume that 200 pounds can be shelled per day. This assumption is used here.

8 Uprooting/Burning

CRLDP assume a standard 4 man-days irrespective of yields up to 4,000 pounds. Since poorer yields are likely to be partially due to lower plant densities with lower weights of crop residues it seems reasonable to assume that 2 labour-days are required for the two lower yield categories and 3 for the others.

9 Miscellaneous

Assumed to require 1 labour-day.

10 Total Labour-Days Required per Acre of Maize

The final estimated requirement of 48 days for a 1400 pound crop compares favourably to CRLDP's estimate of 55 days for the same yield in a system involving ridging, Johnson's estimate of 59 days for a 2,600 pound crop, Catt's estimate of 48 man-days, and Phase II's assumption of 61 man-days.
II.3.4 Rainfed Rice - Labour Requirements per Acre (labour-days)

Materials currently available to the Survey do not permit estimates of labour requirements for rainfed rice to be made with the same confidence as for the previously cited crops. Doubts centre more on the hours required for particular tasks although there are wide discrepancies between sources concerning total requirements per acre.

Data provided by BIRP include labour requirements for two rainfed rice farmers in 1971/72. One of these failed to harvest most of his crop and hence had an unduly low average labour input. The data for the second farm, referred to as "farm 1971/72", is employed below. In addition the Economist at BIRP, M. W. Felton, has kindly sent his own preliminary estimates of labour requirements for rainfed rice based on data now being collected for the 1972/73 season.

<table>
<thead>
<tr>
<th>Operation</th>
<th>1,500</th>
<th>2,000</th>
<th>2,500</th>
<th>3,000</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(l/bd/acre)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land Preparation</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Planting</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>Weeding</td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>40</td>
</tr>
<tr>
<td>Cutting</td>
<td>15</td>
<td>17</td>
<td>19</td>
<td>21</td>
</tr>
<tr>
<td>Threshing</td>
<td>10</td>
<td>14</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Winnowing</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Bird Scaring</td>
<td>25</td>
<td>25</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>6</td>
<td>8</td>
<td>10</td>
<td>12</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>132</td>
<td>141</td>
<td>150</td>
<td>159</td>
</tr>
</tbody>
</table>

1 Land Preparation

NB. A 5 hour labour-day is assumed.

Sources:

(a) BIRP - Farm 1971/72 employed 74 labour hours, equivalent to 15 days.

(b) BIRP - 1972/73 data indicate the use of 180 labour hours, equivalent to 36 days.

(c) CRLDP - assume that 15 man-days are required for land preparation.

It is assumed that on average 25 labour-days are required for land preparation; this is 5 days more than for ridged cotton land.
2 Planting

NB. (i) Planting of rainfed rice is assumed to consist of direct seeding into planting holes.
(ii) A labour-day of 6.5 hours is assumed.

Sources:
(a) BIRP - Farm 1971/72 employed 31 hours in planting, equivalent to 5 days.
(b) BIRP - 1972/73 data suggest 50 hours, equivalent to 8 days.
(c) CRLDP - assume 5 days.
(d) AES (Chilwa) - estimate an average of 85 hours, equivalent to 13 days.

It is assumed that 8 days are required.

3 Weeding

NB. (i) A 6.5 hour labour-day is assumed.

Sources:
(a) BIRP - Farm 1971/72 - 307 hours, equivalent to 47 labour-days.
(b) BIRP - 1972/73 - 200 to 300 hours, equivalent to from 30 to 46 days.
(c) CRLDP - assume 15 man-days.
(d) AES (Chilwa) - 342 hours required, equivalent to 53 days.

It is assumed that 40 labour-days are needed to weed rainfed rice.

4 Cutting

NB. (i) Cutting is defined to include stooking the rice.
(ii) A 5.5 hour labour-day is assumed.

Sources:
(a) BIRP - Farm 1971/72, 80 hours, equivalent 15 days.
(b) Farrington - Likangala and Malomba Settlement Schemes, approximately 150 hours or 27 labour-days.
(c) CRLDP - assume 12 man days if cut by knife, 7 if cut by sickle.
(d) AES (Chilwa) - Harvesting found to require an average 331 hours or 60 days, but this includes bird-scaring.

It will be assumed that cutting and stooking time takes 15 labour days for 1,500 pounds of rice increasing by 2 days for every extra 500 pounds of yield.

5 Threshing

NB. (i) Assume 6 hours per labour-day.
Sources:
(a) BIRP - Farm 1971/72 - 115 hours or 19 days for 2,361 lbs.
(b) CRLDP - assume 8 days at home or 5 days in the field for 1,600 lbs.
(c) AES (Chilwa) - 107 hours or 18 days for 2,564 lbs.
It will be assumed that threshing time is proportional to yield starting with 10 days for 1,500 lbs and increasing by 4 days for every additional 500 lbs.

6 Winnowing
NB. (i) Assume 6 hours per day.

Sources:
(a) BIRP - Farm 1971/72 - 34 hours or 6 days for 2,361 lbs.
(b) CRLDP - assume 3 days for 1,600 lbs.
It will be assumed that it takes 1 labour-day to winnow 500 lbs. of rice.

7 Bird Scaring
NB. This is a crucial activity which appears to demand a great deal of family labour time. The task is frequently performed by children and other forms of cheap labour (less than 5 tambala per day), and so each hour of bird-scaring should receive a lower weighting than for other jobs. Accordingly it is assumed that 12 labour hours are equivalent to 1 labour-day.

Sources:
(a) BIRP - Farm 1971/72 - 341 hours or 28 days.
(b) AES - The 331 hours harvesting recorded include bird scaring. If 20 days of this (130 hours) were for cutting and stocking this would leave approximately 200 hours, 17 days, for bird-scaring.
It will be assumed that 25 labour days are engaged in bird scaring.

8 Miscellaneous
NB. (i) This is defined to include marketing and transporting.
(ii) 6 hours per labour-day are assumed.

Sources:
(a) BIRP - Farm 1971/72 - 61 hours or 10 days.
(b) CRLDP - assume 5 days for transport to market with a bicycle and 3 days on miscellaneous tasks.
(c) AES (Chilwa) - 9 hours or 2 days for marketing.
Since miscellaneous includes marketing and carrying, labour required is expected to vary with yield. It is assumed to require 2 days for every 500 pounds.

9 Total Labour Requirement per Acre of Rice

Sources:

(a) BIRP - Farm 1971/72 - 146 labour-days for 2,361 lbs.
(b) CRLDP - 77 man days, excluding bird scaring, for 1,600 lbs.
With bird scaring at 25 days this is equivalent to 102 days.
This is rather low, but account should be taken of the 7½ hour length assumed for a man day. Converting the 77 days by a factor 7.5:6 leads to an overall figure of 121 days.
(c) AES (Chilwa) - 1,639 hours or 145 labour-days per acre, excluding land preparation. Allowing for this at 25 days would give 170 days for 2,564 lbs.

The total requirements derived above are not unacceptable in comparison to the estimates cited.

II.3.5 Groundnuts - Labour Requirements per Acre (Labour-days)

<table>
<thead>
<tr>
<th>Operation</th>
<th>600</th>
<th>800</th>
<th>1,000</th>
<th>1,200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Land Preparation¹</td>
<td>10</td>
<td>10</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Planting/Supplying²</td>
<td>7</td>
<td>7</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Weeding³</td>
<td>18</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Lifting⁴</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Stripping⁵</td>
<td>9</td>
<td>11</td>
<td>14</td>
<td>17</td>
</tr>
<tr>
<td>Marketing⁶</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Miscellaneous⁷</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Total (Unshelled)⁸</td>
<td>68</td>
<td>71</td>
<td>74</td>
<td>78</td>
</tr>
<tr>
<td>Shelling⁹</td>
<td>15</td>
<td>20</td>
<td>25</td>
<td>30</td>
</tr>
<tr>
<td>Total (Shelled)⁹</td>
<td>83</td>
<td>91</td>
<td>99</td>
<td>108</td>
</tr>
<tr>
<td>Shelled Yield (lbs)¹⁰</td>
<td>390</td>
<td>520</td>
<td>650</td>
<td>780</td>
</tr>
</tbody>
</table>

¹ Land Preparation

NB. (i) According to the CCDP Farm Survey 1971/72 28 percent of spraying cotton farmers and only 19 percent of non-spraying farmers ridged their groundnut gardens. It therefore seems reasonable to assume that the average groundnut grower in the Lower Shire does not use ridges, although these are much in evidence in the hills of Chapananga and South Nsanje.
Sources:
(a) Catt - 15 man-days.
(b) CRLDP - assume 6 man-days for ridging, with no other preparation time allowed for.
It is assumed that land preparation is done on the same basis as for unsprayed cotton, that is using 10 labour-days per acre.

2 Planting/Supplying
NB. Assume 6 hours per labour-day.
Sources:
(a) Catt - 9 man-days.
(b) CRLDP - 7 man-days.
(c) AES (Mbawa 1971/72) - 41 labour hours, equivalent to 7 labour-days.
It is assumed that 7 labour-days are required.

3 Weeding
NB. Assume 5 hours per labour-day.
Sources:
(a) Catt - 18 man-days.
(b) CRLDP - 12 or 15 man-days dependent upon yield.
(c) AES (Mbawa 1971/72) - 91 labour hours, equivalent to 18 days.
It is assumed that 18 labour-days are required.

4 Lifting
NB. Assume 5 hours per labour-day.
Sources:
(a) Catt - 35 man-days for harvesting operations excepting shelling. It is presumed therefore to cover lifting and stripping.
(b) CRLDP - assume 7 man-days.
(c) AES (Mbawa 1971/72) - 170 labour hours were required for harvesting tasks excluding shelling for a yield of 538 pounds of shelled nuts. This is equivalent to 34 days for lifting and stripping.
It is assumed that 18 labour-days are required for lifting. Any bias in this estimate will tend to be compensated by that for stripping.

5 Stripping
CRLDP assume that the rate of stripping varies with yield from 70 to 90 pounds per man-day. The lower estimate will be used here since comparatively low yields are assumed for the Lower River.
The resultant estimated total labour-days required for lifting and stripping vary from 29 to 37 which is consistent with the Catt and AES data.

6 Marketing
Sources:
(a) CRLDP - 4 days per 1000 lbs. unshelled groundnuts.
(b) AES (Mbawa 1971/72) - only 2 hours, which seems lower than expected for the average situations.

In considering the marketing of cotton it was assumed that 300 pounds could be marketed per labour-day. The same assumption is used here.

7 Miscellaneous
This will be assumed at 2 labour-days.

8 Total Labour Requirement per Acre of Unshelled Groundnuts
Sources:
(a) CRLDP - assume that 1,000 lbs of unshelled Mani Pintar per acre require 54 man days. Given that CRLDP assume a 7½ hour man-day compared with approximately 5½ hours in our estimates, their 54 man days are almost exactly equivalent to 74 of our labour-days.
(b) Catt - 97 man-days to include shelling. Allowing 20 man-days for shelling this leaves 77 man-days which compares very closely with our figures.
(c) Johnson - 100 man days for 1,000 lbs of groundnuts per acre. If this estimate is assumed to include shelling it accords closely with our results.
(d) Phase II - assume 106 man-days.

9 Shelling
Sources:
(a) Catt - 20 man days.
(b) AES (Mbawa 1971/72) - 44 hours per acre to produce 538 pounds of shelled nuts. At 5 hours per labour-day this only amounts to 9 days.

It will be assumed that in one labour-day 40 pounds of unshelled nuts can be shelled.

10 The shelling percentage is assumed to be 65 percent.
II.4 Margins per Acre for Rainfed Crops

In this case the purpose of calculating the monetary returns to the farmer per acre is to set these against the estimated labour requirement per acre and to calculate returns per labour-day for different crops. In consequence the way in which margins per acre are calculated has to take into account the way in which labour-days were calculated.

One problem arises with respect to the treatment of hired labour costs. Many farmers hire labour for various crop operations. In agricultural surveys this leads to results of the type "the average spraying cotton farmer spends an average of x kwacha per acre on labour." However the fact of hiring labour does not materially influence the total labour days required per acre, it merely amounts to the substitution of hired labour for family labour. It would therefore be completely inappropriate, in calculating the margin per labour-day, to calculate margins per acre with hired labour costs deducted and to then divide these by total labour days required. If hired labour costs are deducted total labour-days must be reduced by the average number hired, giving average margins per family labour-day. However it seems possible to sidestep this difficulty and to simply estimate average returns per labour-day. That is, average hired labour costs will not be deducted and the full estimated labour requirements will be used to calculate daily margins. To some extent this solution is dictated by the absence of the necessary data. However it is also an appropriate solution since the majority of farmers do not hire labour but rely solely on family labour. Furthermore it appears unlikely that the results will be greatly influenced by not adjusting for hired labour, since preliminary results from the Labour Survey suggest that the average daily cost of hired labour is similar to the estimated average margins per labour-day.

A further difficulty arises with the costs of transporting produce to market. Many cotton farmers and presumably producers of rice and groundnuts, hire ox-carts, trucks or other people to take their produce to the market. The estimated total labour requirements make allowance for transporting time, and thus in principle if average monetary transport costs are deducted in calculating margins per acre some corresponding deduction should be made in the estimates of total labour requirement. Again, it appears wiser to leave out the costs of hiring transport for marketing. Firstly, although something is known about average monetary costs incurred for transporting cotton in the Lower River the same is not true for rice and groundnuts. Hence it is not possible to make
marketing cost adjustments on a comparable basis to the margins for all crops. Secondly, leaving transport costs out of account will make virtually no difference to the comparative margins for sprayed and unsprayed cotton (one of the most crucial of our estimates from the standpoint of policy) since transport costs per acre are linearly dependent upon yield. Thirdly allowance has been made for labour-days required to perform the marketing function, so that a transport cost has effectively been levied, and one which is directly proportional to the amount marketed.

As a result of these decisions about the handling of hired labour and marketing costs the problem of calculating margins per acre for the five rainfed crops is reduced to a very simple one. Very little fertilizer is used in local rainfed agriculture and it is certainly not included in the average production system; ox-cultivation is still a rarity and it can be assumed that no "machinery" is used; seed is obtained either from the farmers own crops or is received free (cotton) and so has negligible or zero cost to the farmer; and the depreciation costs of hand tools are so small that they can be ignored. This leaves only one set of purchased inputs to take into account. These are the costs of spraying associated with sprayed cotton production. For the other four crops the farmer's margin per acre will be taken as yield times the appropriate price per pound of product.

### II.4.1 Margin per Acre from Sprayed Cotton (kwacha)

<table>
<thead>
<tr>
<th></th>
<th>Yield of Cotton (lbs./acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>600</td>
</tr>
<tr>
<td><strong>Gross Revenue A</strong></td>
<td>30.27</td>
</tr>
<tr>
<td><strong>Gross Revenue B</strong></td>
<td>33.27</td>
</tr>
<tr>
<td><strong>Cost of Insecticide</strong></td>
<td>5.84</td>
</tr>
<tr>
<td><strong>Cost of Sprayer</strong></td>
<td>2.04</td>
</tr>
<tr>
<td><strong>Margin A</strong></td>
<td>22.39</td>
</tr>
<tr>
<td><strong>Margin B</strong></td>
<td>25.39</td>
</tr>
</tbody>
</table>

---

1 Gross Revenue A

This is calculated at 1972 ADMARC prices which were 5.5, 4.0 and 2.0 tambala per pound respectively for grades A, B and C. It is assumed that sprayed cotton is typically of the average quality of the last two years for the Lower Shire Valley. In 1970/71 this was 83, 10 and 7 percent respectively for grades A, B and C, and
in 1971/72 it was 83, 4 and 13 percent. The two-year unweighted average is 83 percent A, 7 percent B and 10 percent C.

2 Gross Revenue B

The assumption about quality are as for case A. ADMARC prices for 1973 are employed and these are 6.0, 4.5 and 2.5 tambala per pound for grades A, B and C.

3 Cost of Insecticide

The CCDP 1971/72 Farm Survey recorded average insecticide costs of K5.83 and K5.84 for two different samples of farmers spraying 7.7 and 7.5 times respectively. (The insecticide composition varied slightly for the two samples). It is assumed that the average insecticide cost per acre is K5.84.

4 Cost of Sprayer

The credit cost of a sprayer over the assumed 3 year life of a knapsack sprayer is K24. An additional 50 tambala repair cost is assumed over the 3 years to give a total cost of K24.50. Given that the average spraying farmer has approximately 4 acres of sprayed cotton the average annual cost per acre of a sprayer is assumed to be K24.05/12 which equals K2.04.

II.4.2 Margins per Acre of Unsprayed Cotton (kwacha)

<table>
<thead>
<tr>
<th>Yield of Cotton (lbs/acre)</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>500</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margin A 1</td>
<td>9.27</td>
<td>13.91</td>
<td>18.54</td>
<td>23.18</td>
</tr>
<tr>
<td>Margin B 2</td>
<td>10.27</td>
<td>15.41</td>
<td>20.54</td>
<td>25.68</td>
</tr>
</tbody>
</table>

1 Margin A

As there are no monetary input costs to be taken account of the margin per acre equals gross revenue per acre. This is calculated at 1972 ADMARC prices which were 5.5, 4.0 and 2.0 tambala per pound respectively for grades A, B and C. It is assumed that unsprayed cotton is typically of the average quality of the last two seasons in the Lower Shire. In 1970/71 this was 69, 14 and 17 percent respectively for grades A, B and C, and in 1971/72 it was 69, 7 and 24 percent. The two year unweighted average is 69 percent A, 11 percent B and 20 percent C.
2 Margin B

Quality is assumed to be the same as for case A. ADMARC prices for 1973 are employed, and these are 6.0, 4.5 and 2.5 tambala per pound for grades A, B and C respectively.

II.4.3 Margin per Acre of Maize (kwacha)

<table>
<thead>
<tr>
<th>Yield of Maize (lbs/acre)</th>
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<th>800</th>
<th>1,100</th>
<th>1,400</th>
</tr>
</thead>
<tbody>
<tr>
<td>Margin A</td>
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<td></td>
</tr>
<tr>
<td>1.0</td>
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<td>10.00</td>
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<td>17.50</td>
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<td>Margin B</td>
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<td>2.0</td>
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<td>16.00</td>
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<td>28.00</td>
</tr>
</tbody>
</table>

1 Margin A

Margin per acre is defined equal to gross revenue. Margin A is calculated for maize sold at the ADMARC buying price of 1.25 tambala per pound.

2 Margin B

In the Lower Shire Valley very little maize is sold to ADMARC. It is mainly grown for home consumption or local sale. Maize for subsistence should be valued at the price at which farmers would have to buy it. Thus the subsistence production margin (Margin B) is calculated at the ADMARC selling price of 2 tambala per pound.

II.4.4 Margin Per Acre of Rainfed Rice (kwacha)

<table>
<thead>
<tr>
<th>Yield (lbs/acre)</th>
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<th>2,500</th>
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<td>49.50</td>
<td>66.00</td>
<td>82.50</td>
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</table>

1 Although some rice is retained for domestic consumption, rice is mainly a cash crop in the major growing areas of the Lower Shire Valley. The ADMARC buying price of 3.3 tambala per pound has therefore been used.

II.4.5 Margin Per Acre of Groundnuts (kwacha)

<table>
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<th>Yield of Unshelled Nuts (lbs./acre)</th>
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</thead>
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<td>600</td>
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<tr>
<td>Margin - Shelled Chalimbana 1</td>
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<tr>
<td>Margin - Shelled Malimba 2</td>
</tr>
<tr>
<td>Margin - Unshelled Malimba 3</td>
</tr>
</tbody>
</table>
1 A shelling percentage of 65 percent is assumed. The ADMARC buying price for grade A shelled nuts of the Chalimbana type is 6.5 tambala per pound.

2 A shelling percentage of 65 percent is assumed. The ADMARC buying price for shelled Malimba nuts is 5 tambala per pound.

3 The ADMARC buying price for unshelled Malimba groundnuts is 3.3 tambala per pound.
APPENDIX III

COTTON STATISTICS

III.1 Purchases of Cotton by Market for the Lower Shire Valley

It has been decided to reproduce the complete set of data on cotton purchases as this is not published in its complete form elsewhere. Data on purchases at markets within the CCDP area have been published in CCDP Cotton Statistics Reports for the period from 1963/64. Comparable data for non-CCDP markets and for earlier years are not available in published form.

These other data have been assembled from the following sources:

1. Records at the Southern Region Headquarters of ADMARC provided the data for non-CCDP markets from 1967/68 to 1971/72.


3. Data found at M'tole Ginnery provided the information for 1958/59, 1959/60 and 1960/61.

4. An unpublished table in the files of the CCDP Evaluation Unit permitted some of the data gaps for 1962/63 and 1965/66 to be filled.

All data presented have been discussed with the Economist at CCDP, Mr. T. J. P. Russell, and it is an agreed set of statistics which is presented. In several instances these figures differ from those published previously by CCDP, but the new figures are agreed to be 'more' correct. In several years the market data do not reconcile exactly with Lower Shire total production employed in Chapter 5.

III.2 Estimating CCDP's Contribution to Cotton Production Using Method 2

The procedure adopted is based upon the following assumption:

1. The contribution of the Project is equal to the additional cotton production of all new cotton spraying farmers who have adopted the technology since the start of the Project in April 1968.

2. It is assumed that all classes of spraying farmers would in the absence of the Project have grown cotton without spraying on exactly the same acreage.

3. Hence the amount of a spraying farmer's output attributable to the Project equals the average cotton yield for the type of spraying
<table>
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<tr>
<th>YEAR / SEASON</th>
<th>CCDC NORTH</th>
<th>MABUNI NW</th>
<th>MABUNI SW</th>
<th>TABWA</th>
<th>KIRAGA</th>
<th>INZENDA</th>
<th>MAMARO</th>
<th>KAPASO</th>
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n.i. = no information
### TABLE III.A: Continued

#### NSANJE NORTH

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<td>151</td>
<td>64</td>
<td>61</td>
<td>179</td>
<td>86</td>
<td>189</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>1970/71</td>
<td>198</td>
<td>134</td>
<td>28</td>
<td>30</td>
<td>161</td>
<td>49</td>
<td>185</td>
<td>-</td>
<td>trace</td>
</tr>
<tr>
<td>1971/72</td>
<td>227</td>
<td>184</td>
<td>40</td>
<td>41</td>
<td>176</td>
<td>33</td>
<td>45</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

#### CHIKWANA NORTH

<table>
<thead>
<tr>
<th></th>
<th>Chapananga</th>
<th>Nkadana</th>
<th>Kasi</th>
<th>Mitole</th>
<th>Mikolongo</th>
<th>Maperera</th>
<th>Masseah</th>
<th>Nkhate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1958/59</td>
<td>200</td>
<td>154</td>
<td>98</td>
<td>67</td>
<td>165</td>
<td>156</td>
<td>160</td>
<td>123</td>
</tr>
<tr>
<td>1959/60</td>
<td>313</td>
<td>179</td>
<td>174</td>
<td>135</td>
<td>248</td>
<td>280</td>
<td>222</td>
<td>223</td>
</tr>
<tr>
<td>1960/61</td>
<td>252</td>
<td>132</td>
<td>210</td>
<td>97</td>
<td>227</td>
<td>258</td>
<td>296</td>
<td>323</td>
</tr>
<tr>
<td>1961/62</td>
<td>428</td>
<td>245</td>
<td>309</td>
<td>450</td>
<td>473</td>
<td>298</td>
<td>472</td>
<td>327</td>
</tr>
<tr>
<td>1962/63</td>
<td>93</td>
<td>42</td>
<td>60</td>
<td>143</td>
<td>n.i</td>
<td>102</td>
<td>461</td>
<td>75</td>
</tr>
<tr>
<td>1963/64</td>
<td>301</td>
<td>153</td>
<td>128</td>
<td>332</td>
<td>236</td>
<td>232</td>
<td>270</td>
<td>155</td>
</tr>
<tr>
<td>1964/65</td>
<td>355</td>
<td>226</td>
<td>159</td>
<td>291</td>
<td>272</td>
<td>277</td>
<td>316</td>
<td>153</td>
</tr>
<tr>
<td>1965/66</td>
<td>367</td>
<td>185</td>
<td>148</td>
<td>489</td>
<td>141</td>
<td>204</td>
<td>211</td>
<td>186</td>
</tr>
<tr>
<td>1966/67</td>
<td>131</td>
<td>71</td>
<td>108</td>
<td>264</td>
<td>45</td>
<td>243</td>
<td>302</td>
<td>148</td>
</tr>
<tr>
<td>1967/68</td>
<td>182</td>
<td>70</td>
<td>43</td>
<td>104</td>
<td>31</td>
<td>227</td>
<td>140</td>
<td>144</td>
</tr>
<tr>
<td>1968/69</td>
<td>477</td>
<td>115</td>
<td>171</td>
<td>256</td>
<td>144</td>
<td>644</td>
<td>370</td>
<td>154</td>
</tr>
<tr>
<td>1969/70</td>
<td>464</td>
<td>357</td>
<td>225</td>
<td>412</td>
<td>236</td>
<td>619</td>
<td>464</td>
<td>335</td>
</tr>
<tr>
<td>1970/71</td>
<td>499</td>
<td>291</td>
<td>143</td>
<td>308</td>
<td>160</td>
<td>506</td>
<td>298</td>
<td>397</td>
</tr>
<tr>
<td>1971/72</td>
<td>440</td>
<td>424</td>
<td>114</td>
<td>305</td>
<td>128</td>
<td>567</td>
<td>387</td>
<td>466</td>
</tr>
</tbody>
</table>

*n.i = no information*
farmer minus the average unsprayed cotton yield times the average acreage of the type of farmer.

4. Three different types of cotton spraying farmer are considered:
   (a) Registered spraying farmers who own a knapsack sprayer.
   (b) Unrecorded spraying farmers who hire sprayers and purchase insecticide surplus to the requirements of registered spraying farmers.
   (c) Aerial spraying farmers - these are farmers who participated in a scheme whereby cotton land was consolidated into blocks and sprayed from the air at a fixed cost per acre.

5. It is necessary to allow for the fact that aerial spraying farmers also have additional cotton which is sprayed by hand. In the analysis this land is treated exactly as the cotton land of registered spraying farmers.

6. It is assumed that the Project has not caused any increase in the non-spraying farmers, but has merely transformed some of them into spraying farmers.

7. There were 145 farmers already using knapsack sprayers in 1967/68 before the Project began. Thus the number of registered knapsack spraying farmers in each year has to be reduced by this number in order to calculate the amount of production rightly attributable to the Project.

8. The class of unrecorded spraying farmers has only been numerically identified for the first time in the CCDP 1971/72 Farm Survey. There is no direct estimate of numbers in previous years. It is therefore assumed that in all years the relationship between numbers of unrecorded and registered spraying farmers is exactly as estimated in 1971/72. In point of fact this is likely to overestimate the number of unrecorded sprayers in years prior to 1971/72 as one would expect of the adoption of this type of activity to lag well behind sprayer ownership.

TABLE III.B: Estimate A of CCDP's Contribution to Cotton Production

<table>
<thead>
<tr>
<th>Method 2</th>
<th>Year of the Project</th>
<th>1968/69</th>
<th>1969/70</th>
<th>1970/71</th>
<th>1971/72</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Unsprayed Cotton Yields (lbs/ac)</td>
<td>278</td>
<td>311</td>
<td>242</td>
<td>324</td>
<td></td>
</tr>
<tr>
<td>(2) Total Registered Spraying Farmers</td>
<td>853</td>
<td>1,723</td>
<td>2,679</td>
<td>4,959</td>
<td></td>
</tr>
<tr>
<td>(3) Incremental Spraying Farmers</td>
<td>708</td>
<td>1,578</td>
<td>2,534</td>
<td>4,814</td>
<td></td>
</tr>
<tr>
<td>(4) Yield knapsack sprayed cotton (lbs/acre)</td>
<td>1,309</td>
<td>1,059</td>
<td>977</td>
<td>653</td>
<td></td>
</tr>
<tr>
<td>(5) Incremental yield to spraying</td>
<td>1,031</td>
<td>748</td>
<td>735</td>
<td>329</td>
<td></td>
</tr>
<tr>
<td>(6) Average acreage per spraying farmer</td>
<td>3.14</td>
<td>3.23</td>
<td>3.62</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>(7) Incremental production per spraying farmer (lbs)</td>
<td>3,237</td>
<td>2,416</td>
<td>2,661</td>
<td>1,086</td>
<td></td>
</tr>
<tr>
<td>(8) Incremental production of registered spraying farmers due to the Project (short tons)</td>
<td>1,146</td>
<td>1,906</td>
<td>3,371</td>
<td>2,613</td>
<td></td>
</tr>
<tr>
<td>(9) Total aerial spraying farmers</td>
<td>-</td>
<td>96</td>
<td>317</td>
<td>405</td>
<td></td>
</tr>
<tr>
<td>(10) Total aerial sprayed acreage</td>
<td>-</td>
<td>244</td>
<td>843</td>
<td>1,053</td>
<td></td>
</tr>
<tr>
<td>(11) Aerial sprayed yields (lbs/acre)</td>
<td>-</td>
<td>1,151</td>
<td>1,135</td>
<td>850</td>
<td></td>
</tr>
<tr>
<td>(12) Incremental yield to aerial spraying (lbs/acre)</td>
<td>-</td>
<td>840</td>
<td>893</td>
<td>526</td>
<td></td>
</tr>
<tr>
<td>(13) Incremental production of aerial spraying due to the Project</td>
<td>-</td>
<td>102</td>
<td>376</td>
<td>277</td>
<td></td>
</tr>
<tr>
<td>(14) Average knapsack sprayed acreage per aerial farmer</td>
<td>-</td>
<td>1.48</td>
<td>1.48</td>
<td>1.48</td>
<td></td>
</tr>
<tr>
<td>(15) Incremental yield to knapsack spraying</td>
<td>-</td>
<td>748</td>
<td>735</td>
<td>329</td>
<td></td>
</tr>
<tr>
<td>(16) Incremental knapsack sprayed production of aerial sprayers due to the Project (short tons)</td>
<td>-</td>
<td>53</td>
<td>172</td>
<td>99</td>
<td></td>
</tr>
<tr>
<td>(17) Total unrecorded spraying farmers</td>
<td>438</td>
<td>884</td>
<td>1,374</td>
<td>2,544</td>
<td></td>
</tr>
<tr>
<td>(18) Average sprayed acreage per unrecorded spraying farmer</td>
<td>1.97</td>
<td>1.97</td>
<td>1.97</td>
<td>1.97</td>
<td></td>
</tr>
<tr>
<td>(19) Yield of unrecorded spraying farmers (lbs/acre)</td>
<td>1,003</td>
<td>811</td>
<td>748</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>(20) Incremental yield of unrecorded spraying farmers</td>
<td>725</td>
<td>500</td>
<td>506</td>
<td>176</td>
<td></td>
</tr>
<tr>
<td>(21) Incremental production per unrecorded spraying farmer (lbs)</td>
<td>1,428</td>
<td>985</td>
<td>997</td>
<td>347</td>
<td></td>
</tr>
<tr>
<td>(22) Incremental production of unrecorded spraying farmers due to the Project (short tons)</td>
<td>313</td>
<td>435</td>
<td>685</td>
<td>441</td>
<td></td>
</tr>
<tr>
<td>(23) Total production due to the Project (short tons)</td>
<td>1,459</td>
<td>2,496</td>
<td>4,432</td>
<td>3,331</td>
<td></td>
</tr>
</tbody>
</table>

Notes on Table III.B: Where "CCDP official statistics" are referred to, the data for years 1968/69 to 1970/71 come from the CCDP Annual Cotton Statistics Report 1971, and 1971/72 data come from CCDP Farm Survey 1971/72.
(1) Source CCDP official statistics.
(2) Source CCDP official statistics.
(3) = (1) minus 145, where 145 is the number of registered spraying farmers in 1967/68.
(4) Source CCDP official statistics.
(5) = (4) minus (1).
(6) Source CCDP official statistics. These acreages are based upon measurements conducted by Development Assistants on the holdings of all registered spraying farmers. They are not the acreages derived from the special cotton surveys which appear to have been liable to upward bias.
(7) = (5) times (6).
(8) = (7) times (3).
(10) As (9).
(11) As (9).
(12) = (11) minus (1).
(13) = (10) times (12).
(14) The only figure available is the estimate for 1971/72 given in the CCDP Farm Survey 1971/72. This figure has been assumed constant for all years.
(15) Identical to (5).
(16) = (9) times (14) times (15).
(17) It is estimated in the CCDP Farm Survey 1971/72 that there were 2,544 unrecorded spraying growers in 1971/72 when registered spraying growers totalled 4,959. Unrecorded spraying farmers are assumed always to be in this 1971/72 proportion to registered spraying farmers.
(18) This figure is from the 1971/72 Farm Survey, and is assumed constant in all years.
(19) The 1971/72 yield estimate is obtained from the CCDP 1971/72 Farm Survey. Unrecorded sprayers yields in earlier years are assumed to be in the same proportion to registered sprayers yields as in 1971/72.
(20) = (19) minus (1).
(21) = (20) times (18).
(22) = (21) times (17).
(23) = (8) + (13) + (16) + (22).
One quite serious difficulty with Estimate A above is that the procedure used for estimating unsprayed cotton yields in 1971/72 is different to that employed in the earlier years. Indeed had the 1971/72 yield of 283 pounds per acre been estimated on the basis previously employed the figure would have been 170 pounds. This illustrates the considerable downward bias in earlier official yield estimates for unsprayed cotton. It also indicates that there is likely to be a substantial upward bias in the 1968/69 to 1970/71 estimates of the Project's contribution to cotton production.

To partially overcome this bias the data in Table III.B are recalculated using higher estimates of unsprayed cotton yields in the first three years of the Projects. As there are no estimates of these on a comparable basis to the 1971/72 figure, it is therefore necessary to resort to some assumptions. Perusal of the experimental and survey literature on cotton yields, which is cited in section III.3 below, suggests that unsprayed cotton yields do not typically fall much below 40 percent of sprayed yields, and that in many instances they are higher than this. It is therefore assumed that unsprayed yields were 500 pounds in 1968/69 which was a very good year in which sprayed cotton yields reached 1,309 pounds. In 1969/70 and 1970/71 when sprayed yields were around 1,000 pounds it is assumed that unsprayed yields were 400 pounds.

Using these assumptions and all the remaining data in Table III.B, estimate B of the Project's contribution to cotton production is produced in Table III.C.

**TABLE III.C: Estimate B of CCDF's Contribution to Cotton Production**

**Method 2**

<table>
<thead>
<tr>
<th>Year of the Project</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1968/69</td>
<td>500</td>
<td>400</td>
<td>400</td>
<td>324</td>
</tr>
<tr>
<td>1969/70</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1970/71</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1971/72</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Unsprayed Cotton Yield (lbs/acre)

Project Contribution: (short tons)

(a) Registered Spraying Farmers

(b) Aerial Spraying Farmers:

Farmers 1

Farmers 2

(c) Unrecorded Spraying Farmers

Total Contribution

### Notes:

(b)1 is contribution from aerially sprayed plots.

(b)2 is contribution from knapsack sprayed plots.
III.3 Sources of Data on Cotton Yields

The following sources have been examined to throw light on the comparative yields of sprayed and unsprayed cotton. This has been necessary because of the unreliability of the official statistics on unsprayed yields for the CCDP area. The general impression obtained from these sources is that even in the field situation where inferior husbandry practices on non-sprayed cotton have an effect, the yield of unsprayed cotton is rarely less than 40 percent of sprayed yields. Experimental results seem to suggest that spraying itself cannot account for all of this difference.

(2) British Central Africa Co. Ltd., Records left at Mitole Ginnery Chikwawa.

Because these records are not generally available the data on unsprayed cotton yields from this source are presented below. As spraying was not practised in the period 1956/57 to 1960/61, the yields recorded are of unsprayed cotton.

Records of British Central Africa Company

<table>
<thead>
<tr>
<th>Areas of Chikwawa around Mitole Ginnery</th>
<th>Bande</th>
<th>Mapera</th>
<th>Lisuli</th>
<th>Mitole</th>
<th>Kasindula</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1956/57 Growers (No.)</td>
<td>249</td>
<td>129</td>
<td>47</td>
<td>81</td>
<td>81</td>
<td>587</td>
</tr>
<tr>
<td>Acreage</td>
<td>278</td>
<td>112</td>
<td>33</td>
<td>95</td>
<td>114</td>
<td>632</td>
</tr>
<tr>
<td>Yield(lbs/ac)</td>
<td>580</td>
<td>462</td>
<td>391</td>
<td>496</td>
<td>518</td>
<td>525</td>
</tr>
<tr>
<td>1957/58 Growers (No.)</td>
<td>378</td>
<td>148</td>
<td>105</td>
<td>142</td>
<td>163</td>
<td>936</td>
</tr>
<tr>
<td>Acreage</td>
<td>666</td>
<td>179</td>
<td>167</td>
<td>219</td>
<td>344</td>
<td>1,575</td>
</tr>
<tr>
<td>Yield(lbs/ac)</td>
<td>527</td>
<td>411</td>
<td>486</td>
<td>577</td>
<td>575</td>
<td>527</td>
</tr>
<tr>
<td>1958/59 Growers (No.)</td>
<td>465</td>
<td>140</td>
<td>125</td>
<td>96</td>
<td>294</td>
<td>1,120</td>
</tr>
<tr>
<td>Acreage</td>
<td>745</td>
<td>155</td>
<td>160</td>
<td>202</td>
<td>510</td>
<td>1,771</td>
</tr>
<tr>
<td>Yield(lbs/ac)</td>
<td>671</td>
<td>608</td>
<td>702</td>
<td>715</td>
<td>823</td>
<td>717</td>
</tr>
<tr>
<td>1959/60 Growers (No.)</td>
<td>488</td>
<td>157</td>
<td>136</td>
<td>138</td>
<td>356</td>
<td>1,275</td>
</tr>
<tr>
<td>Acreage</td>
<td>928</td>
<td>206</td>
<td>203</td>
<td>377</td>
<td>590</td>
<td>2,304</td>
</tr>
<tr>
<td>Yield(lbs/ac)</td>
<td>497</td>
<td>710</td>
<td>799</td>
<td>1,522</td>
<td>739</td>
<td>913</td>
</tr>
<tr>
<td>1960/61 Growers (No.)</td>
<td>429</td>
<td>163</td>
<td>141</td>
<td>328</td>
<td>350</td>
<td>1,411</td>
</tr>
<tr>
<td>Acreage</td>
<td>1,030</td>
<td>228</td>
<td>239</td>
<td>737</td>
<td>903</td>
<td>3,137</td>
</tr>
<tr>
<td>Yield(lbs/ac)</td>
<td>510</td>
<td>672</td>
<td>671</td>
<td>1,101</td>
<td>474</td>
<td>747</td>
</tr>
</tbody>
</table>

n.i = no information


(8) Empire Cotton Growing Corporation, *Progress Reports from Experiment Stations Nyasaland*. 1953/54 (p. 8), 1962/63 (p. 8), 1964/65 (pp. 7, 8), 1965/66 (p. 14), London.


APPENDIX IV

SURVEY WEIGHTS AND DEFINITIONS

IV.1 The NSSA Sample Frame and Weighting System

The NSSA sample frame was designed to provide summary data for the
23 districts and for 35 selected natural areas of Malawi. The sample
universe was the 4059 enumeration areas which had been defined for the
1966 Population Census.\(^1\) The universe was then divided into two major
strata - "the natural areas" and the "rest of districts": one containing
all the enumeration areas included in the selected natural areas, the
other, the remainder. The two strata were then further stratified. Three
strata were defined for the natural areas and four for the "rest of
districts". The seven strata were then sampled independently with
enumeration areas selected with probability proportional to size to give
at least five enumeration areas for each natural area and for each "rest
of district" group. One village was then randomly selected from each
sampled enumeration area and, within each village, either ten households,
in the case of the "rest of district" strata, or fifteen households in
the case of the natural area strata were sampled using the Population
Census Register as a frame.

Three natural areas - 29, 34 and 35 - fall wholly or partly into
the SVADP Phase II area. One, 29, intrudes into the north-west of T.A.
Chapananga's area in the Chikwawa District, whilst 35 comprises the
lighter soils immediately north of the heavier black cotton soils of
the Makande Plain which itself comprises natural area 34. Of the 158
enumeration areas in Chikwawa District, 15 of those sampled lay within
the natural areas and six within the remainder of the district. For
Nsanje District, of 104 enumeration areas, one was selected from natural
area 34 and eight from the remainder.

To compute the weights for the NSSA survey an estimate of the number
of rural households in 1969 was obtained by raising the 1966 rural
population at 3 percent per annum and dividing this number by an estimate
of household size obtained from earlier surveys. The weights were then
computed by dividing the total estimated number of rural households in
1969 for each stratum by the number of households sampled in the stratum,

\(^1\) National Sample Survey of Agriculture, 1968/69, Zomba, National Statistical
suitably adjusted to take into account non-respondents and spoil returns. Each natural area and "rest of district group" was assigned the weight of the stratum in which it was sampled.

IV.2 The SOLV Weighting System

Although in outline the procedure used in constructing the NSSA weighting system is clear, we have been unable to trace sufficient details of the original sampling procedures to enable us to replicate it. In particular, we have been unable to find the lists of villages which lie within the natural areas from which the original sample was drawn. In addition, the broad division into "natural areas" and "rest of districts", eminently suitable for a general overview of agriculture at the national level, is not particularly suitable for our purposes since we wish to make finer distinctions between areas within the Lower Shire Valley. We have, therefore, devised a weighting system based upon Traditional Authority areas. In essence, we treat the 20 villages in the SOLV sample as if they had been drawn to represent Traditional Authority areas. More precisely, since not every Traditional Authority area contains a sampled village whilst some contain more than one (see Table I.B, Appendix I), we treat groups of villages as representing groups of Traditional Authority areas but, in each case, a group may have only one member. In Table I.B, Appendix I, two types of weights are displayed: one for means relating to households, the other for population totals. Their derivation is now considered.

IV.2.1 Weighting scheme for means relating to households

(a) Grouped T.A. area level means

\[ W_g = M_v \cdot H_v/H_g \] (for each village in the group)

(b) District level means

\[ W_d = M_g \cdot H_g/H_d \]

(c) Regional level means

\[ W_r = M_d \cdot H_d/H_r \] (for each T.A. area in the two districts.

\( W = \) Weight, \( M = \) Mean, \( H = \) number of sampled households and the sub-scripts \( v, g, d \) and \( r = \) village, group, district and region respectively).

IV.2.2 Derivation of Weights for Population Totals

(a) Village Totals

\[ T_v = T_s \cdot P_v/P_s \]
(b) **Grouped T.A. area Totals**

\[ T_g = \sum_{v=1}^{j} T_v \cdot (P'g/\sum_{v=1}^{j} P_v) \]

(c) **District Totals**

\[ T_d = \sum_{g=1}^{j} T_g \]

(d) **Regional Totals**

\[ T_r = \sum_{d=1}^{j} T_d \]

(T = Total, P = 1972 sample population, P' = estimated population at 1972, \( \sum_{i}^{j} \) = summation over the values from the i\textsuperscript{th} to the j\textsuperscript{th} member of the group and the subscripts s, v, g, d, r = sample, village, group, district and region respectively).

**IV.2.3 Population Estimates**

In the case of P', the estimated population, used to derive weights for grouped T.A. area totals, the data we have on levels of fertility indicate that the rate of natural increase is probably in the region of 2 percent per annum. However, we have also taken into account the relatively high rate of immigration from Mozambique which adds about 0.6 percent per annum to the population of the valley as a whole, but is variable in its local incidence, as also is the differential movement of the population among the Traditional Authority areas. We have then used the information gathered in our field surveys to adjust the weights to reflect local growth rates and migration patterns. This seems preferable to simply assuming a flat rate of increase for the whole area which would lead to considerable distortion in certain areas. The details of population growth and migratory movements from which the various rates of increase used in the construction of the weights have been derived, are given in Chapter 11.

**IV.3 Definitions Used in the Household Composition Survey**

**IV.3.1 A Household**

A household was defined as comprising a group of people who normally

(a) were related
(b) ate together
(c) worked together in the gardens
(d) had one decision taker, the household head
(e) slept in the dwelling or group of dwellings owned and looked after
by the household head
(f) were represented to the section head and the village headman by the
household head who is held responsible for their behaviour.

IV.3.2 Residential Statuses
In order to enable both de jure and de facto populations to be
distinguished the following residential statuses were defined.

(a) Permanent Resident
A member of the household who normally resided there and who did
not fall into any other category of residential status.

(b) Temporary Absentee
A member of the household who normally resided there but who had
been away from the household for less than one month.

(c) Circulating Husband
One who, as a polygynist had wives living in two or more villages
and lived with each wife in turn. A circulating husband was
recorded as living at the dwelling of the most senior wife in the
sampled village. In all tabulations an adjustment has been made
for circulating husbands to avoid inflating the totals.
Where a polygynist had all his wives living in the sampled village
he was recorded as living at the dwelling of the senior wife.

(d) Labour Migrant
A labour migrant was defined as a person who was away working in
wage employment (or who was self-employed) outside the village and
who was not in local wage employment, but who had expressed an
intention to return to the household, or to the village, at some
time in the future. In addition, the wives and children of labour
migrants who had accompanied them were also classed as "labour
migrants". A special effort was made at the conclusion of each
interview to identify all labour migrants. In addition, as a
separate exercise, details were collected from section heads,
village headmen and other informed persons in cases where whole
households were away.

(e) Permanent Labourer
Defined as someone not normally closely related to the household
head who had been living in the household for more than one month
as a worker or whom the household head stated had a permanent job
in the household.
(f) **Temporary Labourer**
Someone working in the household but who had been there for less than one month and whom the household head stated did not have a permanent job.

(g) **Visitor**
Defined as someone who had stayed with the household for less than one month and who did not fall into categories (e) or (f).

---

**IV.4 The Definitions of the de jure and de facto Populations**
The **de jure** population included all those defined as permanent residents, temporary absentees, circulating husbands (adjusted), permanent labourers and labour migrants. The **de facto** population includes permanent residents, circulating husbands (adjusted), permanent labourers, temporary labourers and visitors. It excludes temporary absentees and labour migrants and corresponds directly with the definition of the population used in the 1966 Census.

---

**IV.5 The Definitions Used in the Garden Survey**

(a) **A Garden**
A garden was defined as a continuous piece of land cleared for cultivation and farmed by a member, or members, of the household which was not internally divided by a path, road or stream greater than ten yards in width.

(b) **A Plot**
A garden was considered to be divided into plots, each of which contained one crop or crop mixture only. A piece of land within a garden containing one crop or crop mixture which was divided by a path, stream or other line of demarcation greater than one yard in width was treated as two plots.

(c) **The Plot Operator**
Defined as the person primarily responsible for cultivating the plot and for taking decisions about it. It was possible to have two or more operators working different plots in the same garden.

(d) **Loaned and Borrowed Gardens**
Only gardens borrowed by members of a household were surveyed. Gardens which had been loaned were excluded from consideration.
APPENDIX V

ACREAGE DATA FOR SAMPLE VILLAGES 1968/69 AND 1972/73
<table>
<thead>
<tr>
<th>Sample Village</th>
<th>Number of Households</th>
<th>Number of Persons</th>
<th>Cultivated Acreage</th>
<th>Fallow Acreage</th>
<th>Cultivable Acreage</th>
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1 The NSSA garden measurement work was completed between December 1968 and April 1969. The measured acreages may therefore be assumed to relate only to cultivable and cultivated wet (summer) season land.

2 It has been assumed that the all zero crop code found on NSSA type 3 computer cards refers to fallow land.
<table>
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<tr>
<th>Sample Village</th>
<th>Number of Households</th>
<th>Number of Persons</th>
<th>Wet Season Cultivated Acreage</th>
<th>Wet Season Fallow Acreage</th>
<th>Wet Season Cultivable Acreage</th>
<th>Dry Season Replanted Acreage</th>
<th>Dry Season post-fallow Acreage</th>
<th>Other Dry Season Acreage</th>
<th>Dry Season Cultivated Dimba Acreage</th>
<th>Wet Season Dimba Acreage</th>
<th>Dry Season Dimba Acreage</th>
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1 The fractions of persons are due to counting polygamous males with weight = number of wives in village / total wives. (See notes Table 12.7.B).

2 This includes gardens borrowed for winter cultivation. At Sila and Chithumba it includes the summer acreage on which pigeon peas was underplanted as a major crop; 15.89 and 17.15 acres respectively.

3 Thought to be overestimated - enumerator failed in some cases to indicate the fraction of the plots replanted.

4 Acreage almost certainly underestimated for reasons noted in the text of Chapter 12.

5 These acreages have been scaled up by a factor equal to the total sample population of households in the main Garden Survey divided by the number of households recorded in the Garden Replanting and New Garden Surveys.
<table>
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<tr>
<th>Sample Village</th>
<th>Total Cultivated</th>
<th>Pure Cotton</th>
<th>Pure Cotton Mixtures</th>
<th>Pure Maize</th>
<th>Pure Maize Mixtures</th>
<th>Sorghum Millet</th>
<th>Groundnuts</th>
<th>Rice</th>
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1 These "pure" crop acreages may have contained scattered plantings of fruit and vegetables.
2 Acreage on which some groundnuts were planted was 19.0.
3 Acreage on which some groundnuts were planted was 38.5.
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<th>Bullrush 1 Millet</th>
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<th>Rice 1</th>
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</table>

1 Pure crop.
2 The acreage in which maize was the major crop. Maize is however commonly grown in mixtures with other crops; the maize/cotton acreage is presented under "cotton Mixed" and maize with other cereals as "Cereal Mixtures"; the acreage in this column includes cases in which groundnuts in particular were grown as subsidiary crops.
3 Cotton with other crops, mainly maize.
4 Mixtures comprised wholly of cereals.
5 22.26 acres of this entry is of groundnuts with assorted other crops in a minor role.