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AGRICULTURAL RESEARCH RESOURCE ASSESSMENT
IN THE SADCC COUNTRIES

VOLUME II
COUNTRY REPORT: ZAMBIA

Submitted by

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PREFACE

AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

IN THE SADCC COUNTRIES

This document has been prepared by DEVRES, Inc. in cooperation with the Consultative Technical Committee for Agricultural Research (CTCAR) of the Southern African Development Coordination Conference (SADCC) in accordance with the terms of a contract with the US Agency for International Development.

The national agricultural research resource assessments which provide the necessary background information for this document were conducted by national agricultural research scientists from SADCC countries¹ under the guidance of DEVRES in consultation with the CTCAR. Financial support was provided by the US Agency for International Development (under Contract No. AFR-0435-C-00-2084-00 and Project No. 698-0435 entitled Strengthening African Agricultural Research) on behalf of the member countries of the Cooperation for Development in Africa (CDA).

Discussions concerning this country report were held with the country report authors, responsible officials in the ministries of agriculture, rural development and plan, as well as specialists from international organisations, bilateral donors, and universities. On two occasions, drafts of this final report were examined by SADCC's Consultative Technical Committee for Agricultural Research (CTCAR). Suggestions by its members were incorporated into the report.

The results of the assessment are contained in the following reports:

Volume I - Regional Analysis, Strategy, Programmes and Summaries of Country Reports

Volume II - Country Reports:²

Botswana
Lesotho
Malawi
Mozambique³
Swaziland
Tanzania³
Zambia
Zimbabwe

These reports are available in English and in microfiche or printed form at a cost determined by document size at the address below. The Regional Analysis and Strategy and the Mozambique country report are also available in Portuguese in the same forms.

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¹SADCC member countries are Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. Angola, however, did not participate in this study.

²Each country is printed separately.

³Italy provided technical advisors for the preparation of the Tanzania national report and France provided an advisor to help in the preparation of the Mozambique country report.

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Many organisations assisted in locating and making available essential documents and reports upon which this effort has relied heavily. Special thanks are due the Planning Division and the Agricultural Research Branch of MAWD for their assistance.

LIST OF ACRONYMS AND ABBREVIATIONS

AID	Agency for International Development (United States)
ARPT	Adaptive Research Planning Team
ARRA	Agricultural Research Resource Assessment
ASF	African Swine Fever
BSc	Bachelor of Science degree
BS	Block Supervisor
CDA	Cooperation for Development in Africa
CIDA	Canadian International Development Agency
CIMMYT	International Maize and Wheat Improvement Centre
CIRDAFRICA	Centre on Integrated Rural Development for Africa
CRT	Commodity Research Team
CSRT	Commodity and Specialist Research Team
CTCAR	Consultative Technical Committee for Agricultural Research
CVRI	Central Veterinary Research Institute
DANIDA	Danish International Development Agency
DAO	District Agricultural Officer
DOA	Department of Agriculture
DVTCS	Department of Veterinary and Tsetse Control Services
ECF	East Coast Fever
EEC	European Economic Community
EPADP	Eastern Province Agricultural Development Programme
FAO	Food and Agriculture Organization of the United Nations
FDO	Fisheries Development Officer
FINNIDA	Finnish International Development Agency
FMD	Foot and Mouth Disease
FTE	Full Time Equivalent
GDP	Gross Domestic Product
GNP	Gross National Product
GRZ	Government of the Republic of Zambia
GVS	German Volunteer Service
IAEA	International Atomic Energy Agency
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDRC	International Development Research Centre (Canada)
IITA	International Institute of Tropical Agriculture
IFAD	International Fund for Agricultural Development
IRRI	International Rice Research Institute
IRD ^P	Integrated Rural Development Programme
JOVS	Japanese Overseas Volunteers Service
K	Kwacha (Zambia)
LPDCC	Livestock Pests and Disease Control Centre

MAWD	Ministry of Agriculture and Water Development
MHE	Ministry of Higher Education
MLNR	Ministry of Lands and Natural Resources
MSc	Master of Science degree
NAMBOARD	National Agricultural Marketing Board
NCSR	National Council for Scientific Research
NIRDC	National Integrated Rural Development Centre
NORAD	Norwegian Agency for Development
NRDC	Natural Resources Development College
OAU	Organization of African Unity
PAO	Provincial Agricultural Officer
PFDO	Provincial Fisheries Development Officer
PFO	Provincial Forest Officer
PhD	Doctor of Philosophy degree
PTA	Preferential Trade Area
PVO	Provincial Veterinary Officer
RDSB	Rural Development Studies Bureau
RLEO	Research Liaison Extension Officer
SACGAR	Southern African Centre for Cooperation in Agricultural Research
SADCC	Southern African Development Coordination Conference
SAS	School of Agricultural Sciences
SIDA	Swedish International Development Agency
SMS	Subject Matter Specialist
SPADP	Southern Province Agricultural Development Programme
SRT	Specialist Research Team
SVO	Senior Veterinary Officer
T&V	Training and Visit
TBZ	Tobacco Board of Zambia
TNDP	Third National Development Plan
UN	United Nations
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
UNZA	University of Zambia
US	United States
USAID	United States Agency for International Development
WFP	World Food Programme
ZCA	Zambia College of Agriculture
ZFC	Zambia Forest College
ZIAH	Zambia Institute of Animal Health

CURRENCY EQUIVALENTS
(December 31, 1983)

Currency unit = Kwacha (K)

US\$ 1.00 = K 1.37

K 1 = US\$ 0.73

K 1 = 100 ngwee

WEIGHTS AND MEASURES

1 hectare (ha) = 10,000 m²
= 2.471 acres

1 acre = 0.405 ha

1 kilogram (kg) = 2.204 pounds

1 metric ton (MT) = 1,000 kg
2,204 pounds

1 kilometer (km) = 0.621 miles

1 square kilometer (km²) = 100 ha

1 mile = 1.609 km

1 liter = 1.066 quarts

1 quart = 0.9464 liters

GOVERNMENT OF ZAMBIA FISCAL YEAR

January 1 to December 31

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EXECUTIVE SUMMARY

A. Background

1. Country description and economic overview

Zambia is a landlocked country of about 750,000 km² in the centre of southern Africa. The country may be divided into four major agro-ecological zones: the northern high-rainfall zone, which favours perennial crop production such as tea and coffee; the western semiarid plains zone, which primarily is covered by infertile Kalahari sands; the Luangwa-Zambezi rift valley, which is the driest zone, with shallow, sandy soils that are marginal for agriculture; and the central, southern and eastern plateau area which, with fertile soils suitable for growing maize, groundnuts, tobacco and cotton, is Zambia's most populous region and the one in which most of the commercial and mechanised farming is done.

Mean annual rainfall ranges between 1,200 mm in the north to 700 mm in the south. Recently, however, there have been abnormal seasonal distributions. Over the past three years, the areas of lowest rainfall have received 40 percent less rainfall than the long-term average. This has resulted in total crop failure and severe water shortages.

Zambia's population is 5.68 million, and is growing at the rate of 3.3 percent annually. In 1980, 67 percent of the labour force was engaged in agriculture, 11 percent in industry and 22 percent in services. Migration of males from rural to urban areas affects many rural households, 30 percent of which are headed by females, and results in labour shortages for agricultural production. About 44 percent of the population live in urban areas, making Zambia the most urbanised of SADCC countries.

As a result of its dependence upon copper exports whose prices have been declining, the Zambian economy has suffered greatly. Real GNP in Zambia fell 23 percent between 1971 and 1981; the country has a balance of payment problem. Agriculture contributes about 13 percent to the GDP. Mining and quarrying represent a larger but declining share, accounting for 21 percent in 1981. Services contributed 34 percent. Zambia's efforts to diversify by expanding agricultural production has begun to bear fruit as is evidenced by the fact that agriculture's share in output grew by two percentage points from 1975 to 1981. In the 1981 and 1982 cropping seasons, agricultural output actually declined because of drought. Nevertheless, agriculture remains the most feasible alternative for restructuring the economy away from the declining mining industry.

2. Agriculture in Zambia

Only 16 percent of Zambia's arable land is currently being utilised. One of the three categories of land is state lands, which comprise 6.5 percent of total land area and are controlled by the President; long-term leases are granted for state lands. Reserve land is public land set aside for game preserves and forests. Trust land, which covers more than half the country, may be occupied and used in accordance with customary law without lease or formal occupancy rights.

There are four categories of farmers. Large-scale commercial farmers, numbering 700, have an average farm size of 80 ha; they employ hired farm labour and high input technologies. Medium-scale commercial farmers number 21,000. Their farm size ranges between 10 ha and 40 ha, and animal draught power and family labour are used. Small-scale commercial farmers number 122,000. With an average farm size of three ha, they produce 60 percent of marketed maize and 35 percent of all staples. The largest group, with 460,000 families, consists of subsistence producers whose average farm size is two ha.

Among major food crops, maize output and yields have been relatively static since 1975, while wheat and oilseed production and yields have increased. Cassava is grown extensively by small farmers; yields are higher than the current African average of 6.4 MT/ha, and the domestic demand outlook is favourable. Tobacco is the traditional export crop, but output has been declining since 1975. Livestock accounted for 11 percent of total agricultural output in 1981. Of the 2.1 million head of cattle, only 16 percent are held in the commercial sector which produces 37 percent of the beef. Milk is produced by small farmers for their own needs and by medium-scale and commercial or state farms for market. Commercial milk production has, however, declined since 1965. Poultry is raised by small farmers, as well as on a commercial scale for both meat and eggs. Although poultry meat production has declined recently, egg production increased significantly up to 1981.

Freshwater fishing in Lakes Tanganyika, Kariba, Mweru and Bangweulu employs 20,000 fishermen, for whom fish are an important source of income. There is a high consumer demand for fish, but less than 60 percent of potential demand is met. Average fish production is 54,000 T per annum, although a sustainable yield of 85,000 T is feasible.

Agricultural input and product marketing and provision of credit are handled primarily by parastatals and cooperatives. Large commercial farmers are served by commercial banks, the Development Bank of Zambia and the Zambia Agricultural Development bank.

B. Agricultural Institutions

1. Research

Agricultural research in Zambia is conducted by seven institutions: three departments of the Ministry of Agriculture and Water Development (MAWD), the National Council for Scientific Research, two programmes of the University of Zambia, and the Forestry Department of the Ministry of Lands and Natural Resources. The institutions altogether employ 28 administrative, 212 professional (of whom 100 are expatriate), 135 technical and 349 support staff. All administrative positions are held by Zambians, but 47 percent of the professional positions are held by expatriates. In 1983-1984, research expenditures amounted to US\$ 12.6 million, of which two-thirds was contributed by donor agencies.

a. Department of Agriculture

The MAWD's Department of Agriculture (DOA) is responsible for research, and extension in crops, breed improvement, nutrition, pasture and land use services. The Research Branch of the DOA is headed by an Assistant Director of Agriculture at the Lusaka headquarters, and by a Chief Agricultural Research Officer at the Central Research Station outside Lusaka where research is conducted. It is also carried out at nine regional stations and 13 testing fields. Research priorities are determined by the objectives of the Third National Development Plan, and include achievement of food self-sufficiency, increased production for export and creation of new employment and income opportunities.

For organisational purposes, the Agricultural Research Branch is divided into Commodity and Specialist Research Teams, which focus on commodity research, and the Adaptive Research Planning Teams, which apply the farming systems approach and conduct on-farm trials. Programmes emphasise cereals research to develop improved varieties of maize, sorghum, millet, wheat and rice. Research is also done on other crops, including: oilseeds such as sunflower, groundnuts, soybeans; grain legumes; cotton; other food crops such as roots and tubers; vegetables; and tree and plantation crops. Animal research emphasises nutrition, breed improvement and pasturage improvement. Soil productivity, plant protection and food conservation and storage are also parts of the research programme.

The DOA's staff consists of 321 people, of whom 117 are professionals and 11 administrators, the rest being technical and support staff. There are 55 expatriates on the staff. Office and laboratory facilities at the research stations are inadequate; each has sufficient land for annual field crop research. Financing comes from the MAWD and some external donors. In 1983, the budget for research was US\$ 3.2 million.

b. Department of Veterinary and Tsetse Control Service

The MAWD's Department of Veterinary and Tsetse Control Service conducts research through the Central Veterinary Research Institute (CVRI), with the participation of several international organisations such as FAO/UNDP, DANIDA, EEC and Dutch Technical Aid. The CVRI's activities include: diagnoses of animal diseases; epidemiological surveillance and disease investigations; production of vaccines; conduct of applied research; and dissemination of scientific and technical information to the field services. Among the diseases being evaluated are East Coast Fever, trypanosomiasis, Foot and Mouth disease, and African Swine Fever. There are 12 professional, three administrative, ten technical and 69 support staff at the CVRI. Of the administrative and professional staff, 13 are expatriates; eight of these are funded by donor agencies such as FAO, DANIDA, EEC and UNDP. The research centre has ten administrative offices, well-equipped laboratories, 2,000 ha of land to raise research animals, a conference room, a garage, a shop and animal sheds. Its estimated recurrent expenditure for 1984 was nearly US\$ 1 million, a large proportion of which was provided by donor agencies.

c. Department of Fisheries

The MAWD's Department of Fisheries has its headquarters at Chilanga outside Lusaka. It also operates seven field stations at major fishing waters. Research programmes include production studies of new man-made lakes, investigation of phytoplankton periodicity, and studies of zooplankton. The research staff consists of nine professionals (five of whom are expatriates), 16 technicians, four administrators and 95 support staff. Its facilities include three office blocks, a research laboratory, a library and a fisheries museum at Chilanga. The 1984 budget amounted to US\$ 210,000 for salaries and wages and US\$ 53,000, for operating costs.

d. University of Zambia

The University of Zambia's School of Agricultural Sciences offers a five-year programme leading to the BSc degree. It also does research through various departments, including research on: improved varieties of cereals; development of stockfeeds from locally produced ingredients; fruit and vegetable production; soil and water conservation; irrigation; and rural technology. The School's staff consists of 32 professionals, 18 of whom are expatriates, and nine technical personnel. Only a fourth of the personnel are engaged in research. Its facilities include 20 offices, a field station with animal sheds and stores, a production/research farm and three laboratories. The laboratory space is inadequate. The total operational budget for 1984 was US\$ 216,000. The University allocates US\$ 14,600 to the School for research; donors also contribute to the research budget.

The Rural Development Studies Bureau (RDSB) of the University conducts policy-oriented research on rural development issues. It constitutes the Zambian component of the Centre on Integrated Rural Development for Africa. The RDSB's projects include demographic and socioeconomic surveys and studies of input utilisation.

e. National Council for Scientific Research

The National Council for Scientific Research (NCSR) advises the government on research policy; it also coordinates and promotes scientific research. The Livestock Pests and Disease Control Centre of the NCSR conducts research on livestock pests and diseases, livestock infertility and nutrition, tsetse fly eradication and tick-borne diseases. The NCSR food technology research unit is concerned with developing low-cost food processing technologies to develop small-scale industries among low-income families. Some new products have been developed, such as fruit juice concentrates, squashes, cereal-legume composite flours for infant formulas and biscuits. The Livestock Pests and Disease Control Centre has modern laboratory facilities and field equipment. Its staff consists of 23 professionals, of whom two are expatriates. Nine people have PhD, ten have MSc, and four have BSc degrees. Its estimated recurrent costs for 1984 amounted to US\$ 58,400, excluding salaries, wages and donor funding. Funding is generally by the Government through the Ministry of Higher Education.

f. Forestry Department

Within the Forestry Department of the Ministry of Lands and Natural Resources, research is conducted by the Forest Research and Forest Products Research Divisions. Both divisions are located at Kitwe. The former focusses upon producing healthy trees; the latter deals with their utilisation. The Forest Research Division's work is in the areas of forest pathology, entomology and genetics. It maintains an herbarium, a seed store and a soil testing laboratory. Of the seven professionals on the staff, four are donor-funded expatriates. The recurrent and capital budgets for 1984 were US\$ 182,500 and US\$ 219,000, respectively. The research programmes of the Forest Products Division include sawmilling, preservation, seasoning and strength testing. There are six professionals (including three expatriates) and seven technicians on the staff. The recurrent budget for 1984 is US\$ 146,000, which is supplemented by an equal amount from the FINNIDA project.

2. Training

The University of Zambia through its School of Agricultural Sciences offers the bachelor's degree in agriculture with specialisation in five subject matter areas. The five-year course consists of two years of general science study, followed by two years of study in agriculture and a fifth year of specialised study. The curriculum also includes farm practicals, tutorials and seminars;

vacation time is used for 30 weeks of practical training on farms and at agricultural institutions. The staff consists of 30 professionals and 12 technicians, 25 of whom are expatriates. Six have PhD degrees, 18 have MScs and 5 have BScs. Twelve people are abroad studying for the PhD and four for the MSc degree. The School has offices, classrooms and a largely undeveloped farm of 600 ha. The total budget for 1983 was US\$ 682,000.

The Natural Resources Development College is under the training wing of the MAWD. It offers a three-year diploma course, underwritten by the University of Zambia, with specialisation in a number of areas. Emphasis is given to practical training in laboratories and workshops and on the farm. Students are also expected to get field experience during a long vacation. Two categories of students are admitted: direct entry and in-service students. The latter are those who have worked for some time and are recommended by the heads of departments for further study. Of the 29 professionals on the staff, 18 are expatriates. The College is located at a 300 ha teaching farm, with an irrigated area and swine, poultry and dairy units. The college, in addition, has a 1500 ha ranch for cattle, sheep and goats. The GRZ budget in 1983 was US\$ 1,864,000, an additional amount was provided by donor agencies.

The two campuses of the Zambia College of Agriculture are engaged mostly in training people employed by the Department of Agriculture in field extension work. They provide a two-year certificate course in agriculture, for which fields of study include crop and animal production, home economics, farm machinery, farm management and extension. Of the 14 professionals on staff, about half are donor-supported expatriates. The College's facilities include modern classrooms, offices, a library, laboratories and workshops. In 1983, capital expenditures amounted to US\$ 657,000, but they are expected to be half that amount in 1984.

The Zambia Institute of Animal Health trains field-level staff to help farmers institute disease prevention and control measures. Students are accepted, after they have completed a year of general agricultural training at the College of Agriculture, for a year-long certificate programme in animal health. The facilities include good laboratories, three classrooms, an office block and a library. The Institute's capital expenditures in 1983 amount to US\$ 73,000. The Zambia Forest College trains foresters to the diploma and certificate levels. Its enrollment capacity is 50 students per year. The curriculum emphasises practical experience in the use of various tools, equipment and machinery; logging operations, nursery and plantation techniques are also taught. There are six professional staff members. Its practical training facilities, machinery and equipment are modern. The recurrent budget in 1983 was US\$ 48,000, and was provided by the government. The MAWD also operates five farmer training colleges offering one- or two-year programmes and short courses that are production-oriented.

While the training institutions have adequate Zambian administrative and technical staff, 62 percent of the professional staff are expatriates. In 1983, the total recurrent costs amounted to US\$ 1.2 million, and capital costs were US\$ 1.3 million. Donor grants from SIDA, the Netherlands and the EEC financed US\$ 1.02 million of the capital costs.

3. Extension

The Department of Agriculture's Extension Service was created to promote the adoption of improved agricultural practices and the efficient use of inputs among smallholder farmers, and to provide research solutions to farmers. The Extension Service has several programmes in crop and animal husbandry, horticulture, agricultural mechanisation, home economics and youth extension. Its Training and Visit Programme is aimed at increasing the frequency and efficiency of extension worker/farmer contact and providing continuous in-service training for extension workers. Although the programme was implemented in every province, transport and housing problems have reduced effectiveness except in the eastern and southern provinces.

The LIMA programme is designed to deliver a farm input package for use by smallholder farmers on land units as small as one-fourth ha. The extension work involves demonstrations on farmer fields. A related programme is designed to minimise the operating costs of training extension workers and farmers engaged in the LIMA project.

Three projects for women, run by the Home Economics Section and funded entirely by SIDA, focus on getting women involved in income-generating activities. Overall, the extension programmes have not been entirely satisfactory for a variety of reasons that are specific to each one.

The Extension Service is headed by an Assistant Director of Agriculture supported by a team of sectional heads known as Subject Matter Specialists followed by Senior Specialists. The Service is organised into similar posts at the provincial, district and field levels. Each of the nine provinces is managed by a Provincial Agricultural Officer, assisted by Provincial Subject Matter Specialists who are responsible for supervision of district and field staff. The District Agricultural Officer heads the district extension service, and is assisted by a technical staff of Agricultural Supervisors. The field staff at the Block level are Senior Agricultural Assistants, Agricultural Demonstrators and Commodity Demonstrators. There are 71 professionals in the extension service, 27 of whom are expatriates. There are 1,645 technical staff who have been trained to the diploma or certificate level, and 131 administrative and support staff.

The Extension Services facilities include national, provincial and district offices. In addition, each province has a farm institute

of vehicles and equipment. Lack of staff training opportunities, inadequate laboratory facilities and inadequate transportation were also cited as important constraints. Staff at all institutions indicated some dissatisfaction with some terms of service, including shortages of housing, relatively low salaries and inadequate staff evaluation procedures. The housing and transportation shortages were seen as particularly restrictive for the extension services.

E. Conclusions and Recommendations

1. Agricultural institutions

The proposed strategies for the research institutions include more emphasis upon funding research that will help small-scale farmers, and a continuation and expansion of present bilateral and multilateral funding of research programmes. Since there is a shortage of foreign exchange to purchase and repair research equipment, it is recommended that cost-effective central repair facilities be set up for all the research institutions. It is also recommended that each research institution establish a five- or ten-year staff training programme to upgrade the professional, technical and support staff capability of Zambians. New policies should be devised for meeting the vehicle and housing shortages. In order to improve staff evaluation procedures, an evaluation committee should be set up in each institution.

The above recommendations also apply to the training institutions. In addition, the training institutions should focus more on small farmers and on farming systems. In order to increase the number of district and field extension staff, it is recommended that increased housing be provided. Funding for vehicles should also be increased and the in-service training programme improved. Strengthening of rural information services, which include radio and farm publication, is needed.

2. Agricultural productivity

Improved varieties of the major food crops should be developed that are higher-yielding, more disease and pest resistant, and better adapted to varying rainfall and soil conditions. Special attention must be given to the role of women both in agricultural production and professional positions. More funds should be available for oxen training and for medium-term loans to help farmers acquire livestock. It is recommended that a region-wide company should be developed that could supply low-energy equipment such as hand planters, hand weeders and cultivators to small-scale farmers. Other recommendations to improve productivity include: higher producer prices; development of a better marketing system and more efficient input delivery; research on the industrial uses of cassava and sorghum; and greater credit availability. The institutions' emphasis should be on the establishment of programmes in accord with current

national development objectives which contain evaluation and monitoring mechanisms.

The recommendations to improve livestock productivity are development of improved pasturage, research into cheaper sources of supplementary feeds, dam construction to improve water supply in low rainfall areas and improved veterinary services. Construction of abattoirs that reduce the cost of production could lower prices, raise demand and increase the off-take rate from the traditional herd.

I. INTRODUCTION

A. Background

This Agricultural Research Resource Assessment (ARRA) was conducted from July 1983 through August 1984 in the following countries of the Southern African Development Coordination Conference (SADCC): Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. The ARRA was initiated as a result of discussions between the SADCC Consultative Technical Committee for Agricultural Research (CTCAR) and representatives of the Cooperation for Development in Africa (CDA). The CDA is an informal association of donors including Belgium, Canada, France, Italy, West Germany, the United Kingdom and the United States.

The inventory and assessment were carried out within the framework of the high priority accorded by the CDA to developing and strengthening agricultural research capability in Africa. The United States, assisted by other CDA donors, was assigned the specific responsibility for coordinating the development of CDA-supported agricultural research programmes in the Southern African and Sahelian regions. The ARRA inventory reports were financed by the United States Agency for International Development (AID) for CDA, and were carried out with the full collaboration and support of SADCC through the CTCAR. DEVRES, Inc., a U.S. private consulting firm based in Washington, DC, was engaged by AID to implement the ARRA together with senior agricultural research personnel from the SADCC countries and to prepare a SADCC regional report. Two other CDA donor countries, Italy and France, also provided technical experts and other assistance for some of the SADCC countries' reports.

The CDA members recognise that the African nations have established Africa-wide and regional institutions, such as SADCC, and that the heads of African states have given unanimous support to the Organization of African Unity's Lagos Plan of Action which emphasises the development of a strong capability to increase agricultural productivity. The donors have, therefore, joined with the African countries and their regional organisations--SADCC in Southern Africa and the Institute du Sahel in the Sahel--to develop country-specific and regional analyses of existing resources and of the medium- to long-term needs and opportunities in agricultural research that will lead to increased agricultural productivity.

The World Bank, in its 1983 report entitled Sub-Saharan Africa: Progress Report on Development Prospects and Programs, reiterated its emphasis on the high priority which governments and donors should give to agricultural research. More specifically the report noted:

Even within the present state of technical knowledge, improved incentives and marketing arrangements would permit very large increases in agricultural output. However, for the longer term, increased output will depend on the development of effective technical packages, pest and disease control and developments in animal husbandry. . . In a situation of budgetary stringency and of immediate crisis, expenditure on research having a possible, but uncertain, payoff ten years or more in the future is frequently seen as dispensable. This danger is increased when research programmes are manifestly weak and unfocussed. It is, therefore, essential that these programmes be formulated and implemented in ways which will enable them to contribute more effectively to the process of development. . .¹

The ARRA reports, and the recommended research priorities, programmes, and projects within them, are set in a 20 to 25 year time-frame. This long-term perspective permitted the flexibility to make recommendations which are more carefully adapted to the needs of agricultural research. Individual country research staff in charge of country reports, assisted by technical experts provided through the CDA have endeavoured to be sensitive and responsive to the severe budgetary constraints in SADCC countries. The reports confirm that, even when a high priority is given to research, the SADCC country governments initially will not be able to meet all of the recurrent costs of certain research projects. Donors, therefore, will need to provide for some of these costs.

B. Methodology

This study was carried out with the full participation of African professional agricultural researchers and agriculturalists. It was agreed that such participation was of central importance for all phases of the activity--the design of the questionnaires, the data collection process, the analysis, the assessments of research programmes and direction, the actual preparation of the country reports, and the development and review of a regional agricultural research strategy. DEVRES provided a group of technical experts who had wide African and other international experience to assist the country researchers, to contribute to the analysis of the country reports, and to prepare a SADCC regional report. Italy and France also provided technical experts to assist country researchers in Mozambique and Tanzania, respectively.

The ARRA was initiated with a pilot study performed collaboratively with the SADCC member states of Botswana, Malawi and Swaziland. Following review of this pilot report by both SADCC and CDA members, the ARRA was expanded to include additional SADCC countries: Lesotho, Mozambique, Tanzania, Zambia and Zimbabwe. At the time these countries were added, the pilot country reports were updated and a regional analysis was prepared.

Senior researchers from the SADCC countries were designated as National Coordinators. Each Coordinator provided overall direction and support for the ARRA in her/his country. In turn, each Coordinator nominated researchers to be in charge of completing the questionnaires and preparing the national reports for their respective countries. The Country Researchers also used other experienced researchers for short periods to help complete questionnaires on specific subjects. The scope of the questionnaires included not only the research institutions, but also training institutions and extension institutions which provide links between research professionals and the farmers who are intended to utilise research results.

The expanded ARRA was prepared from July to September 1984 by the Country Researchers in cooperation with the DEVRES staff. A regional report, including summaries of the national reports, was prepared by DEVRES in consultation with the CTCAR members and the Country Researchers. The regional report was based on a regionally-oriented analysis of programmes and national reports, on the answers to the questionnaires, on contacts with international research organisations and national and international donors, and on other available information.

During the course of the ARRA, DEVRES provided assistance in the development of a computerised data bank to process ARRA data and to assist the SADCC countries in meeting their future needs for research which, when combined with other available information, can provide a foundation of practical, useful data that can be continuously updated. The data bank can be a valuable tool for use by those designing programmes and projects in agricultural research. It will remain with the Southern African Centre for Cooperation in Agricultural Research (SACCAR) which will update the data bank, as well as ARRA, in the future.

In preparing recommendations for programmes and projects, the National Coordinators, Country Researchers and DEVRES staff took into account research work already proposed or underway. New ideas were also included in this country report and in the regional report as well. One of the principal objectives of the analysis was to build on existing national research, analyses, conclusions and recommendations in a manner which will strengthen these research activities. A concerted effort was made to place recommendations in a wider context, involving not only the research institutions, but also the training of researchers, the use of research results by the farmers, and the linkages with other SADCC member institutions or other international research institutions.

¹The World Bank, Sub-Saharan Africa: Progress Report on Development Prospects and Programmes (Washington, D.C.: The World Bank, 1983).

II. GENERAL INFORMATION ON ZAMBIA

A. Description of the Country

1. Geography

Zambia is a landlocked country with an area of about 750,000 km². Located in the centre of southern Africa, Zambia shares common borders with eight countries: Tanzania and Zaire on the north; Malawi and Mozambique on the east and southeast, respectively; Zimbabwe, Botswana and Namibia on the south; and Angola on the west. Zambia lies between latitudes 8° and 18° South and longitudes 22° and 34° East. It has an average altitude of about 1,000 m, with peaks reaching 2,500 m along the border with Malawi.

2. Agro-ecological zones

Zambia can be divided into four major agro-ecological zones. (See Figure 1.) The distinguishing characteristics of these zones are summarised in Table 1.

a. The northern high rainfall zone

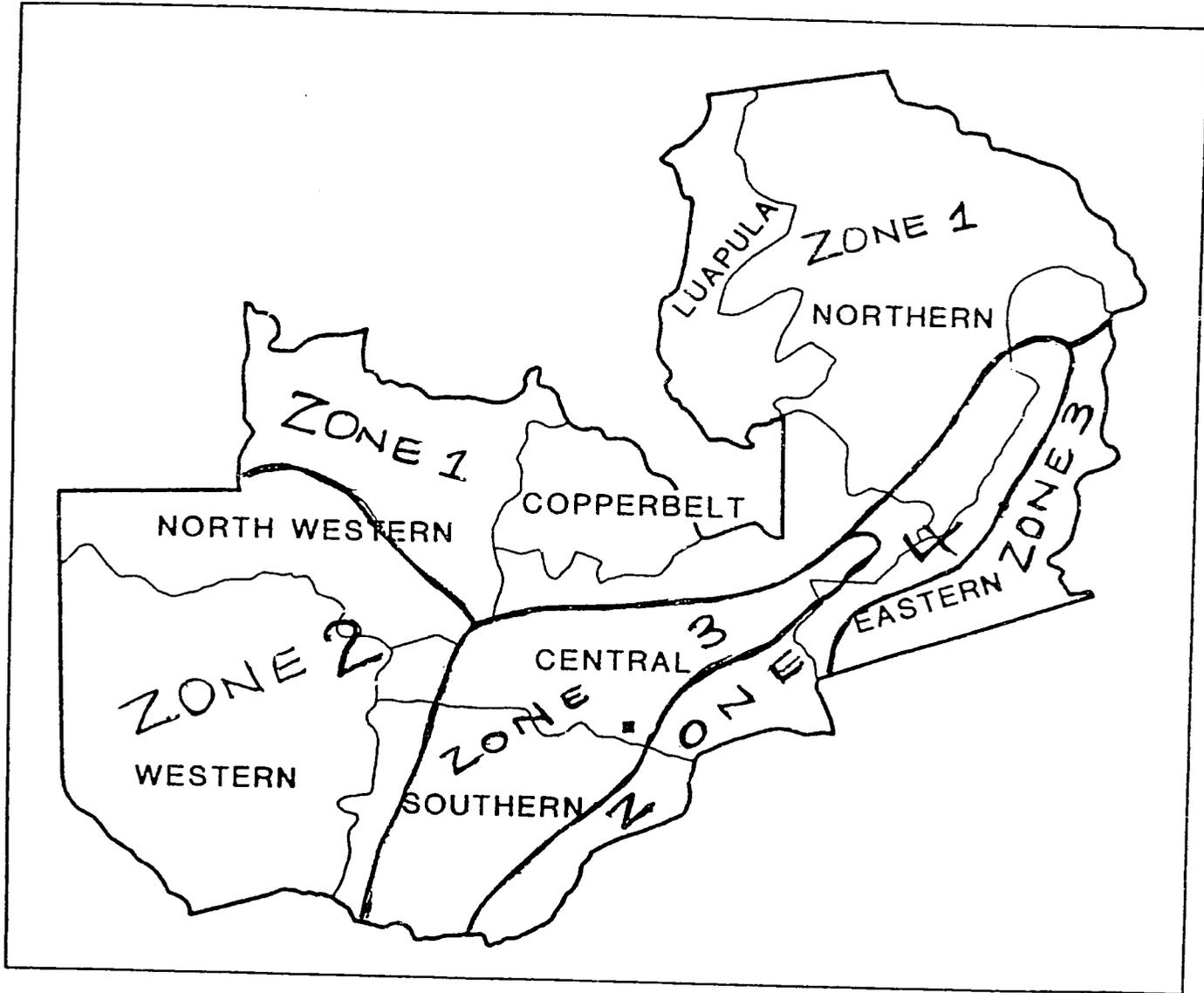
The northern high rainfall zone covers the Northern, Luapula, Copperbelt and Northwestern Provinces, and receives between 1,000 and 1,500 mm of rainfall per year. Highly leached sand veld soils of low fertility are predominant. Temperature is affected by long hours of cloud cover and averages about 21° C. This zone is best suited for perennial crops such as tea and coffee. Conditions are less favourable for maize, cotton and tobacco production.

b. The western semiarid plains zone

The western semiarid plains zone includes most of the Western Province and the Zambezi District of the Northwestern Province. Annual average rainfall varies from 600 to 1,000 mm. Extensive areas of the zone are covered by infertile Kalahari sands which extend into Botswana and Angola. Temperature fluctuates widely, with an annual average of between 21° and 24° C. Frost occurs in some areas during the cold season.

c. The central, southern and eastern plateau zone

The central, southern and eastern plateau zone covers the plateau areas of the Central, Southern and Eastern Provinces, and has some of the most fertile soils in Zambia. It also has the highest population density of any zone--about 8.6 persons per km². The soils of this zone are suitable for growing maize, groundnuts, tobacco and cotton. Most Zambian commercial and mechanised farming is found in this region. Average rainfall varies from 800 to 1,200 mm per year.



ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 1: Agro-Ecological Zones

Source: The World Bank, Zambia Agricultural Research and Extension Review, October, 1983.

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 1: Characteristics of Major Agro-Ecological Zones

<u>Zone</u>	<u>Average Altitude</u> (m)	<u>Average Rainfall Range</u> (mm)	<u>Area</u> (000 km ²)	<u>Climate and Mean Temperature Ranges</u> (°C)	<u>Main Vegetation</u>	<u>Main Crops/ Livestock</u>
1. Northern High Rainfall Zone	1,200	1,000-1,500	350	21	Dense woodland cover	Cassava, sorghum, millets, rice, maize
2. Western Semi- Arid Plains Zone	850	600-1,000	208	Hot and cool occasionally with frost 21-24	Kalahari sand, woodland and swamp	Cassava, pearl millet, cattle
3. Central, Southern and Eastern Plateau Zone	1,000	800-1,200	94	Warm and cool 18-21	Acacia woodlands	Maize, groundnuts, tobacco, cotton, cattle
4. Luangwa-Zambezi Rift Valley Zone	600	600-800	108	Hot and humid 24-26	Thicket with ephemeral grass cover, mopane woodland	Sorghum, pearl millet

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

d. The Luangwa-Zambezi Rift Valley zone

The Luangwa-Zambezi Rift Valley zone is comprised of the Zambezi River Valley below Victoria Falls, the area along Lake Kariba and the Luangwa Valley. It is the hottest and the driest zone, with an average annual rainfall of about 700 mm and average annual temperatures as high as 26° C. Soils are mainly shallow chestnut sands. Of marginal value for agriculture, most of the zone is utilised for national parks and game reserves.

3. Climate

a. Rainfall

The distribution of rainfall in Zambia is shown in Figure 2. There is a distinct rainy season beginning about the end of October and ending in March or early April. Mean annual rainfall ranges from about 1,200 mm in the north to 700 mm in the south. Rainfall is heaviest in the northwest and the northeast, averaging between 1,000 and 1,200 mm annually. The central regions receive between 800 and 1,000 mm annually. Rainfall is lowest and most erratic in the south and the low-lying areas of the Luangwa-Zambezi Rift Valley.

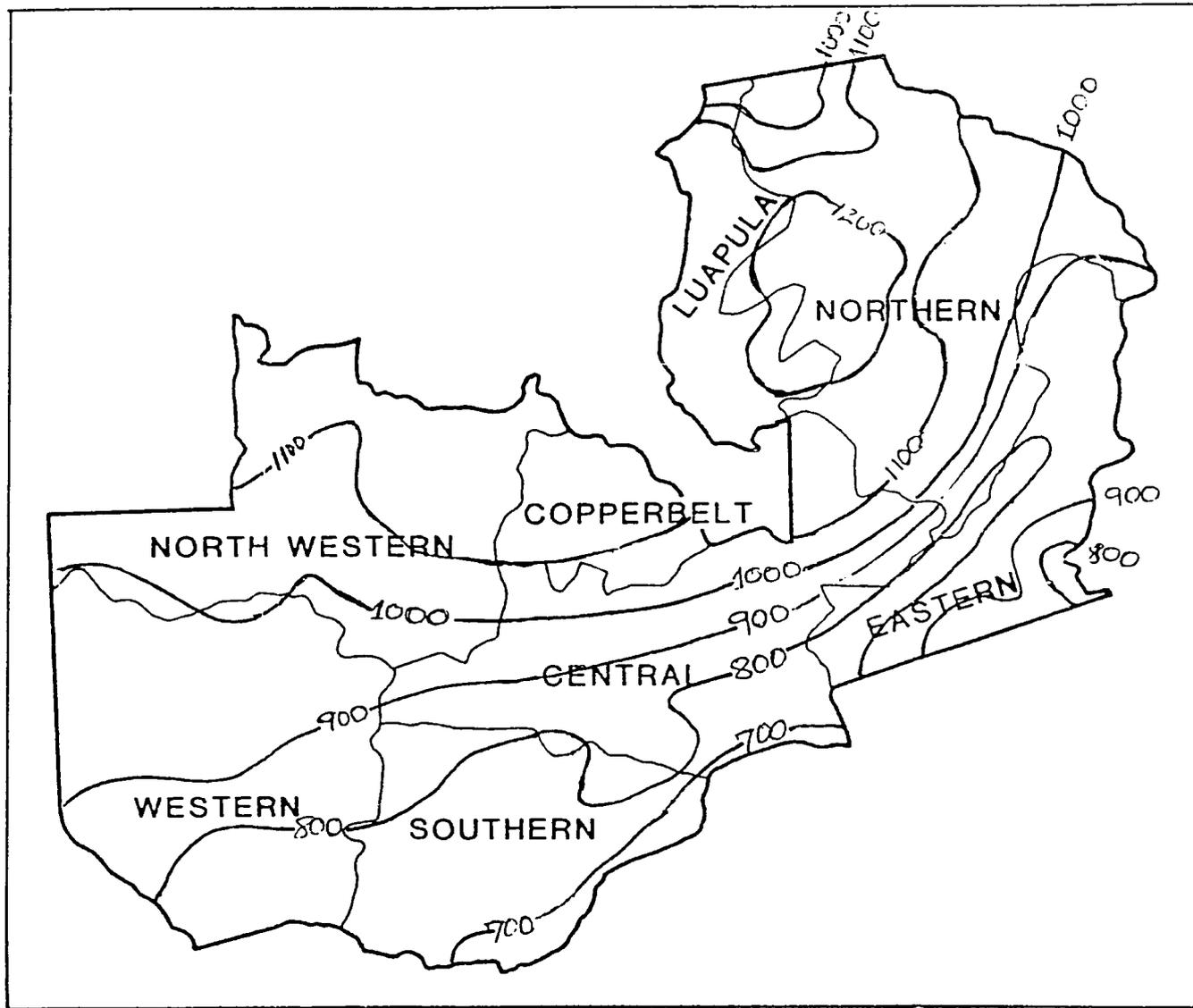
b. Temperature

Temperatures are generally moderate, due partly to the altitude and partly to the cooling effect of the cloud cover. The highest daily mean temperatures occur in October, the lowest in July. The mean maximum temperature recorded in October ranges between 27.8° at Mbala in the north, located at the highest altitude, and 35.1° C at Sesheke in the southwest, located at the lowest altitude. Mean minimum temperature in July ranges from 3.66° C at Sesheke to 10.6° C at Mbala. Recorded extremes have ranged from -7° C in July at Sesheke to 44° C in October in the Luangwa Valley.

c. Seasons

There are three main seasons in Zambia: the rainy warm season, the subsequent dry cool season, and the dry hot season. The rainy season begins towards the end of October and continues until the end of March or beginning of April. The main rains generally occur in late November and December, with variations in different agro-ecological zones. In the northern part of the country, this season may continue until the beginning of May. The rainy season is longer in the north (maximum of 190 days) and shorter in the south (maximum of 120 days).

The dry cool season lasts from April or May to August, with occasional frosts in some areas during June and July. Rainfall is rarely recorded during this season.



ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 2: Mean Annual Rainfall (mm)

Source: Department of Metecrology, Average Rainfall between 1931-1960.

The dry hot season lasts from August to October, with temperatures reaching their highest levels in October. In early November, moist oceanic air blows over Zambia, increasing humidity and cloud cover and resulting in the onset of the rainy season.

d. Drought

The descriptions of rainfall, temperature and seasons given above are based on long-term averages and do not take into account the abnormal seasonal distribution of rainfall experienced recently. During the past three years (1981-1984), the areas with the lowest long-term average annual rainfall, such as the Luangwa-Zambezi Rift Valley, have been receiving about 450 to 500 mm of rainfall, which is about 40 percent less than the long-term average. The results have been total crop failures and severe shortages of water for domestic animals. To sustain human lives, drought relief operations have been undertaken by both government and charitable organisations in the Gwembe Valley near Lake Kariba and the Luano Valley northeast of Lusaka.

B. The People

1. Population

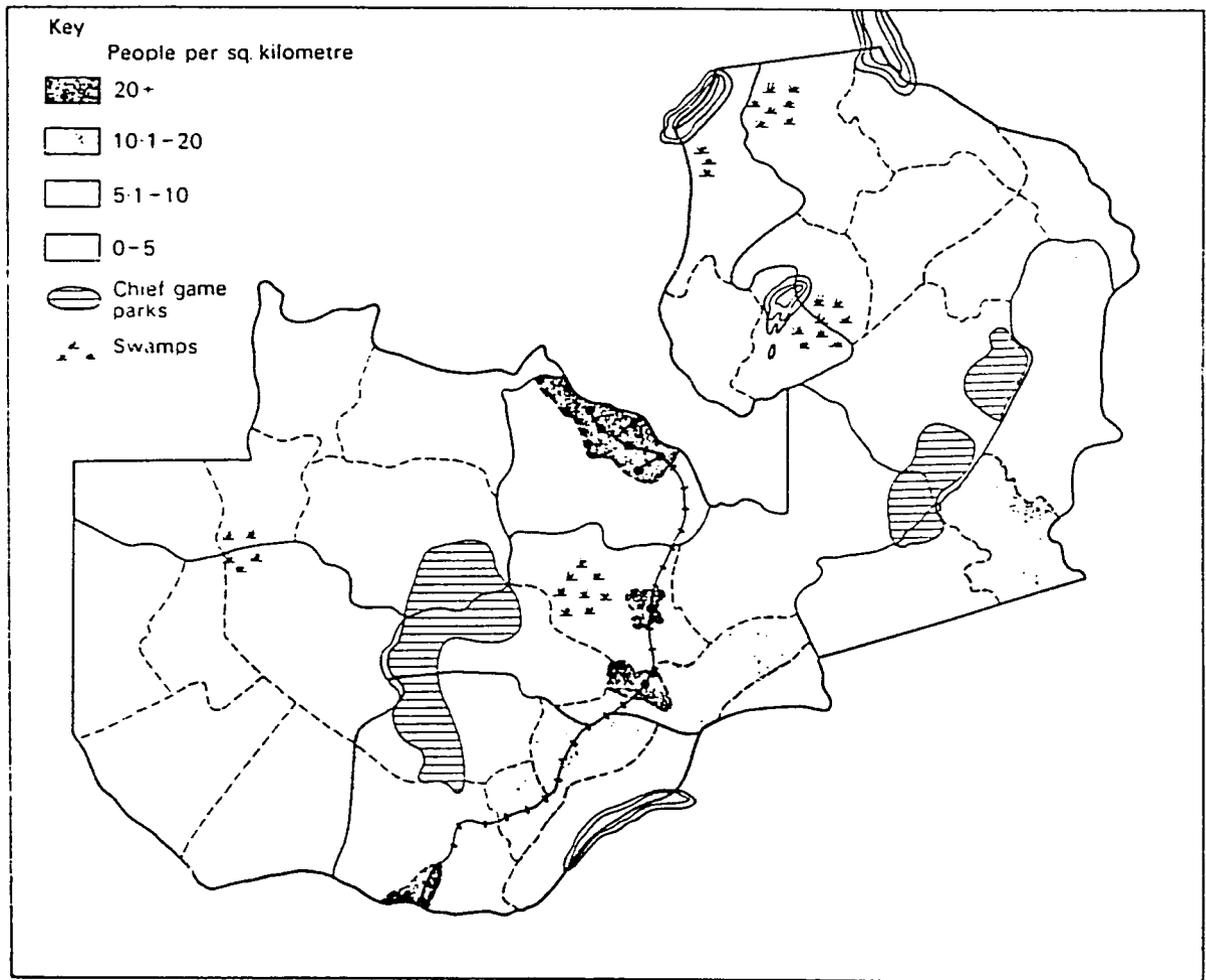
The population of Zambia at the time of the 1980 census was 5,679,808. The present growth rate is 3.3 percent; it is estimated that the total population will be 11 million by the year 2000.

In 1980, life expectancy at birth was 46 years, and 52 percent of the population was under 16 years of age. It is estimated that in the next 20 years this age group will be increasing more rapidly than others.¹ For the nation as a whole there were 96 males to every 100 females. In urban areas the ratio was 104 males to 100 females compared with 91 to 100 in rural areas. These differences reflect significant rural-to-urban migration of males. In 1975, it was estimated that 41 percent of rural households faced labour constraints in their efforts to increase agricultural production, and that 30 percent of rural households were headed by women.

Zambia has one of the highest levels of urbanisation in Africa, with 44 percent of its population living in urban areas. As shown in Figure 3, the highest population density is along the railroad line passing through the Southern, Lusaka, Central and Copperbelt Provinces. These provinces contain 55 percent of the total population of Zambia. Other areas with a population density of more than ten persons per km² are Chipata in the Eastern Province and Kasama in the Northern Province. The rest of the country has a population density of less than ten people per km².

2. Occupational patterns

The occupational patterns of the Zambian labour force have changed since Independence. In 1960, 79 percent of the labour force was engaged in agriculture, 7 percent in industry and 14 percent in services.



ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 3: Population Density and Distribution

Source: Noode, C. A Secondary School Geography of Zambia, 1978.

By 1980, however, only 67 percent of the labour force was engaged in agriculture, while the percent in industry and services had increased to 11 percent and 22 percent, respectively.

3. Language and ethnic groups

English is Zambia's official language and the language of instruction in all schools. There are 73 local languages and dialects, the main ones being Bemba (spoken by 19 percent of the population), Njanja, Lunda, Luvale, Kaonde, Tonga and Lozi. The common local language spoken in Lusaka is Njanja. The Bemba have traditionally occupied northeastern Zambia; the males have been the main ethnic group working in the Copperbelt, leaving agriculture, at least in past years, in the hands of the aged, children and women. The majority of the Njanja are still found in the Eastern Province. The plateau Tonga are situated along the railroad line in the Southern Province and part of the Central Province. They have adopted improved farming technologies and produce surplus food for market. The Lozis traditionally have been located in the Western Province.

4. Religion

The main religion is Christianity, including Catholics and many Protestant denominations. There is a small group of Zambians of Asian origin who are Moslem and Hindu. Some ethnic groups practice indigenous beliefs.

5. Educational system

The educational system in Zambia has developed rapidly since Independence in October, 1964. In 1960, only 42 percent of the primary school-aged children were enrolled in school; this figure had doubled to 95 percent by 1980. At the secondary level, the percentage of eligible children enrolled has increased dramatically from 2 percent in 1960 to 17 percent in 1980. However, only 2 percent of the age group were enrolled in institutions of higher education in 1980. Adult literacy increased from 29 percent in 1960 to 44 percent in 1980.

There is one teacher training college in each of the eight provinces. These colleges recruit secondary school leavers who, after two or three years of study, are awarded either certificates or diplomas in teaching. In addition to these colleges, there are trade institutes and colleges located throughout the country which offer training in various vocational trades. The diploma- and certificate-holders from these colleges are utilised by the country's industry.

The University of Zambia (UNZA), the only university in the country, now enrolls about 3,000 students annually. It awards BA and BSc degrees in education and agriculture as well as in other disciplines. Graduates from the UNZA School of Education become teachers in secondary schools and colleges, while those from the

School of Agricultural Sciences are employed by a variety of public and private organisations related to agriculture. The National Resources Development College (NRDC) in Lusaka admits form five school leavers. These are awarded diplomas in various rural development-related fields after three years of study. There are two agricultural colleges, one each in the Northern and Southern Provinces, which admit form three and form five school leavers and award them certificates.

Adult education in Zambia is coordinated by the Ministry of Higher Education which, in conjunction with the Adult Education Bureau of UNZA, has established one or more adult education centres in each province.

C. Government and Political Framework

1. The structure of government

The Government of the Republic of Zambia (GRZ) is comprised of three distinct branches--executive, legislative and judicial.

a. The executive branch

The executive power of the Republic is vested in the President; that power is exercised by him either directly or through officers subordinate to him. He is the commander-in-chief of the armed forces. The Prime Minister, who is appointed by the President, is the head of government administration and the leader of government business in the National Assembly (Parliament); he is also responsible for such other business of the government the President may assign to him. The Cabinet consists of 21 Ministers appointed by the President, each of whom is in charge of a ministry. The Cabinet is responsible for advising the President with respect to government policy and any other matters referred to it by the President. In addition, the Cabinet is responsible for implementing policy decisions made by the Central Committee of the Party, which is chaired by the President. A Minister of State assists each Cabinet Minister.

b. The legislative branch

The legislative power of the Republic is vested in the Parliament of Zambia, which consists of the President and the National Assembly (Members of Parliament). The National Assembly consists of 125 elected members and ten nominated members appointed by the President. To qualify to be elected or nominated as a member of the National Assembly, a candidate must be a citizen of Zambia, at least 21 years old and a member of the United National Independence Party. Candidates must also be literate and conversant in English. The speaker of the House is elected by the members of the Assembly, from among persons who are qualified to be elected as members of Assembly, but who are not members of the Assembly. The legislative power of Parliament is exercised through bills passed by the National Assembly and approved by the President.

c. The judicial branch

The Supreme Court of Zambia is the final court of appeal for the Republic. The judges of the Supreme Court are the Chief Justice, the Deputy Chief Justice, two Supreme Court Judges or such number as may be prescribed by Parliament. When the Supreme Court determines any matter it is composed of an uneven number of judges, not less than three. The Supreme Court has unlimited original jurisdiction to hear and determine any civil or criminal proceedings under any law.

2. Political parties

Zambia's political party, the United National Independence Party, was founded in 1959. The President of the Party is the President of the GRZ. Party policies and constitutional changes are formulated and passed by a National Council, which meets annually, and the Party's general conference, which meets once every five years. These policies are formulated by the 25 members of the Central Committee, which functions through a set of subcommittees which include the elections, publicity and strategy, appointments and disciplinary, political and legal, defense and security, social and cultural, economic and finance, youth and sports, rural development, and women's affairs subcommittees. These subcommittees work very closely with the respective ministries in the government structure. In each province and district, the President is represented by a member of the Central Committee and by a Governor, respectively.

3. National budget

The national budget is prepared by the Minister of Finance after receiving submissions from each ministry. It is presented to Parliament at the beginning of the fiscal year. After being debated and passed, it stipulates the capital and recurrent expenditures which each ministry and department may incur during the year. However, not all the money that is approved is actually made available for expenditure. Funds are released on a quarterly or monthly basis by the Ministry of Finance to the other ministries, which in turn may allocate them to the Departments and Provinces. The fiscal year is the same as the calendar year.

4. Government policies regarding agriculture

The long-term policy objectives of the GRZ for agricultural development have been:

- o To become self-sufficient in major foodstuffs and agricultural products;
- o To aid in diversifying the economy, reducing its dependence on copper by producing an agricultural surplus, which can be exported;

- o To increase personal income and employment in the rural areas: and
- o To redress the imbalance of development between the urban and rural sectors.

A variety of programmes have, in the past, been adopted to achieve these long-term objectives. These include production projects and settlement schemes, state or cooperative farms, and special purpose, commodity-oriented or area-based production schemes. However, the country still lacks sufficient trained and skilled manpower in agriculture.

5. Membership in international organisations

Zambia is a member of a number of international organisations, including the Commonwealth of Nations, the Nonaligned Movement, most of the United Nations organisations, the Organization of African Unity, the Preferential Trade Area, and the Southern African Development Coordination Conference.

D. Economic Overview²

1. General indicators

The economy of Zambia has been highly dependent on exporting copper but over the past five years world copper prices have declined. In real terms, the 1981 GNP of K 1.4 billion was 23 percent less than the GNP ten years earlier. No other sector of the economy has been able to make up for the decrease in earnings by the mining industry. The agricultural sector, which includes forestry and fisheries, has never contributed more than 13 percent to the GDP, with an average of 11.9 percent over the period between 1978 and 1981. (See Figure 4.) A decline in agricultural output occurred in the 1981-1982 and 1982-1983 cropping seasons because of drought. The manufacturing sector's contribution to GNP averaged about 11.2 percent from 1978 to 1981.

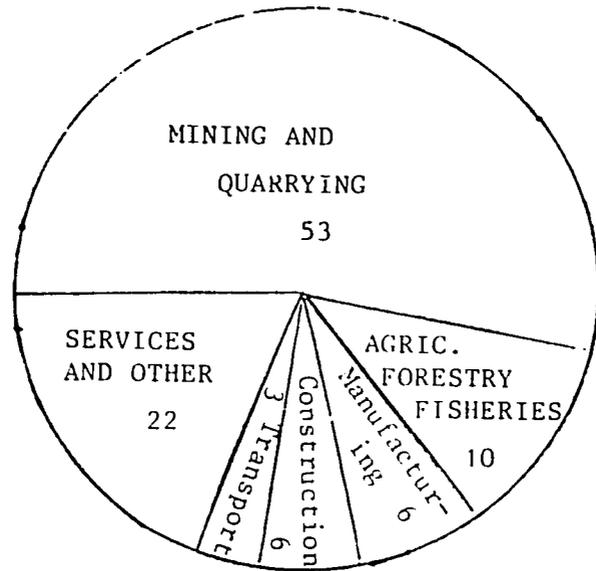
2. International trade

Zambia's balance of payments has not been favourable in view of declining copper prices and the world economic recession. Government has therefore embarked on programmes to strengthen the agricultural sector, thereby increasing its contribution to Zambia's international trade through exports of agricultural products.

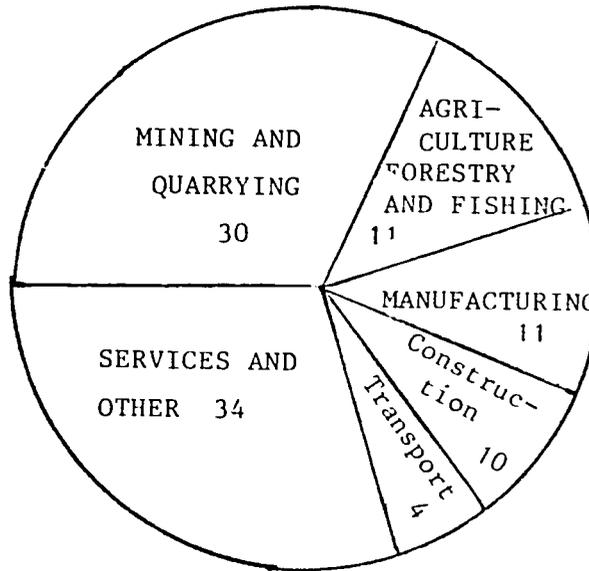
3. National development plan

With the contribution of the mining and quarrying sector to the GDP falling from 53 percent in 1965 to 26 percent in 1981, the challenge facing Zambia is to develop alternative sources of income,

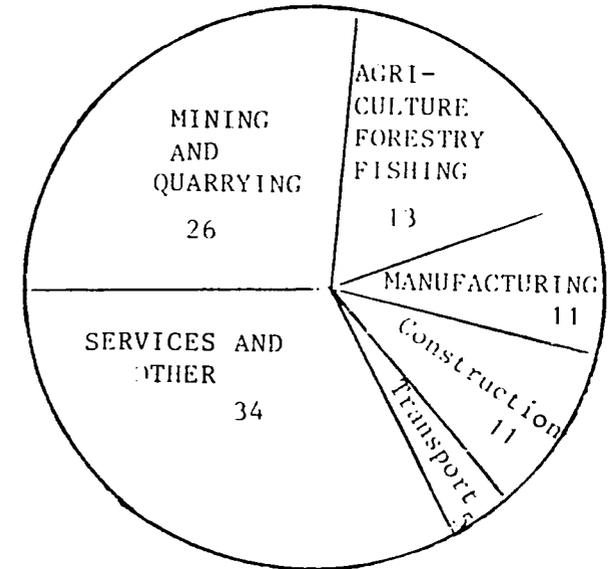
1965



1975



1981



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Figure 4: Sectoral Shares in Real Gross Domestic Product as a Percentage of Total

Source: IBRD/The World Bank, World Development Report 1983 (New York: Oxford University Press, 1983).

employment and exports. The most feasible alternative source is the agricultural sector, which has been marked as a high-priority sector in the effort to restructure the economy. This sector has enormous potential. Only about one-sixth of the arable land currently is cultivated. It is the only sector with strong potential for providing employment for large numbers of people in the short run and for absorbing a large population increase over the next 20 years. It is the sector with the greatest capacity for expansion, it uses little foreign exchange, and it is not capital-intensive. The main elements of the GRZ's strategy for developing the agricultural sector include: concentration of resources on smallholders; reform of incentive structures to ensure better prices for their products; a more open and competitive marketing system; a major effort in research and extension, especially for smallholders; a focus on maintaining existing capacity in the commercial farming sub-sector through the provision of needed inputs; and increases in the availability of consumer goods in rural areas.

4. External aid

Zambia receives assistance in the form of loans and technical assistance grants from many friendly countries and institutions. In 1979, these groups gave approximately US\$ 102.7 million for technical assistance projects in agriculture, health, education, transportation, communications and natural resource planning. Of this amount, 10 percent was allocated for capital expenditures in agriculture.

5. Food aid

Food aid to Zambia has been provided by several donors and agencies during times of need, such as the droughts of the past three years. Among the donors have been FAO, Japan, the United States, the European Economic Community (EEC), the UN World Food Program (WFP) and religious organisations.

E. Agriculture

1. Land use and land tenure

It is estimated that Zambia has about nine million ha of arable land, or about 12 percent of the total land area, with good to high agricultural production potential, and that only about 16 percent of that resource is being utilised. Although rainfall has tended to be erratic during the drought years 1980/81 to 1982/83, under normal climate conditions rainfall is not erratic, the climate is generally favourable for a number of crops and livestock production. However, greater utilisation of this land is seriously constrained by a number of ecological and institutional factors.

There are several categories of land in Zambia. The ultimate control of the land is vested in the President, the Head of State. State land accounts for about 6.5 percent of Zambia's total area, and

is under the control of the President who may make grants and arrange leases through the Commissioner of Lands. Freehold titles were abolished following the 1975 Land Act. Title-holders of state land are individuals, groups or townships. Long-term leases of state land are granted mainly in areas of high population density and commercial farming around Lusaka, and in the Central, Southern, Eastern and Copperbelt Provinces. Non-state land is that which has been set aside by the President for public purposes without payment of compensation. It comprises nearly one-third of the total land area, and includes national parks, game management areas and protected forests. Non-state land also includes land which may be occupied and used in accordance with customary law without lease or formal right of occupancy. Land in this category covers more than one-half of Zambia's total land area. It can be acquired for public purposes on payment of compensation and, when so acquired, it becomes state land.

2. Principal agricultural production systems

The farming population in Zambia may be divided into four categories. (See Table 2.)

a. Large-scale commercial farmers

There are about 700 large-scale commercial farmers in Zambia. They use high-technology inputs and rely on permanent and hired labour for their farm operations. The average farm size is 80 ha. About 80 percent of the farms in this category are located along the railroad line.

b. Medium-scale commercial farmers

There are about 21,000 medium-scale commercial farmers who market practically all of their produce. They use commercial technologies but rely extensively on animal draughtpower and on family labour. The farm sizes range from 10 to 40 ha, and are correlated with the farming system being applied.

c. Small-scale commercial farmers

Small-scale commercial farmers, sometimes referred to as emergent farmers, number about 122,000. They still rely, to a significant extent, on hand cultivation, while using improved seeds and substantial quantities of fertiliser. Oxen are used in some areas. This group produces about 60 percent of all the maize marketed and about 35 percent of all the staple crops. The average farm size for this group is three ha.

d. Subsistence farmers

Subsistence, or traditional, farmers include about 460,000 family household producers. Members of this group rely almost entirely on hand cultivation and produce primarily to meet their own

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Table 2: Number of Farms and Farm Population by Province and by Farm Type, 1980

<u>Province</u>	<u>Large-Scale Commercial</u> (>40 ha)		<u>Medium-Scale Commercial</u> (10-40 ha)		<u>Small-Scale Commercial</u> (1-10 ha)		<u>Traditional</u>		<u>Total</u>	
	<u>Farms</u>	<u>Pop</u>	<u>Farms</u>	<u>Pop</u>	<u>Farms</u>	<u>Pop</u>	<u>Farms</u>	<u>Pop</u>	<u>Farms</u>	<u>Pop</u>
Southern	320	16,000	8,000	76,000	49,900	374,100	7,500	33,900	65,720	500,000
Central	300	15,200	7,630	72,500	21,400	160,500	18,400	82,800	47,730	331,000
Lusaka	90	4,300	1,910	18,100	4,300	32,300	13,400	60,300	19,700	115,000
Copperbelt	-	-	490	4,700	2,000	14,900	17,900	80,400	20,390	100,000
Eastern	20	1 000	3 100	29,500	27,000	202,700	80,900	363,800	111,020	597,000
Western	-	-	-	-	5,450	40,800	85,400	384,200	90,850	425,000
N/Western	-	-	80	800	2,900	21,900	53,600	241,300	56,580	264,000
Luapula	-	-	50	500	2,050	15,300	73,600	331,200	75,700	347,000
Northern	-	-	90	800	7,400	55,500	111,900	503,700	119,390	560,000
TOTAL	730	36,500	21,350	202,900	122,400	918,000	462,600	2081,600	607,080	3239,000

Source: MAWD, Food Strategy Study, 1981.

needs, although they may occasionally sell some produce. The average size of the subsistence farm is two ha.

3. Principal crops

The crops grown in Zambia can be grouped into four major categories: cereals, consisting of maize, wheat, sorghum, rice and millet; oilseeds, consisting of cotton, soybeans, sunflower, and groundnuts; traditional cash crops, consisting of tobacco, coffee and tea; and minor crops, such as cassava, vegetables and fruits. Sugarcane is produced on a single large estate at Mazabuka whose output renders Zambia self-sufficient in this commodity. The area planted and the quantities produced and marketed of the major crops are given in Table 3.

a. Cereals

Maize and wheat are the major food grains in Zambia, particularly in urban centres where they constitute the preferred cereals. Sorghum and millet and, to a lesser extent, cassava are the principal food crops in those rural areas less well-suited to maize cultivation. Total production of maize was estimated at about one million MT in 1982. Marketed maize production in 1983-1984 was estimated at slightly over one-half million MT.

From 1965 to 1975, the marketed production of maize grew at an average annual growth rate of about 12 percent. Quantities of maize marketed have remained essentially constant since 1975, while the urban population has increased at a rate of 6 percent per annum. This led to massive imports of maize during the period from 1975 to 1982 to meet the steadily growing urban demand. The average yield of maize per ha has been generally static since 1965. Increased maize production has been strongly correlated with increases in the area harvested of 266,000 ha in 1965 to 540,000 ha in 1980. Price incentives in recent years have been important in stimulating increased maize production, especially among the commercial and small-scale farmers.

Wheat, mainly consumed by the urban population, has registered substantial production growth rates in the past two decades. This has been brought about both by increases in the area cultivated and improvements in varieties as well as by producer price incentives. Varietal selection was the principal factor responsible for the dramatic increase in average productivity from about 2 MT/ha in 1965 to about 4.5 MT/ha in 1982. Since wheat production in Zambia is capital-intensive and dependent on irrigation, provision of medium- and long-term credit to producers has played a critical role.

Production estimates for sorghum and millet are uncertain since relatively small quantities are traded. The trade in beer made from millet and sorghum is more significant. It is estimated that more than 50 percent of these crops is used for this purpose. Since both

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Table 3: Area Planted and Volume Produced and Marketed for Major Crops, 1980/81 - 1982/83

<u>Commodity</u>	<u>Area Planted</u>			<u>Total Production</u>			<u>Production Marketed</u>		
	<u>(000 ha)</u>			<u>(000 MT)</u>			<u>(000 MT)</u>		
	<u>1980/81</u>	<u>1981/82</u>	<u>1982/83</u>	<u>1980/81</u>	<u>1981/82</u>	<u>1982/83</u>	<u>1980/81</u>	<u>1981/82</u>	<u>1982/83</u>
Maize	494	482	-	1008	8018	1715	694	506	378
Wheat	3.6	3.8	-	12	14	20	12	14	20
Rice	5.4	5.8	-	5.3	5.3	-	2.8	2.9	-
Soy beans	3.9	6.0	-	4.1	5.8	-	3.3	3.7	-
Groundnuts (shelled)	33	21	-	15	7.8	-	-	-	-
Sunflower	47	40	-	19	21	-	19	20	-
Seed cotton	37	26	-	-	-	-	17	13	-
Tobacco	2.8	2.1	-	-	-	-	2.4	1.9	-

Source: National Commission for Development Planning, Agricultural Baseline Data for planning, July 1983.

crops can be grown on poor leached soils, they are grown more widely than is maize.

b. Oilseeds

Oilseed production has been the main source of agricultural growth since independence. All oilseed crops, except groundnuts, have shown significant increases in marketed production during the period 1975 to 1982. There is some evidence suggesting that total production of groundnuts actually reached a peak of over 7,800 MT in 1982 with slightly more than 3 percent being marketed. Increased oilseed production has been due both to increased areas under cultivation, particularly of cotton, soybeans and sunflower, and increased yields per ha. The complementarity of wheat and soybeans has also increased production of the latter, because it allows farmers to spread the fixed costs of irrigation and minimising the use of nitrogenous fertilisers. Varietal selections have helped to improve yields of soybean and sunflower but not of cotton and groundnuts. Major constraints in oilseed production include the lack of adequate technical information, the high cost of marketing and processing systems, and the susceptibility of the present varieties to pests and diseases.

c. Traditional cash crops

The traditional cash crops are tobacco, coffee and tea. The first two would have the best export potential for Zambia if they could be produced more economically than at present.

Coffee is produced on two parastatal estates in the Northern Province. There also is limited coffee production by individual smallholders. Production has increased from 71 MT in 1964 to 77 MT in 1977 and 100 MT in 1982.

Tea is grown on the 284 ha Kawambwa tea estate, a small parastatal in Luapula Province. Average yields in 1982 were 1,100 kg/ha of high-quality tea, which can compete favourably on the world market. However, current production caters to domestic consumption.

Tobacco is the traditional export crop for Zambia, although its production has drastically declined since Independence. Virginia and burley tobacco are the main types produced, the former accounting for the bulk of production. The main areas of production are the Southern, Eastern and Central Provinces. At Independence, all tobacco was produced by expatriate commercial farmers who left soon after Independence. The Government thereafter formed the Tobacco Board of Zambia (TBZ) to promote tobacco production by Zambian farmers through production schemes. Because of various production problems faced by the TBZ, its functions were reduced to tobacco marketing only in 1981, leaving production and extension work to the Department of Agriculture. In 1983, 60 percent of total tobacco production came from the commercial farm sector. Tobacco production declined at a

rate of 4.8 percent per annum between 1975 and 1982. However, the government is presently revamping the tobacco industry.

d. Cassava

Cassava, like maize, is grown by a large number of smallholder farmers in almost every province. It occupies a significant portion of the area cultivated in the Luapula, Northern, Western and Northwestern Provinces, where it is a staple food. Cassava could become an import substitution crop if yields could be increased above the present levels of between 7 and 12 MT/ha of dry cassava. However, these yields are above the current African average yield of 6.4 MT/ha. Limited research, confined to varietal selections, continues to be conducted.

FAO production statistics show that 177,000 MT of dried cassava were produced in 1980. In addition to its use as a staple food, there is a potential demand for cassava flour for breadmaking, brewing, and the manufacture of starch, glucose and dextrine. It can also be used as a substitute for maize in animal feeds. Given these various purposes, the domestic demand outlook for cassava is quite favourable.

4. Principal livestock and animal products

The most important livestock commodities in Zambia are beef and dairy cattle and poultry. The value of livestock output accounted for 11 percent of the total agricultural output in 1981.

a. Beef

The national herd of cattle, estimated in 1983 at 2.1 million head, consists of 1.8 million in the traditional sector and 0.3 million in the commercial sector. The annual herds' growth has averaged 2 percent for the national herd and 6 percent for the commercial sector. The national annual off-take rate for consumption or sale has averaged between 7 and 10 percent during the post-Independence period, while that of the commercial sector has averaged 16 percent. The higher off-take rate of the latter is due to both its market orientation and its use of quicker-maturing breeds. The commercial sector accounts for about 37 percent of total beef production, although it contains only 16 percent of the national herd. Exports of beef are minimal. The major constraints in the beef sub-sector include seasonal forage and feed supply, frequent outbreaks of foot and mouth disease, and tsetse fly infestations.

b. Dairy

Although it has existed for many years in Zambia, the dairy industry is still in its infancy. Fresh milk is supplied by smallholder farmers, who produce small quantities of milk for their own use; emergent farmers, who produce for commercial transactions from crossbred or purebred dairy cattle; and commercial or state

farms, which produce for sale from purebred herds. In addition, the Dairy Produce Board reconstitutes fluid milk from imported skimmed milk powder for commercial sales in major urban centres. It produces pasteurized milk and processes cream, butter and cheese. Trade in non-processed milk is confined largely to rural villages, while processed pasteurized milk is traded extensively in urban centres along the railroad line.

From 1975 to 1981 the annual total milk supply was 82,000 MT, of which 54 percent was domestically produced. Supply has declined from 100,000 MT prior to 1965. Commercial farmers, who produced 45 percent of the total domestic supply in 1965, were producing less than 15 percent in 1981. The GRZ established state dairy farms to offset this decline.

The main causes of this decline in milk production have been poor dairy herd management in some state and emergent dairy farms, insufficient supplementary feeding during the long, hot, dry seasons, and the movement of some farmers from dairying into other farm enterprises.

Potential domestic demand for milk was estimated at 124,000 MT in 1981. Future demand for milk has been estimated at 184,000 MT in 1990. Domestic market prospects for milk thus are considered favourable, since nearly 50 percent of present consumption is met by imports. There is great potential for import substitution in milk and milk products.

c. Poultry

Poultry production consists of commercial and subsistence flocks. The latter are raised in the backyard or on a free range basis with virtually no inputs involved. The quantity of chickens thus produced is unknown. However, chickens are raised by almost every rural household in Zambia for subsistence and provide the cheapest source of animal protein for most rural households. Commercial poultry production is largely centered along the railroad line where broilers and eggs are often produced as part of large, mixed farming operations. The use of poultry manure in cattle feeding has tended to encourage the production of beef and poultry as complementary enterprises.

Poultry production registered a rapid growth from 1,000 MT in 1964 to about 21,500 MT in 1976, but declined to 17,300 MT in 1981. Poultry meat production grew at 72 percent per annum during the 1965-1975 period. During the same period, egg production increased from 23 million in 1965 to about 143 million during the 1975-1981 period. Zambia has had a good export market for day-old chicks to Tanzania, Malawi and Zaire. This declined to 0.2 million chicks in 1981 after reaching a peak of 1.43 million in 1977, largely because of stock feed problems in the country. Domestic market prospects for poultry products for the next decade are particularly favourable.

5. Fisheries

Fish and fishing are important for many Zambians, both as a major source of protein and as a major source of income. Fishing is mainly of an artisanal and seasonal nature for an estimated 20,000 fishermen, the majority of whom are also engaged in subsistence agriculture. About two-thirds of them live in the Luapula, Northwestern and Western Provinces where per capita incomes from crop production are low. The major fishery areas are Lakes Tanganyika, Mweru, Mweru-Wa-Ntina, Kariba, and Kafue and the upper Zambezi River. Between 1973 and 1983, these areas produced about half of the total catch and will continue to do so.

The domestic demand for fish is well above the amount caught. It is estimated that in 1980, less than 60 percent of the potential demand was met. Since 1974, per capita consumption has gradually declined from 15 to 8.8 kg in 1980. The growing gap between demand and supply of fish is the result of a fairly constant level of total landings and a rapidly increasing population.

The total production of fish shows a fairly stable level over the years, with an average production of about 54,000 MT per annum. In several fishing areas, considerable variations in the size and composition of the catch exist. Over the next decade, an increase to a total sustainable yield of 85,000 MT is feasible.

6. Agricultural marketing and credit

The marketing of agricultural inputs and products and the administration of agricultural credit are largely handled by parastatals and cooperatives. The GRZ is concerned about the poor performance of the parastatals which require heavy subsidisation to cover their high operational costs. Such deficits increased from about K 132 million during 1970-1973 to K 361 million in 1978-1982. The parastatals have absorbed a considerable amount of public funding. While several external factors have contributed to the parastatals' losses, internal deficiencies have been the major factor behind their poor performance. The government has introduced economic pricing of goods produced by parastatals in order to improve their efficiency in production.

Traditionally the National Agricultural Marketing Board (NAMBOARD) imported and distributed agricultural inputs and purchased agricultural products. However, in the past few years some of these functions have been assumed by the Provincial Cooperative Unions.

At present, small-scale farmers' credit is provided by the Agriculture Finance Company, the Cattle Finance Company and the Zambia Cooperative Federation Financial Services. Large commercial farmers are serviced by commercial banks, the Development Bank of Zambia and the Zambia Agricultural Development Bank.

7. Food and security

a. Food consumption and dietary patterns

Staple foods in Zambia consist mainly of cereals, roots, vegetables, oils and fats, fish, and meat. Over 80 percent of the average Zambian's caloric intake comes from cereal and root crops. Except in certain northern and central areas, where millet and sorghum are preferred, maize is the main staple food. Rice is increasingly popular, especially in urban areas. Cassava also is important as a staple food or as a dietary supplement in all parts of the country. It is consumed both in the form of raw or cooked tubers and as nshima made from its flour. Its leaves are consumed as a salad or vegetable. Vegetable consumption is high throughout the country. Beans, peas, pumpkins and various other green leaves are usually eaten as a vegetable or side dish with a staple food. Groundnuts, usually in pounded form, are used to season relishes. Consumption of fruit tends to be low except in the Eastern Province. Consumption of eggs, milk, fats and oils also is low, except for sour milk in the Southern and Western Provinces where cattle are the basis of the local economy. Fish constitute over 50 percent of the total protein consumed, and thus are much more important than meat or poultry, which are eaten only occasionally.

b. Food security

Zambia is expected to need to import over 350,000 MT of grain during the coming year, about two-thirds of which will be maize.³ At least one-half of this will probably depend on external aid. Wheat production amounts to only 10 percent of consumption, and outputs of cassava, sorghum and rice have not grown sufficiently to fill the gap.

8. Ministries responsible for agriculture

The ministries responsible for agriculture are the Ministry of Agriculture and Water Development (MAWD), the Ministry of Lands and Natural Resources (MLNR), the Ministry of Cooperatives, and the Ministry of Higher Education (MHE). MAWD is responsible for agricultural training up to the diploma level, as well as for agricultural research, land development services, veterinary services, and agricultural extension. Training at the degree level in agriculture is undertaken by MHE through the University of Zambia's School of Agricultural Sciences. The Ministry of Cooperatives is responsible for initiating and forming cooperative unions which later take on annual marketing functions for all agricultural commodities. Natural resource conservation, forestry, land survey, and the protection of wildlife and national parks are all undertaken by the MLNR and MAWD. This distinct division of responsibilities by ministry diminishes under day-to-day government operations, which involve a considerable amount of interaction and coordination among the different ministries.

¹P.D. Ncube, Agricultural Baseline Data for Planning, No. 1
(Lusaka: NCDP and the University of Zambia, July 1983).

²This section draws from the Government of the Republic of Zambia, Restructuring in the Midst of Crisis. Vol. 1: Development Policies and Objectives, consultative group for Zambia presented to the Paris Club in May 1984.

³U.S. Agency for International Development, Zambia: A Country Profile, 1982 (Washington, D.C.: Government Printing Office, 1983).

III. AGRICULTURAL RESEARCH INSTITUTIONS

A. Overview of Agricultural Research in Zambia

Agricultural research in Zambia is conducted by three departments of the Ministry of Agriculture and Water Development (MAWD), by the National Council of Scientific Research and the University of Zambia under the aegis of the Ministry of Higher Education (MHE), and by the Forestry Department of the Ministry of Lands and Natural Resources (MLNR). (See Figure 5.)

The funding, research activities and number of staff of each of these institutions conducting agricultural research are summarized in Table 4 and described below.

B. Agricultural Research Institutions of the Ministry of Agriculture and Water Development

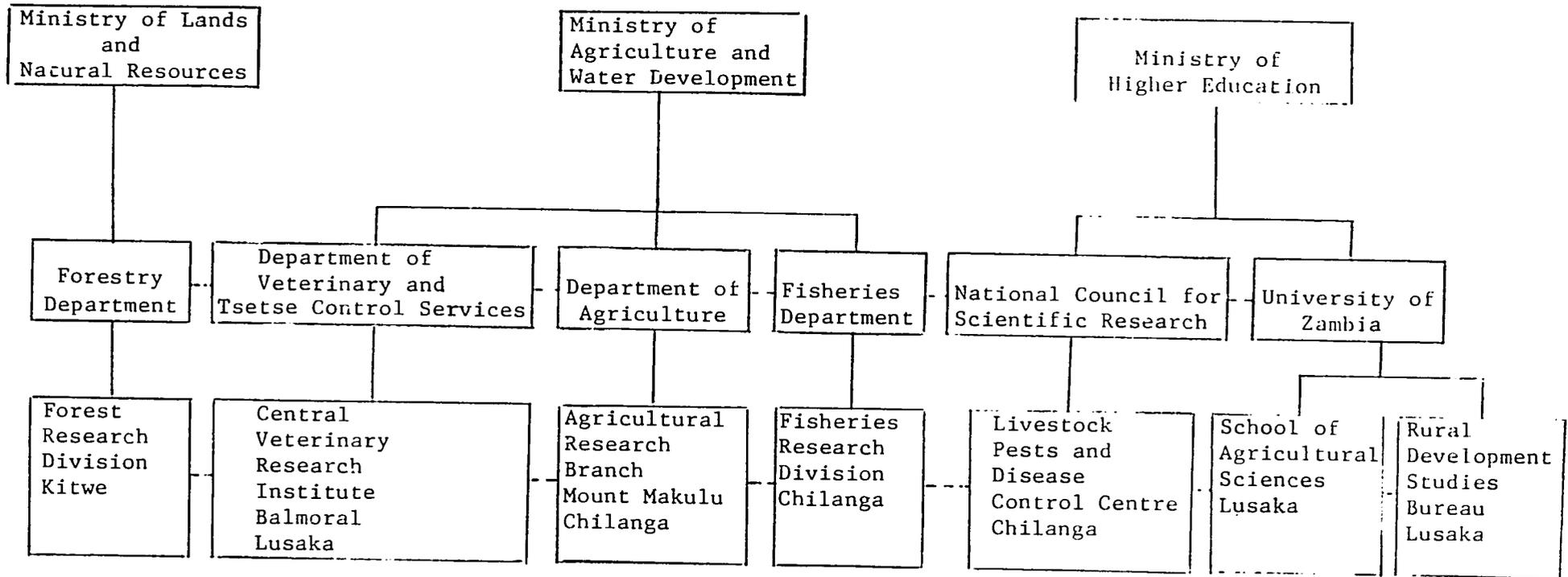
The MAWD is headed by the Minister with support from a Permanent Secretary, and Under Secretary and six Assistant Secretaries. The four operating departments--Agriculture (DOA), Veterinary and Tsetse Control Services (DVTCS), Fisheries and Water affairs--are serviced by a Planning Division and by a Headquarters Division. Research is carried out by the DOA, the DVTCS and the Fisheries Department. The Planning Division coordinates planning, compiles agricultural statistics, and monitors activities. It is headed by a Director who reports directly to the Permanent Secretary. The Headquarters Division is responsible for overall policy formulation and administration. It consists of four sections--Finance, Personnel, Administration, and Special Duties and Training--each of which is headed by an Assistant Secretary. The reorganisation and activities of the Training Section are discussed in Chapter IV of this report.

1. Department of Agriculture: Research Branch

The MAWD's Department of Agriculture (DOA) headed by a director, is responsible for research, extension and land use services. These functions are performed by the Research, Extension and Land Use Branches. The organisation and activities of the Extension Branch are discussed in Chapter V of this report.

a. Organisational structure and purpose

The Research Branch of DOA is headed by an Assistant Director, located at the MAWD headquarters in Lusaka, who is assisted by a Chief Agricultural Research Officer at the Mount Makulu Central Research Station 25 km southwest of Lusaka. Research is conducted at the Central Research Station, at nine regional stations and at 13 testing fields well-distributed through the four agro-ecological regions. (See Figure 6.)



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Figure 5: Organisational Structure of Agricultural Research Institutions

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

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Table 4: Agricultural Research Institutions: Funding, Location, Activities and Staff, 1984

<u>Institution</u>	<u>Funding^a</u>		<u>Location of Headquarters</u>	<u>Principal Research Activities</u>	<u>Number of Staff</u>				<u>Total</u>
	<u>Source</u>	<u>Amount</u> (000 US\$)			<u>Profes- sional</u>	<u>Adminis- trative</u>	<u>Technical^b</u>	<u>Support Services</u>	
Department of Agriculture Research Branch	MAWD	2,469	Mt. Makulu Chilanga	Research on crop improvement, soil productivity, seed services and food conservation and storage, animal husbandry.	117	11	81	112	321
DVTCS Research Division	MAWD	748	Balmoral Chilanga	Research on animal diseases, tsetse control and vaccine production.	12	3	10	69	94
Dept. of Fisheries Research Division	MAWD	207	Chilanga	Monitoring of primary fish productivity, fish biology, limnological studies of different fisheries and improvement of fishing craft.	9	4	16	95	124
School of Agricultural Sciences University of Zambia	MHE	138	Lusaka	Crop improvement and animal nutrition	8	2	16	78	104
Rural Studies Bureau University of Zambia	MHE		Lusaka	Socioeconomic aspects of rural population and farmers.	12	2	2	28	44

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 4: Agricultural Research Institutions: Funding, Location, Activities and Staff, 1984 (cont.)

<u>Institution</u>	<u>Funding^a</u>		<u>Location of Headquarters</u>	<u>Principal Research Activities</u>	<u>Number of Staff</u>				<u>Total</u>
	<u>Source</u>	<u>Amount (000 US\$)</u>			<u>Profes- sional</u>	<u>Adminis- trative</u>	<u>Technical^b</u>	<u>Support Services</u>	
National Council for Scientific Research (NCSR)	MHE	46 ^c	Lusaka	Animal produc- tivity, nutri- tion, disease and pest control; food technology and indigenous fruit trees improvements.	23	3	34	61	121
Forest Dept. Research Division	MLNR	431	Ndola	Forest silvicul- ture, pathology and updating of forest tree spe- cies herbarium; forest products research.	16	4	7	66	93
TOTAL		<u>4,039</u>			<u>197^d</u>	<u>29</u>	<u>166</u>	<u>509</u>	<u>901</u>

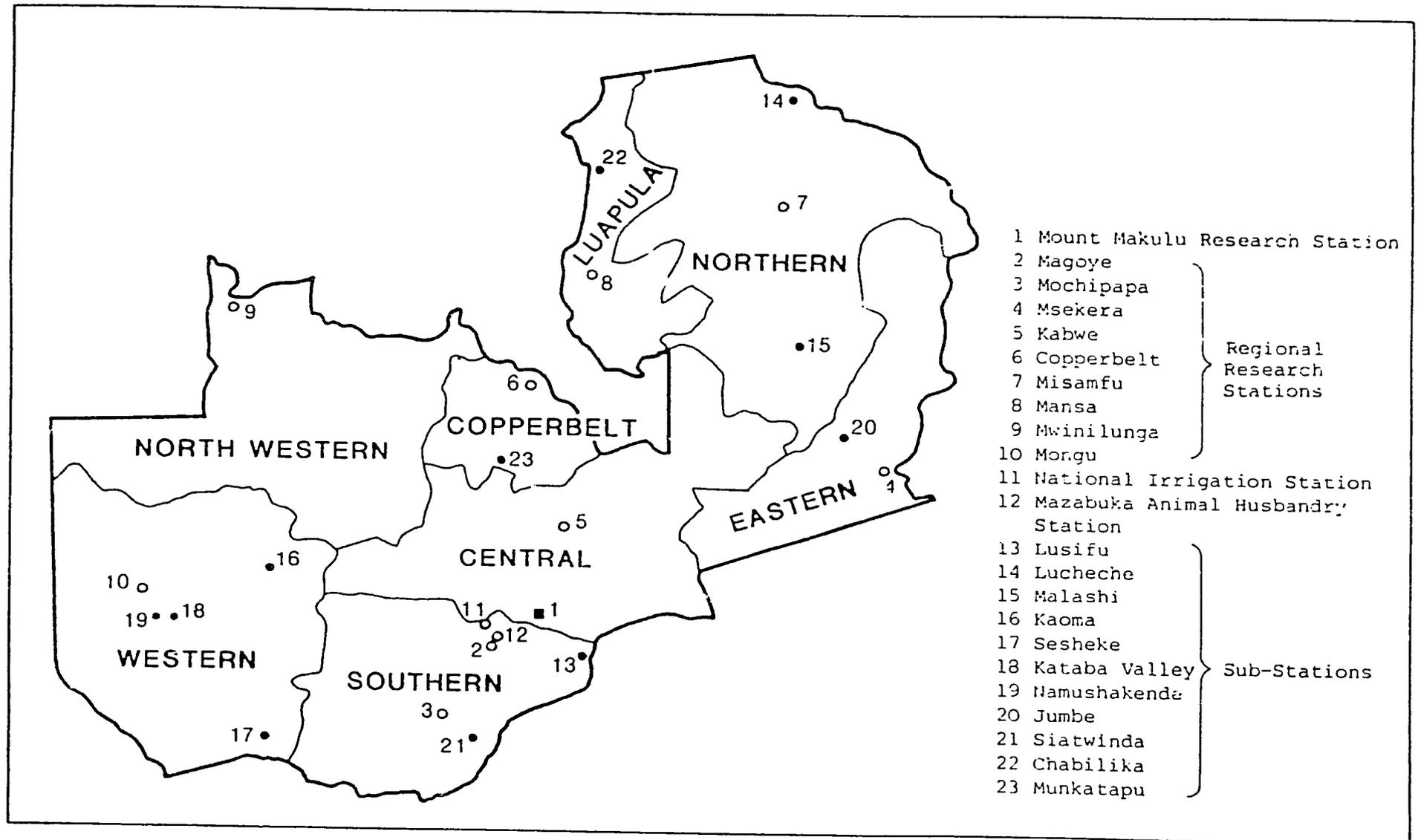
^aOnly GRZ funding sources are included in this table. Additional funding is provided by donor agencies. (See Table 10.)

^bTechnical = diplomate.

^cThe amount indicated excludes salaries and wages.

^dDiscrepancies between the figures in Tables 4 and 6 and those in Tables 5, 7, and 8 are due to changes in staffing levels between August and October.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.



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Figure 6: Location of Central, Regional and Sub-Station Research Stations of the Agricultural Research Branch of the Department of Agriculture

Source: The World Bank, Zambia Agricultural Research and Extension Review, October, 1983.

The priorities of agricultural research are designed to support the broad objectives of agricultural development identified in the Third National Development Plan (TNDP) of 1979-83. These objectives are:

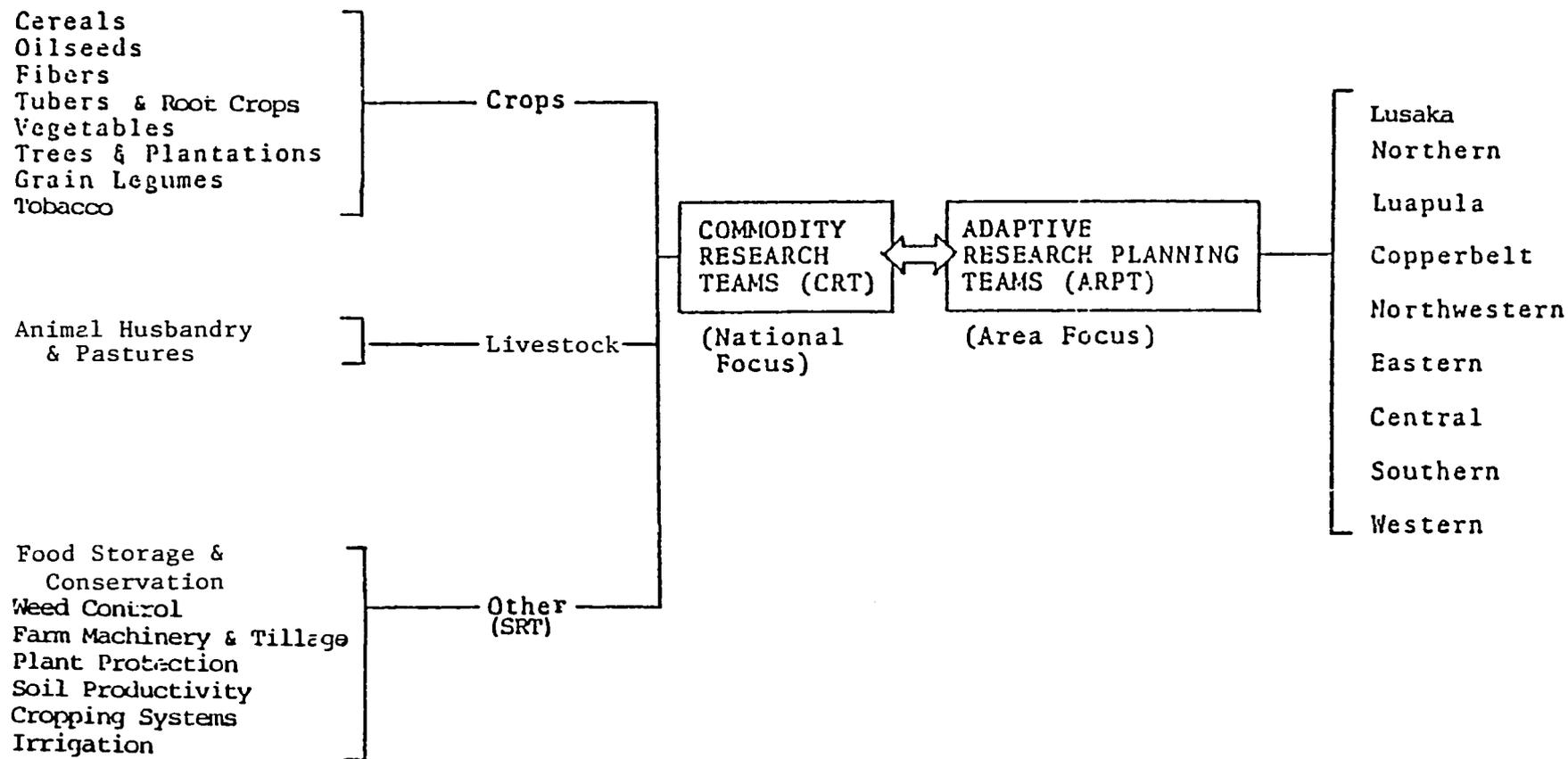
- o To achieve self-sufficiency in staple foods and, where feasible, to provide raw materials for agro-industries;
- o To stimulate and increase production for export;
- o To increase the contribution of the rural sector to the GNP and promote diversification of the rural economy;
- o To improve the rural population's standard of living and nutritional status; and
- o To create new employment and income opportunities in rural areas to counteract rural to urban migration.

The strategy for the agricultural sector is geared to the development needs of the following farming groups:

- o Traditional subsistence farmers;
- o Emergent (small-scale commercial) farmers;
- o Commercial farmers; and
- o State farms.

As a result of a recent reorganisation based on the objectives of the TNDP, the Research Branch of the DOA has been structured into Commodity and Specialist Research Teams (CSRTs) and Adaptive Research Planning Teams (ARPTs) as shown in Figure 7. The former, consisting of Commodity Research Teams (CRTs) and Specialist Research Teams (SRTs), conduct broad, applied agricultural research on given commodities to generate new technologies and to build up a pool of knowledge and expertise on specific commodities; the latter focus on the production constraints of given localities of farming systems. The ARPTs draw on the pool of knowledge generated by the CSRTs in developing potential technologies and solutions to local problems. The ARPTs are developing two-way communication links between the CSRTs and the farmers in specific target groups, involving extension staff at several levels.

The essential feature of this reorganisation is the institutionalisation of farming systems research through the ARPTs. Through a series of four sequential activities, these teams bring together biological and social scientists to describe and analyse local farming systems. They identify physical, biological, and socioeconomic production constraints and suggest ways of overcoming them.



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Figure 7: Structure of the Research Programme of the Department of Agriculture's Research Branch

Source: The World Bank, Zambia Agricultural Research and Extension Review, October, 1983.

As part of this process, the ARPTs conduct on-farm trials to test and verify the applicability of alternative production systems and technologies, with the overall objective of developing appropriate and relevant technological packages for each particular farming system. Through this approach, it is hoped that the technological packages developed will be more relevant and appropriate and, consequently, more readily adopted by a majority of the farmers in a given area.

b. Research programmes

(1) Cereals

Cereals receive the greatest amount of research attention, with multi-disciplinary teams working on the following crops:

- o Maize: efforts focus on improving the breeding and evaluation of inbred lines, the development and evaluation of new hybrids and composites, and screening for resistance to ear rots and leaf streak;
- o Wheat: research includes identification of resources of resistance to diseases and tolerance to aluminum toxicity, development and testing of disease-resistant and Al-tolerant varieties, and studies on liming materials and methods as a means of reducing Al toxicity;
- o Rice: work includes reselection, development and testing of varieties and the evaluation of upland varieties in collaboration with IITA and IRRI; and
- o Sorghum/millet: investigations include screening of local selections, multi-locational testing of selected exotic lines of adaptability, and international trials from ICRISAT, including hybrids and disease nurseries.

(2) Oilseeds

Oilseeds research includes work on the following crops:

- o Sunflower: research includes maintenance of breeding populations, selection of lines suitable for hybrids and composites, multi-locational testing of hybrids and composites, and breeding for disease resistance;
- o Groundnuts: work consists of agronomic trials and the evaluation of locally adapted and exotic varieties; and
- o Soybeans: investigations center on the evaluation of introduced varieties, screening to identify naturally nodulating material, and varietal trials.

(3) Grain legumes

The grain legumes programme involves the evaluation of local and exotic germplasm of Phaseolus beans, the identification of bean diseases, varietal trials on cowpeas, and the evaluation of locally-collected Bambara groundnuts and pigeon peas.

(4) Other food crops

Research is being conducted on a variety of other crops, including:

- o Roots and tubers: work involves the collection and maintenance of local germplasm, agronomic trials on cassava and sweet potato, and a survey of cassava pests and diseases;
- o Vegetables: research consists of varietal evaluations, agronomic trials, disease and insect control, and the production and maintenance of breeding stock for several vegetable crops; and
- o Tree and plantation crops: efforts entail performance testing and other agronomic trials on citrus and several tropical and temperate fruits. Work on coffee includes agronomic trials, observations of leaf rust, and varietal trials. The coffee programme includes both dryland production for small farmers and irrigated production for large-scale farmers.

(5) Fibre crops

Research on cotton involves the selection of suitable material for crossing, multi-locational testing, pest control studies, and the maintenance of stock for multiplication of recommended improved varieties.

(6) Animal husbandry and pastures

Animal husbandry studies include:

- o Estimation of heritability of live-weight gain in the Barotse breed on extensive grazing;
- o Establishment of pure breeding herds of Angoni, Boran and Tonga cattle;
- o Survey to identify constraints in traditional cattle production systems; and

- o Nutritional studies on seasonal feed intake, the effects of age of weaning, the improvement of feedstuffs, and natural and cultivated forages.

Pasture research includes work on:

- o Seed production trials for pasture legumes and grasses;
- o Improvement of dambo pastures through better management and the establishment of palatable grasses and legumes adaptable to wet conditions and through the application of fertilisers;
- o Ecological studies of veld areas in the Southern Province to identify suitable pasture plants and effective management practices to increase forage productivity.

(7) Soil productivity

Soil research includes studies on:

- o Agricultural productivity of the classified soils of Zambia;
- o Water infiltration and soil moisture characterisation;
- o Rock phosphate from local sources on different soil types;
- o Efficient use of applied fertilisers in intercropping systems;
- o Efficient use of nitrogen and water by irrigated wheat;
- o Variability in soil types in the Northern Province;
- o Soil analyses on grain size, CEC, exchangeable bases, organic matter, pH, Al, Mn and total N; and
- o Microbiological studies of Rhizobium inoculum for soybeans and groundnuts.

(8) Plant protection

Plant protection work is carried out on:

- o Biological control of insect pests on potatoes, cabbage, tomatoes and citrus;
- o Termite ecology;
- o Seed-borne fungi found on maize, beans and groundnuts, including routine analysis;

- o A local Zambian isolate of Verticillium dahline;
- o Cercospor angolensis on orange; and
- o Identification of the important plant viruses affecting beans, potatoes and oranges.

(9) Food conservation and storage

Post-harvest food research consists of:

- o Evaluation of improved grain storage structures;
- o Modification of the design of storage structures to reduce costs;
- o Studies on the control of storage pests; and
- o Surveys to determine current post-harvest losses of maize and other food crops.

(10) Adaptive research planning teams

The ARPTs conduct studies on:

- o Crop variety performances under small farmer management;
- o Intercropping of various crops with maize, beans and cassava;
- o Fertilisation and weeding practices on farmers' fields;
- o Farming area zones, classifying these based on farming practices used;
- o Characteristics of farming systems, based on both exploratory and indepth surveys focussing on farmer resources, management objectives, and strategies; and
- o Alternative systems of production appropriate for particular farming systems being studied, including on-farm validation of new technologies.

Based on these efforts, the ARPTs are identifying production constraints and assisting in planning research and strategies to overcome them.

c. Human resources

The staff of the DOA's Research Branch totals about 321 persons: of these, 117 are professionals, 11 are administrators, 81 are technical personnel and 112 are support staff. (See Table 4.) Of the professional staff, 55 are expatriates.

d. Research facilities

There is one central research station at Mount Makulu, Chilanga, as well as nine regional research stations and 13 research sites. At Chilanga there are enough administrative offices for the present number of staff. There is a sufficient number of laboratories for soil testing, plant protection, seed services and other general research work. There are also two conference rooms, a well-equipped garage for repair of government vehicles, and numerous storage sheds. At each of the regional stations, there is a conference room with a capacity of 50 people, an administrative block of about 15 offices, and another block housing storage and laboratory rooms. Each research station has sufficient land to conduct research on annual field crops.

e. Financial resources

The Research Branch's activities are normally financed by the MAWD through the Department of Agriculture. In the 1983 fiscal year, about K 4.4 million was spent on research activities. A substantial amount of this money was financed by different donor agencies.

2. Department of Veterinary and Tsetse Control Service

a. Organisational structure and purpose

Research has been conducted by the Research and Diagnostic Services section of this department since 1928. Prior to 1979, the work was conducted at the Central Veterinary Research Station at Mazabuka in the Southern Province. In 1979, the staff, facilities and services were moved to a new 3,750-acre site at Balmoral, about 25 km southwest of Lusaka, and renamed the Central Veterinary Research Institute (CVRI). The transfer coincided with the implementation of the FAO/UNDP Animal Disease Project (ZAM/77/002).

The CVRI is organised into eight units: epidemiology, protozoology, tick ecology, bacteriology, virology, pathology, helminthology and vaccine production. Several international organisations operate as an integral part of the institute. These include: FAO/UNDP, Dutch Technical Aid, the Arab League, Japan Overseas Cooperation Volunteers, the European Economic Community (EEC) and DANIDA.

The main objectives of the CVRI are to:

- o Provide laboratory diagnoses of animal diseases;
- o Conduct epizootiological surveillance and disease investigations;
- o Produce animal vaccines;

- o Conduct applied research; and
- o Disseminate scientific and technical information to the field services.

b. Research programmes

The principal diseases currently being investigated are East Coast Fever and other tick-borne diseases of cattle, trypanosomiasis, fertility disease, contagious bovine pleuropneumonia and other bacterial diseases, foot and mouth disease, and African Swine Fever. Bacterial vaccines for control of some animal diseases are being produced.

(1) East Coast Fever and other tick-borne diseases

Investigations into East Coast Fever (ECF) and other tick-borne diseases of cattle include:

- o Surveys and field studies to determine the distribution and economic importance of ECF and other tick-borne diseases;
- o Development of serological and other techniques for study of the epizootiology of tick-borne diseases;
- o Studies of the population dynamics and other aspects of tick biology;
- o Studies of the resistance of Zambian cattle breeds to ticks;
- o Development of techniques for testing the resistance of ticks to acaricides; and
- o Assistance in formulating a detailed plan for the control of ticks and tick-borne diseases.

(2) Tsetse and trypanosomiasis

Activities focussing on tsetse problems and trypanosomiasis include:

- o Surveys to determine the extent and economic importance of trypanosomiasis;
- o Evaluation of the effectiveness of present control methods and recommendations for improvements;
- o Feasibility studies in areas where tsetse control operations are planned;
- o Determination of the degree and extent of drug resistance against trypanocides currently being used; and

- o Assistance in strengthening present control operations and in formulating a long-term eradication plan.

(3) Reproductive and calf disorders

Activities addressing problems of reproduction and calf mortality include:

- o Determining the prevalence and economic importance of these problems and establishing priorities for the control of such disorders;
- o Development of programmes for control of reproductive diseases, including brucellosis (a bacterial disease); and
- o Assistance in the production of vaccines and antigens for brucellosis.

(4) Foot and mouth disease

Planned activities for the control of foot and mouth disease (FMD) include:

- o Conduct of surveys to determine the extent and economic importance of the disease;
- o Establishment of a virology laboratory in CVRI;
- o Advice on the procurement of type-specific and homologous vaccines; and
- o Formulation of a detailed plan for the control of FMD in Zambia.

(5) African swine fever

Activities addressing problems in swine production are focussed on African Swine Fever (ASF) and include:

- o Conduct of epizootiological surveys to determine the distribution and economic importance of ASF;
- o Studies on the importance of ticks as vectors of ASF; and
- o Establishment of routine procedures for a control programme for the disease.

(6) Other diseases

Efforts towards the control of bacterial and other diseases include:

- o Serological surveys on contagious bovine pleuropneumonia, haemorrhagic septicaemia and other diseases, to determine their distribution and economic importance;
- o Improvement of the procedures used for the diagnosis of bacterial diseases;
- o Production of basic bacterial vaccines and diagnostic reagents; and
- o Assistance in formulating and executing a detailed plan for control of the major bacterial diseases.

c. Human resources

There are 12 professional, three administrative, ten technical, and 69 support staff at the CVRI. (See Table 4.) Of the 17 administrative and professional staff, 13 are expatriates; eight out of the 13 are funded by donor agencies such as FAO, DANIDA, EEC and UNDP.

d. Research facilities

There are modern buildings at CVRI's base in Balmoral, with ten administrative offices and well-equipped laboratories for various types of research activities. Plans are underway to construct another block of laboratories. Two thousand ha of land surround the Centre and are used for rearing of research animals. There also are one conference room, a garage, a shop, storerooms and animal sheds.

e. Financial resources

A large proportion of the funding is provided by donor agencies. The estimated expenditure on recurrent (operating) costs for 1984 was K 1.3 million.

3. Department of Fisheries

a. Organisational structure and purpose

The Research Division of the MAWD's Department of Fisheries has its headquarters at Chilanga, about 25 km southwest of Lusaka. It also operates seven field stations located on the major fishing waters, i.e., on Lake Kariba, Lake Bangweulu, Lake Mweru, Lake Tanganyika, Lake Mweru-Wa-Ntipa, Kafue flood plain and the Itezhi-tezhi reservoir.

b. Research programmes

The major fisheries research programmes are: production studies of new man-made lakes; investigation of phytoplankton

periodicity; ecological studies of zooplankton; monitoring of primary productivity; and fish biology studies, including work on the breeding habits of different species.

Current limnological studies of Lake Itezhi-tezhi include measurements of water temperature, turbidity and chemistry, lake level, and phytoplankton densities. These data will be used to construct an ecosystem model for the lake. The productivity of Itezhi-tezhi is being monitored by gill-netting at various depths and locations, to elucidate the breeding patterns and growth rates of its several fish species. The data will be used to estimate the productivity of the lake and to provide an analysis for developing management strategies to insure the lake's long-term productivity.

On Lake Kariba, field studies are being made on the population density of Kapenta (Limnothissa miodon, sp.), a small sardine-like fish that was introduced shortly after the completion of the Kariba Dam. The production dynamics of other fish species are being studied by gill-netting at both in-shore and off-shore sites, with the same objectives as those of the Lake Itezhi-tezhi studies.

The kafue gill-netting programme is focussed on the changes in fish-breeding patterns associated with variations in water levels above the gorge which have been altered by the construction of the Kafue Dam. This has significantly changed the fish-breeding ecology of this water course.

Gill-netting studies similar to those described above are being conducted in Lake Bangweulu, Lake Tanganyika and Lake Mweru. For the border lakes, studies should be jointly planned and executed by investigators from the neighbouring countries.

c. Human resources

The research staff consists of nine professionals, 16 technicians, four administrators and 95 support staff. (See Table 4.) Five of the current professional staff are expatriates.

d. Research facilities

The Research Division has a laboratory, a library and a fisheries museum at Chilanga. There are three office blocks which each house about seven offices. There are 80 offices altogether, including those in other stations. The Division has one classroom with a capacity of 20 people which is used for meetings. There is also a fish processing research shed which is not being used.

e. Financial resources

The 1984 budget for fisheries research consisted of K 287,000 for salaries and wages and K 73,000 for other operating costs.

C. Agricultural Research Institutions of the Ministry of Higher Education

1. School of Agricultural Sciences of the University of Zambia

a. Organisational structure and purpose

The University of Zambia (UNZA), established in 1966, has an enrollment of about 3,000 students. It is supported by a K 24 million grant-in-aid from the Ministry of Higher Education. UNZA's School of Agricultural Sciences (SAS), established in 1971 on the Lusaka campus of the University, offers a five-year programme leading to the BSc degree. The teaching activities of the SAS are discussed in Chapter IV. Agricultural research is being conducted by the staff of the SAS, as well as by the Rural Development Studies Bureau.

The SAS is divided into the departments of animal science, crop science, soil science, agricultural engineering, rural economy, and extension education.

b. Research programmes

The major lines of research are breeding programmes for wheat, triticale and maize conducted by the crop science staff and investigations in animal nutrition by the animal science staff. The crop breeding work is focussed on the development and testing of improved lines and varieties, and involves linkages with CIMMYT. The animal nutrition studies are focussed on the evaluation of stockfeeds formulated from locally-produced ingredients. Both of these research programs are funded in part by CIDA. A limited amount of research is also conducted on fruit and vegetable production, soil and water conservation, irrigation, and rural technology, including farm storage and crop processing. There is some collaboration between the UNZA and the Research Branch of the MAWD, but this is largely informal and between individual scientists.

It is anticipated that the School's research work will increase steadily as the staff now in training return and the MSc programmes now being formulated begin.

c. Human resources

The SAS has a total of 32 authorised professional posts; of these, 11 are filled by Zambian citizens and 18 by expatriates, three of whom are supported by donor funds. Three posts are currently vacant. There are 14 Zambians and two expatriates in technical posts. Three of the technical and 11 of the professional staff are currently in training. Only about one-fourth of the time is devoted to research work; the rest is given to training.

d. Research facilities

The SAS has an office block with more than 20 offices. There also is a conference/coffee room, as well as a field station with animal sheds and stores. The school has a production/research farm 20 km away, and three laboratories which are still insufficient. There are facilities for teaching, research on and production of poultry, swine, sheep, goats, beef and dairy cattle. For library services, staff and students use the main UNZA Library. The school has one bomb calorimeter and an atomic absorption spectrometer.

e. Financial resources

The 1984 budget for the School of Agricultural Sciences includes K 98,000 for emoluments and K 198,000 for operating expenses. The School also received a K 20,000 allotment for research from the K 100,000 UNZA budget. Donor funds are an important source of support for faculty research. It is estimated that one-fourth of the staff time and funds are devoted to research.

2. Rural Development Studies Bureau of the University of Zambia

a. Organisational structure and purpose

The Rural Development Studies Bureau (RDSB) was established by the UNZA in 1972 to undertake policy-oriented research on problems of rural development in the country. Its main objectives are to:

- o Advise and inform GRZ departments and agencies on rural development;
- o Conduct any necessary studies on specific problems encountered in rural development programmes;
- o Collect data and materials relevant to the rural areas;
- o Assist in evaluating rural development programmes;
- o Provide policy guidance on rural development; and
- o Conduct independent research approved by UNZA on Zambia's rural development problems.

The RDSB has been designated by GRZ as the National Integrated Rural Development Centre (NIRDC). As such, it is the Zambian component of the Centre on Integrated Rural Development for Africa (CIRDAFRICA), whose headquarters is in Arusha, Tanzania. CIRDAFRICA was established by the African Ministries of Agriculture at the 10th FAO regional conference on agriculture to carry out the following functions:

- o Identification through research of means of improving rural peoples' production, income, living standards, and nutrition.
- o Identification of methods to encourage rural people to participate in development programmes; and
- o Collection and dissemination of information relating to rural development.

b. Research programmes

The research projects in progress include:

- o Demographic impact of agricultural modernisation: Work was initiated in 1982 and is funded by IDRC. It involves collaboration with University of North Carolina and UNZA;
- o Ecological and socioeconomic influences on cattle cooperatives in the Western Province: Project started in 1983 and is funded by the Western Province Cooperative Union;
- o Socioeconomic survey of Kapompo District: Work began in 1983 and involves collaboration of a German consultant. Project is funded by West Germany and IRDP;
- o Inventory of small-scale rural industries: Work started in 1983 and is funded by SIDA;
- o Oxen cultivation survey: Study was initiated in 1983 in collaboration with NIRDC, and is funded by MAWD;
- o Rural inequality in the Southern Province: The work was started in 1982, and is funded by UNZA and MAWD/USAID;
- o Input utilisation in the agricultural sector: Project began in 1983 with funding by UNZA and MAWD/USAID;
- o Evaluation of the Africare rice project in Chama District: Work was initiated in 1983 and funded by UNZA;

During the past decade, RDSB has published 44 publications, most of which are on socioeconomic aspects of rural life and development.

c. Human resources

The academic staff of RDSB currently consists of a director, a research professor, two senior research fellows, eight research fellows, a staff development fellow and two field assistants. Of these, four have PhD degrees and eight have MA/MSc degrees. Four of the research fellows are on study leave.

d. Research facilities

The RDSB has an office block accommodating all of its research staff. Most of their work is done in the field: their main research holdings consist of vehicles.

3. National Council for Scientific Research

a. Organisational structure and purpose

The National Council for Scientific Research (NCSR) was established by the Zambian Parliament in 1967, coming under the aegis of the MHE. Its main functions are to advise the Government on national research policy and to coordinate and promote scientific research needed for national development. It is governed by a Council of 20 members chaired by the Prime Minister. The Council is advised by four research committees, including one focussed on agricultural and natural resources research. This last committee establishes agricultural research priorities, identifies gaps in programmes, and recommends to the Council the infrastructure and facilities needed for the execution of those activities and programmes. In addition to its advisory and coordinating role, the NCSR conducts research and development work in several fields relevant to this report.

b. Research programmes

(1) Livestock pests and disease

The Livestock Pests and Disease Control Centre (LPDCC), located at Mount Makulu, was established under the aegis of the Agricultural Research Council, which became part of NCSR when the latter was established. Linkages are not effective between this programme and the one being conducted at the MAWD's Central Veterinary Research Institute less than 10 km away.

(2) Infertility

An experimental antigen for local strains of brucellosis has reduced the high incident of brucellosis in most cattle areas of Zambia. Simple management interventions suitable for the traditional ranchers are being studied. The major causes of infertility in cattle in the traditional sector, including low bull-to-cow ratios and poor-quality semen, are being investigated.

(3) Livestock nutrition

This study aims to identify and solve nutritional problems constraining livestock production. A survey monitoring the seasonal fluctuations of nutrients in the peripheral blood of traditionally-managed cattle has been initiated. Feeding trials with beef cattle to prevent dry season weight loss have shown the efficacy of plain maize bran. The value of maximum utilisation of local oil

seed cakes in poultry and pig rations also has been established. A pilot survey has been conducted to assess the nature and extent of mycotoxin contamination in foods and feeds in Zambia.

(4) Tsetse

This study aims to delineate ecological parameters affecting the multiplication and survival of tsetse vectors of livestock trypanosomiasis. Intensive studies of the population ecology of tsetse were conducted in the Chakwenga Game Reserve from 1971 to 1978 and at Lutale near Mumbwa from 1980 to the present. These have been helpful in the development of control strategies. Some physiological studies on tsetse have been conducted for producing sterile male flies. A pilot study on the use of sterile males in tsetse control in selected Zambian habitats has been initiated.

(5) Tick-borne diseases

This study aims to delineate the ecological factors affecting tick reproduction and their role in the epizootiology of several major tick-borne livestock diseases. A survey focussing on ticks occurring in Zambia has been conducted and a monograph on their distribution, ecology and host relations has been written. Intensive studies on the biology of major tick species and their seasonal population dynamics have been conducted at Mount Makulu and Chadiza field stations.

Studies were carried out at villages in Chadiza, Eastern Province to evaluate the efficacy of acaricides on the tick vectors of theileriosis.

(6) Food technology

The food technology research unit conducts research to develop and/or adapt processing technologies for the preservation and use of local raw food materials. It promotes and disseminates low-cost food processing technologies to small-scale industries and among low-income families in rural and urban areas. Current projects include developing technologies for products made from fruits, vegetables, cereals, legumes, roots and tubers.

A carbonated guava drink has been produced and a process for its manufacture standardised. Locally-grown tomato varieties have been evaluated for production of purees and ketchup. A pilot project to disseminate a simple process for making squashes with longer shelf life from masuku has been initiated in the Choma area. A study to evaluate and improve the traditional technologies for solar drying of vegetables also has been initiated.

Cereal legume composite flours having higher protein content have been formulated for infant feeding. Three products have been developed to the commercialisation stage. A high-protein biscuit is

now in commercial production. Good-quality biscuits have been based on cassava/wheat composite flour and the process standardised. A process for starch production from cassava has also been standardised.

A variety of wines have been produced from fruits such as masuku, pineapple and pineapple cannery wastes. The processes have reached pilot plant level. Other alcoholic drinks have been produced on a small scale.

c. Human resources

NCSR has a total staff of 121 and a professional staff of 23. Of these, nine have PhDs, 10 MScs and four have BSc degrees. Except for two expatriate PhDs, all of the professional staff are Zambians. The technical staff consist of 34 diplomates and others at the certificate level. There are 64 support staff members, including 3 administrators. (See Table 4.)

d. Research facilities

The LPDCC has modern laboratory facilities and field equipment. Its station facilities include those for indoor testing of tsetse flies and ticks, assessing the nutritional status of animal feeds, and studying infertility in cattle.

e. Financial resources

The recurrent operating costs for the LPDCC in 1984 were estimated at K 80,000 excluding salaries, wages and other funds from donor sources. Normal funding of all research programmes come as grants from the government through the Ministry of Higher Education. No data were readily available on operating costs for the Food Technology Research Section.

D. Agricultural Research Institutions of the Ministry of Lands and Natural Resources

The Forestry Department of the MLNP is responsible for all forestry matters in Zambia. Its activities are organised by division. Research is conducted by the Forest Research and Forest Products Research Divisions, both of which are located in Kitwe.

1. Forest Research Division of the Forestry Department

a. Organisational structure and purpose

The main work of the Forest Research Division of the Forestry Department is to discover the best ways of growing healthy trees. This includes studies of seed production, nursery techniques, growth rates, soil characteristics, land preparation and different tending methods. Both indigenous and exotic tree species are covered by the research programmes.

b. Research programmes

Research programmes and projects include the following:

- o Forest pathology, which is mainly with the prevention and cure of fungal diseases of trees;
- o Forest entomology, which involves studies of insect pests of living trees and timber and means of controlling them;
- o The Herbarium, which maintains a collection of dried material, leaves, and fruit, covering most of the trees found in Zambia. The Herbarium also contains detailed ecological records dating back to the beginning of the Department;
- o Seed store, which contains seeds mainly of exotic pines and eucalyptus. These are collected, tested and stored ready for distribution for the establishment of plantations. Some seeds are made available to the public;
- o Soil testing laboratory, which is concerned mainly with the selection of plantation sites; and
- o Forest genetics, which involves tree breeding, the production of improved seed, and seed orchards for production of seed for plantations.

c. Human resources

This unit has a Zambian staff of seven professionals and 11 technicians. In addition, there are four expatriate professionals supported by donor programmes.

d. Research facilities

The research centre is located in Kitwe. It has sufficient offices, laboratories, and equipment.

e. Financial resources

The Zambian recurrent and capital budgets for 1984 were K 250,000 and K 300,000 respectively. The 1984 FINNIDA allocation was K 200,000.

2. Forest Products Research Division of the Forestry Department

a. Organisational structure and purpose

This division of the Forestry Department is concerned with developing the best uses of different timbers, both indigenous and exotic.

b. Research programmes

The Forest Products Division's principal areas of work are:

- o Sawmilling--to devise improved sawing techniques for various timbers, to advise on machinery, and to assist with the creation of Forestry Department mills;
- o Preservation--to develop means of preserving timber against insects, fungi and weather. Trials are carried out using a pressure cylinder to impregnate wood with various chemicals and oils. The section also conducts long-term field durability trials for railway sleepers and underground mining timbers;
- o Seasoning--to determine how best to condition timber for use and increase its durability; and
- o Strength-testing--to determine how various timbers with stand stress.

Data from forest products research are used by the Timber Engineering Section, which designs timber structures such as roof trusses, prefabricated housing units, and furniture. The Division of Forest Products also advises the public on the uses and preservation of various timbers and provides some designs.

c. Human resources

The division has a Zambian staff of six professional and seven technical personnel, who are augmented by three expatriate professionals supported by FINNIDA.

d. Research facilities

The division has sawmill facilities and testing facilities where timber products are evaluated.

e. Financial resources

The Zambian recurrent budget for 1984 was K 200,000, and the capital budget K 63,000. This was supplemented by K 200,000 from the FINNIDA project.

E. Total Human Resources Available for Agricultural Research

1. Staffing patterns

As of September 1984, there were a total of 28 administrative, 212 professional, 135 technical and 349 support staff in research institutions. (Table 5.) The administrative posts are all filled by Zambians. At the professional level, 21 percent of the

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Table 5: Total Agricultural Research Staff, October, 1984

	<u>Administrative</u>	<u>Professional^a</u>	<u>Technical^b</u>	<u>Support Staff</u>	<u>Total</u>
<u>Total Authorized Posts</u>	27	135	120	294	576
<u>Positions Vacant</u>	-	-	-	-	-
<u>Nationals (Citizens)</u>					
Staff in training	-	29	9	-	38
Staff on long-term leave ^c	-	4	1	-	5
Number of nationals currently in posts	27	112	133	349	621
Expressed as a percentage of authorized posts	100	83	110	119	108
<u>Expatriates</u>					
Serving in authorized posts ^d	-	29	1	-	30
Expressed as a percentage of authorized posts	-	21	0.8	-	5
Not in authorized posts	1	71	1	-	73
Total number of expatriates	1	100	2	-	103
<u>Total Number of Staff</u>	<u>28</u>	<u>212^e</u>	<u>135</u>	<u>349</u>	<u>724</u>

^aProfessional = BSc or above.

^bTechnical = diplomate.

^cLong-term leave is leave of three months or more.

^dIrrespective of source of funds.

^eDiscrepancies between the figures in Tables 4 and 6 and those in Tables 5, 7, and 8 are due to changes in staffing levels between August and October.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

authorised posts are still occupied by expatriates; at the technical and support levels, the number of expatriates is negligible. As the government has an obligation to employ graduates from the training colleges, the actual number of staff in posts may exceed the total number of authorised posts.

Programme areas, disciplines, and levels of training received for national and expatriate agricultural professional research staff are shown in Tables 6, 7 and 8.

The largest percentage of the professional research effort is directed to livestock (26 percent) and fisheries (7 percent), and to food crop research (29 percent). Eleven percent of the research effort is directed to farming systems and 10 percent to commercial crops. (See Table 6.)

The academic background of the staff is shown by programme areas of work in Table 7 and by discipline area of highest degree held in Table 8. The latter Table indicates there are 11 Zambian citizens and 28 expatriates with PhDs and 48 Zambians and 54 expatriates with MSc degrees currently employed by the research institutions.

2. Staff training

Training activities and plans for the staff of the agricultural research institutions are shown in Table 9.

F. Total Financial Resources Available for Research

The total GRZ funds expended in 1984 for all research institutions is estimated to be about K 15.5 million or US \$4,039. (See Table 4 which includes only the GRZ funding.) Of this, more than one-half was spent by the Research Branch of the Department of Agriculture, which focusses on food crops research. The second largest amount was allocated to veterinary research, carried out by NCSR and the Veterinary Department. Although these amounts seem relatively large in relation to training, they do not adequately cover all that needs to be done by the research institutions.

A very large proportion of the total amount spent on agricultural research is contributed by donor agencies who provide personnel, equipment, and transport. The agricultural research activities carried out by donor countries and institutions are listed in Table 10. Expatriate technical support and donor and Zambian contributions for each programme area as of July 1984 are summarised in this Table. (The discrepancies between the totals of expatriates not in authorized posts in Tables 5 and 10 are due to changes in staffing levels between August and October.) The estimated annual total donor funding is US \$8.6 million, which when added to the GRZ contribution of approximately US \$4 million, results in an estimated total of US \$12.6 million spent on agricultural research in Zambia in the current year. Two thirds, or 68 percent, of the total was provided by donors.

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 6: Summary of Professional Staff Effort and Source of Funds
by Programme Area of Agricultural Research, August 1984^a

<u>Commodity-Related Programme Areas</u>	<u>FTE^b</u>	<u>Source of Funds</u>	<u>Percentage of National Research Effort</u>
<u>Food Crops</u>			
Maize		SIDA, IFAD	
Sorghum		Government	
Millet		University of Zambia	
Cassava		CIDA	
Wheat		Belgium Aid	
Rice		USAID	
Pulses		FAO	
Subtotal, Food Crops	<u>57.0</u>		<u>29</u>
<u>Commercial Crops</u>			
Tobacco		Government	
Cotton			
Sugar cane		Nakambala Sugar Estate	
Fruit and vegetables			
Tea		France	
Coffee		SIDA	
Groundnuts		FAO	
Subtotal, Commercial Crops	<u>20.0</u>		<u>10</u>
<u>Livestock/Fisheries</u>			
Veterinary & tsetse control		Government	
Animal nutrition	51.0	FAO	26
Pasture management		SIDA	
Animal husbandry			
Inland fisheries	<u>9.0</u>		<u>4</u>
Subtotal, Livestock/ Fisheries	<u>60.0</u>		<u>30</u>

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 6: Summary of Professional Staff Effort and Source of Funds by Programme Area of Agricultural Research, 1984^a (cont.)

<u>Commodity-Related Programme Areas</u>	<u>FTE^b</u>	<u>Source of Funds</u>	<u>Percentage of National Research Effort</u>
<u>Other Programme Areas</u>			
Farming systems	22	CIMMYT	11
Farm power	1	NORAD	
Food storage and conservation	2	SIDA	
Soils land water conservation	12	Government	1.0
Agro forestry	9	USAID	6
		Netherlands	4
		FINNIDA	
		World Bank	
		FAO	
Biometrics	1		
Rural institutions	12	Government	6
Librarianship	1		
Subtotal, Other Programme Areas	<u>60</u>		<u>31</u>
TOTAL	<u>197^c</u>		<u>100.0</u>

56

^a Professional staff are those with a BSc degree or above.

^b FTE = Full Time Equivalent.

^c Discrepancies between the figures in Tables 4 and 6 and those in Tables 5, 7, and 8 are due to changes in staffing levels between August and October.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 7: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984

<u>Programme Area</u>	<u>Discipline Areas</u>	<u>Number of Professionals</u>						<u>Total</u>
		<u>Nationals</u>			<u>Expatriates</u>			
		<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	
<u>Food Crops</u>								
Maize	Plant breeding, agronomy, crop physiology, entomology, general	10	2	1	4	-	3	20
Wheat	Plant breeding, agronomy, plant pathology	2	2	-	6	1	2	13
Sorghum/Millet	Plant breeding, agronomy, plant pathology	1	-	-	1	-	1	3
Rice	Agronomy	1	1	-	-	-	1	3
Root and tubers (cassava and potatoes)	Agronomy	1	-	-	-	-	-	1
Grain/Legumes	Agronomy, plant protection	3	-	-	-	-	3	6
Subtotal, Food Crops		<u>18</u>	<u>5</u>	<u>1</u>	<u>11</u>	<u>1</u>	<u>10</u>	<u>46</u>

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 7: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984 (cont.)

<u>Programme Area</u>	<u>Discipline Areas</u>	<u>Number of Professionals</u>						<u>Total</u>
		<u>Nationals</u>			<u>Expatriates</u>			
		<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	
<u>Commercial Crops</u>								
Oilseeds:								
Sunflower	Agronomy, breeding	1	4	-	-	4	4	13
Groundnuts								
Cotton								
Vegetables	Breeding	2	-	-	-	-	2	4
Tree crops	Agronomy	1	1	-	-	1	1	4
Tobacco	Agronomy, breeding	1	-	-	-	-	-	1
Fibres:								
Cotton	Agronomy and plant breeding	-	1	-	2	1	-	4
Kenaf								
Subtotal, Commercial Crops		<u>5</u>	<u>6</u>	<u>-</u>	<u>2</u>	<u>6</u>	<u>7</u>	<u>26</u>
<u>Livestock/Fisheries</u>								
Cattle	Animal productivity and disease control, general animal science	9	20	9	1	5	8	52
Pigs								
Sheep								
Goats								
Poultry								
Fisheries	Limnological studies, sustainable yield estimates	2	1	-	3	1	2	9
Subtotal, Livestock/Fisheries		<u>11</u>	<u>21</u>	<u>9</u>	<u>4</u>	<u>6</u>	<u>10</u>	<u>61</u>

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 7: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984 (cont.)

<u>Programme Area</u>	<u>Discipline Areas</u>	<u>Number of Professionals</u>						<u>Total</u>
		<u>Nationals</u>			<u>Expatriates</u>			
		<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	
<u>Other Programmes</u>								
Cropping systems	Multiple cropping, intercropping	1	-	-	-	-	-	1
Weed control	Weed biology, herbicide trials	1	-	-	-	-	-	1
Soil productivity	Soil survey, classification, chemical and physical properties	4	3	-	1	3	1	12
Plant protection	Plant entomology, nematology and pathology	2	3	1	3	-	-	9
Food storage	Pesticide and herbicide residue, storage entomology	1	1	-	-	-	-	2
Irrigation	Evapotranspiration and water balance measurements	1	1	-	-	-	1	3
Adaptive Research Planning team	Agronomic and socio-economic on-farm trials	7	2	-	4	6	3	22
Seed certification	Seed crop inspection, germination and purity tests	3	-	-	-	-	-	3

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 7: Disciplines of Professional Staff Related to Agricultural Research Programme Area, 1984 (cont.)

<u>Programme Area</u>	<u>Discipline Areas</u>	<u>Number of Professionals</u>						<u>Total</u>
		<u>Nationals</u>			<u>Expatriates</u>			
		<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	
<u>Other Programmes (cont.)</u>								
Biometrics	Design and analysis of agricultural experiments	-	1	-	-	-	-	1
Forest research	Forest entomology, pathology, silviculture, products	5	2	-	-	2	2	11
Librarianship		1	-	-	-	-	-	1
Socioeconomic studies	Policy oriented rural development studies	1	8	2	-	-	2	13
Subtotal, Other Programmes		<u>27</u>	<u>21</u>	<u>3</u>	<u>8</u>	<u>11</u>	<u>9</u>	<u>79</u>
TOTAL		<u>61</u>	<u>53</u>	<u>13</u>	<u>25</u>	<u>24</u>	<u>36</u>	<u>212^a</u>

^aDiscrepancies between the figures in Tables 4 and 6 and those in Tables 5, 7, and 8 are due to changes in staffing levels between August and October.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 8: Summary of Technical Skills of Agricultural Research Professionals by Degree Held, 1984

<u>Discipline Areas</u>	<u>Nationals</u>				<u>Expatriates</u>				<u>Total</u>
	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>Subtotal</u>	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>Subtotal</u>	
<u>Plant/Soil Sciences</u>									
Crop sciences									
(general)	30	3	-	33	-	2	1	3	36
Agronomy	-	4	1	5	3	6	2	11	16
Entomology	-	2	-	2	-	3	-	3	5
Horticulture	-	2	-	2	-	3	2	5	7
Pathology	-	2	2	4	-	4	-	4	8
Range/Pasture	-	-	-	-	-	-	2	2	2
Plant/Soil sciences									
(general)	3	3	1	7	3	5	1	9	16
Crop breeding	-	10	-	10	-	8	5	13	23
Subtotal, Plant/ Soil Sciences	<u>33</u>	<u>26</u>	<u>4</u>	<u>63</u>	<u>6</u>	<u>31</u>	<u>13</u>	<u>50</u>	<u>113</u>
<u>Animal Sciences</u>									
Animal sciences									
(general)	2	2	1	5	3	5	1	9	14
Animal breeding	-	-	-	-	-	-	1	1	1
Animal nutrition	-	3	1	4	-	1	-	1	5
Animal pathology	2	-	-	2	-	4	3	7	9
Animal physiology	1	2	1	4	1	1	2	4	8
Animal production	-	2	-	2	-	1	-	1	3
Entomology	-	1	3	4	-	-	-	-	4
Toxicology	-	2	-	2	-	1	1	2	4
Subtotal, Animal Sciences	<u>5</u>	<u>12</u>	<u>6</u>	<u>23</u>	<u>4</u>	<u>13</u>	<u>8</u>	<u>25</u>	<u>48</u>

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 8: Summary of Technical Skills of Agricultural Research Professionals by Degree Held, 1984 (cont.)

<u>Discipline Areas</u>	<u>Nationals</u>				<u>Expatriates</u>				<u>Total</u>
	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>Subtotal</u>	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>Subtotal</u>	
<u>Other Disciplines</u>									
Agriculture/bio-chemistry	-	1	-	1	-	-	-	-	1
Agr. economics	4	3	-	7	-	1	-	1	8
Agr. engineering	1	1	-	2	-	3	-	3	5
Extension specialist	-	1	-	1	-	1	-	1	2
Rural sociology	-	-	-	-	-	1	1	2	2
Statistics	-	-	-	-	-	1	-	1	1
Fisheries (general)	2	1	-	3	3	1	2	6	9
Forestry	9	2	-	11	-	1	2	3	14
Other	3	1	1	5	1	1	2	4	9
Subtotal, Other Disciplines	<u>19</u>	<u>10</u>	<u>1</u>	<u>30</u>	<u>4</u>	<u>10</u>	<u>7</u>	<u>21</u>	<u>51</u>
TOTAL	<u>57</u>	<u>48</u>	<u>11</u>	<u>116</u>	<u>14</u>	<u>54</u>	<u>28</u>	<u>96</u>	<u>212^a</u>

^aDiscrepancies between the figures in Tables 4 and 6 and Tables 5, 7, and 8 are due to changes in staffing levels between August and October.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 9: Training Plans for Staff of Agricultural Research Institutions, 1984.

<u>Level</u>	<u>General Field of Study</u>							<u>Total</u>
	<u>Crop Science</u>	<u>Animal Science</u>	<u>Veterinary</u>	<u>Forestry</u>	<u>Economics</u>	<u>Fisheries</u>	<u>Other^a</u>	
<u>Current Situation</u>								
Doctorate	6	1	2	-	1	-	2	12
Masters	8	-	5	-	-	-	1	14
Bachelors	-	-	-	-	-	-	4	4
Subtotal, Current Situation	<u>14</u>	<u>1</u>	<u>7</u>	<u>-</u>	<u>1</u>	<u>-</u>	<u>7</u>	<u>30</u>
<u>Future Plans</u>								
Doctorate	11	7	6	1	4	1	5	35
Masters	29	5	5	2	11	4	19	75
Bachelors	17	4	-	1	-	2	14	38
Diploma	17	7	-	-	-	2	50	76
Certificate	<u>26</u>	<u>8</u>	<u>8</u>	<u>-</u>	<u>-</u>	<u>1</u>	<u>47</u>	<u>90</u>
Subtotal, Future Plans	<u>100</u>	<u>31</u>	<u>19</u>	<u>4</u>	<u>15</u>	<u>10</u>	<u>135</u>	<u>314</u>

^aOther fields including soil chemistry, seed technology, plant protection and in disciplines supporting the Adaptive Research System.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 10: Donor-Funded Agricultural Research Activities, 1984

Donor Country/ Institution	Activity	Expected Results	Duration	Expatriate Technical Support (FTE) ^c	Country ^a Contribution (000 US\$)	Donor Contribution ^b	
						Recurrent (000 US\$)	Capital (000 US\$)
Netherlands	Adaptive research planning team.	Carry out on-farm research in Western Province.	1981-1984	2	18	400	-
Norway/NORAD	Soil productivity and research programme.	A long-term research programme in high rainfall areas.	ongoing	-	-	354	-
Norway/NORAD	Soil survey.	Nationwide soil mapping from available data.	ongoing	7	100	1,051	-
UNDP/FAO	Animal disease control project.	Equipment, training advisory services and research on major live-stock diseases.	1977-1986	10	565	3,228	1,076
UNDP/FAO	National oilseeds development.	Provision of research equipment, training of staff and improvement of oilseed crops such as sunflower, soybeans, grounds.	1978-1985	3	-	1,513	504

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 10: Donor-Funded Agricultural Research Activities, 1984 (cont.)

<u>Donor Country/ Institution</u>	<u>Activity</u>	<u>Expected Results</u>	<u>Duration</u>	<u>Expatriate Technical Support (FTE)^c</u>	<u>Country^a Contribution (000 US\$)</u>	<u>Donor Contribution^b</u>	
						<u>Recurrent (000 US\$)</u>	<u>Capital (000 US\$)</u>
FAO/Norway	Development of pest and disease resistance in maize.	Development of new improved hybrid maize for large scale production with emphasis on disease and pest resistance.	extended from 1982 - ongoing	1	-	524	-
IAEA	Tsetse fly control.	Development of sterile insect technique and its application for tsetse control.	ongoing since 1980.	2	-	155	52
IAEA	Radioisotopes in agriculture.	Introduction of nuclear techniques in the use of nitrogenous and phosphate fertilizers to improve crop yields.	1979 - ongoing	2	-	183	-

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 10: Donor-Funded Agricultural Research Activities, 1984 (cont.)

<u>Donor Country/ Institution</u>	<u>Activity</u>	<u>Expected Results</u>	<u>Duration</u>	<u>Expatriate Technical Support (FTE)^c</u>	<u>Country^a Contribution (000 US\$)</u>	<u>Donor Contribution^b</u>	
						<u>Recurrent (000 US\$)</u>	<u>Capital (000 US\$)</u>
IAEA	Radioisotopes in animal science.	Radioimmunoassay studies of reproductive hormones and the cause of infertility in indigenous cattle. Provision of 2 fellowships.	Started in 1982. Ongoing	-	-	98	-
Belgium	Plant protection.	Provision of professional staff, research equipment and the training of counterparts.	1976-1985	3	-	1,414	471
Canada/CIDA	Wheat research.	Development of irrigated and emphasis on rainfed wheat. Provision of breeders.	1979-1989	4	1,800	10,570	-
GVS	Animal disease control service.	Provision of one veterinarian.	1980 - ongoing	1	-	17	-

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 10: Donor-Funded Agricultural Research Activities, 1984 (cont.)

<u>Donor Country/ Institution</u>	<u>Activity</u>	<u>Expected Results</u>	<u>Duration</u>	<u>Expatriate Technical Support (FTE)^c</u>	<u>Country^a Contribution (000 US\$)</u>	<u>Donor Contribution^b</u>	
						<u>Recurrent (000 US\$)</u>	<u>Capital (000 US\$)</u>
Finland	Forestry and forest products research project.	Strengthening forestry and forest products research. Provision of 7 Finnish experts, training of Zambian forestry researchers and equipment.	1979-1985	7	-	9,409	3,136
France	Cotton breeding.	Cotton improvement for seed, oil yield and better animal feed. Provision of research apparatus.	1980-1985	2	-	400	100
GVS	Provision of research agronomists.	Strengthening agricultural research professional personnel.	Ongoing	4	-	92	-

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 10: Donor-Funded Agricultural Research Activities, 1984 (cont.)

<u>Donor Country/ Institution</u>	<u>Activity</u>	<u>Expected Results</u>	<u>Duration</u>	<u>Expatriate Technical Support (FTE)^c</u>	<u>Country^a Contribution (000 US\$)</u>	<u>Donor Contribution^b</u>	
						<u>Recurrent (000 US\$)</u>	<u>Capital (000 US\$)</u>
JOVS	Veterinary research and animal health.	Provision of volunteers and equipment to use at Zambia Institute of animal health and Central Veterinary Research Inst.	Ongoing	2	-	87	29
68 Sweden/SIDA	National Seed Programme.	Support to national seed research and certification and provision of management to Zambia Seed Company.	Started in 1979. Ongoing.	16	-	864	-
USAID	Agricultural Research and extension project.	Provision of experts on agricultural economics, agronomy, plant breeding, short & long-term training, equipment. Research on maize, sunflower and soybeans.	1980-1986	8	-	9,386	3,129

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 10: Donor-Funded Agricultural Research Activities, 1984 (cont.)

Donor Country/ Institution	Activity	Expected Results	Duration	Expatriate Technical Support (FTE) ^c	Country ^a Contribution (000 US\$)	Donor Contribution ^b	
						Recurrent (000 US\$)	Capital (000 US\$)
IDRC	Kafue Fisheries.	Research grant for the tech- nology and industry unit, Institute for African Studies UNZA.	1982-1984	-	-	75	-
69 IDRC	Vegetable dehydration.	Research grant to strengthen food techno- logy research unit of NCSR.	1981-1985	-	-	82	-
TOTAL				74 ===	4,283 =====	39,902 =====	8,497 =====

^aCountry contribution figures are for the year 1984 only.

^bDonor contribution figures are for the total life span of the project. The estimated annual total donor funding, based on projected project duration, is US\$ 8,569,300.

^cFTE = Full Time Equivalent.

Source: United Nations Development Programme, Development Cooperation to Zambia, 1982, September, 1983
Government of the Republic of Zambia, Estimates of Revenue and Expenditure for the year 1984;
data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

IV. AGRICULTURAL TRAINING INSTITUTIONS

A. Overview of Agricultural Training in Zambia

As pointed out in the background material in Chapter II, the Zambian educational system has developed rapidly during the past two decades. The dramatic increase in the number of students enrolled in the primary and secondary schools has significantly improved the adult literacy level, and has provided a larger source of enrollees for the post-secondary institutions. Of these institutions, the ones which serve the agricultural sector are located in three GRZ ministries as shown in Figure 8. The degree, diploma and certificate programmes offered by each of these institutions and the number of staff and students are shown in Table 11. A discussion of each follows.

B. Agricultural Training Institutions

1. University of Zambia

a. Organisational structure and purpose

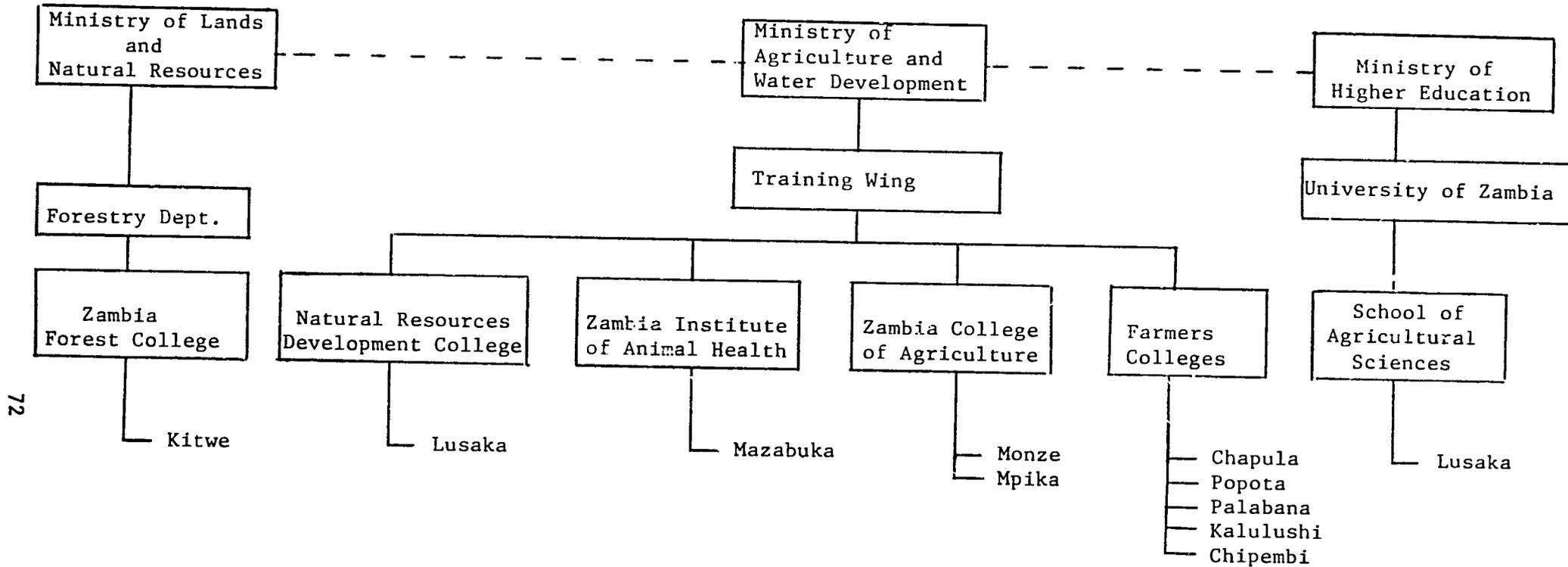
The University of Zambia is the only degree-granting institution in the country and has an enrollment of about 3,000 students. The main campus in Lusaka is organised into Schools of Engineering, Mining, Law, Humanities and Social Sciences, Natural Sciences, Education, Medicine, Agricultural Sciences, and Veterinary Sciences. The School of Veterinary Sciences has just been established and has not yet enrolled students. A School of Business Studies and Accountancy is located in Ndola.

The School of Agricultural Sciences (SAS) was officially established in 1971. It is organised into Departments of Agricultural Engineering, Animal Science, Crop Science, Rural Economy and Extension Education, and Soil Science.

b. Training programmes

Prior to 1979, the SAS granted a BSc degree at the end of a four-year course of study. A total of 209 degrees were awarded for that programme. The first class of the new five-year programme graduated in 1984. Its students will have had an option of specialisation in one of the above five subject matter departments. A new BSc degree programme in agricultural economics has been approved and is expected to begin in 1984 to 1985.

Students enrolling in the School of Agricultural Sciences are required to be O-level secondary school-leavers with five acceptable O-level passes, including at least one each in English, mathematics, chemistry or physical science, and biology or agricultural science.



ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Figure 8: Organisational Structure of Agricultural Training Institutions

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

ZAMBIA: AGRICULTURAL RESEARCH RESOURCE ASSESSMENT

Table 11: Agricultural Training Institutions, Degrees Offered, Number of Staff and Students, 1984

Name of Institution	Degrees, Diplomas, or Certificates Offered	Number of Staff ^a	Enrollment		
			F	M	Total
School of Agricultural Sciences - UNZA	BSc degree in agriculture and agricultural economics	30	3	57	60
Natural Resources Development College	Diploma in seven different agricultural development related fields	29	27	133	160
Zambia College of Agriculture					
Monze	Certificate in Agriculture	6	-	-	140
Mpika	Certificate in Agriculture	8	-	-	80
Zambia Institute of Animal Health	Certificate in Animal Health	4	-	-	100
Zambia Forest College	Diploma and certificate in Forestry	6	-	-	50
Popota Tobacco Centre	Certificate in tobacco production	4	-	-	30
TOTAL		<u>87</u>	<u>-</u>	<u>-</u>	<u>620</u>

^aStaff with BSc and above.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

Beginning in 1980, students holding diplomas in agriculture from the Natural Resources Development College were admitted to fill the School to its maximum capacity of 60. (See Table 11 for enrollment and staffing figures for SAS.)

Students spend their first year of study in the School of Natural Science. During the second year, the courses offered are basic science subjects which emphasise applied fields of agriculture. The third- and fourth-year courses cover various aspects of agriculture; the fifth year permits a more in-depth study of one of the departmental areas of specialisation. The curriculum also includes farm practicals, tutorials and seminars in various fields. Vacation periods are used for 30 weeks of practical training on farms and in agricultural institutions.

c. Human resources

The School of Agricultural Sciences has 32 professional and 12 technical posts; two of the professional and one of the technical posts are currently vacant, and 25 of those filled are held by expatriates. The faculty is assisted by an administrative and support staff of 39. Of the current staff, six have PhD degrees, 18 have MSc degrees, and 5 have BSc degrees. At present, there are 12 staff studying for PhD and 4 for MSc degrees in developed countries. There are 27 studying for BSc degrees in Zambia. It is estimated that three-fourths of staff are engaged in training and one-fourth are engaged in research.

d. Training facilities

The school has office, classroom and laboratory facilities, all in good condition, that are reasonably adequate for its present programmes. A largely undeveloped farm of 600 ha about 14 km from the campus is used for teaching and research purposes. While facilities for poultry are good, those for beef, dairy, sheep, and swine are fair to poor condition.

e. Financial resources

The 1983 budget for the school totaled K 935,000; of which K 747,000 was for salaries and staff emoluments and K 188,000 was for recurring expenses. This was augmented by K 20,000 for research from UNZA and from research funds provided by CIDA and other donor organisations.

2. Natural Resources Development College

a. Organisational structure and purpose

The National Resources Development College (NRDC) falls under the training wing of the MAWD. It is intended to provide young Zambians with the training tools necessary to fully utilise the

abundant natural resources of the country. Its teaching staff are organised into the following departments:

- o General Administration;
- o Farm and Ranch Administration;
- o Agricultural Business Management;
- o Animal Science;
- o Crop Science;
- o Agricultural Engineering;
- o Water Engineering;
- o Agricultural Education;
- o Nutrition;
- o Basic and Applied Sciences; and
- o Extension.

The diplomas offered at NRDC are underwritten by UNZA.

b. Training programmes

The NRDC was opened in 1965, and began with seven two-year diploma courses and a one-year certificate course in home economics. Since then, several changes have been made in the curriculum. The College now offers three-year diploma courses in agriculture, with majors in crop science, animal science, agricultural business management, agricultural engineering, nutrition, and water engineering. Considerable emphasis is placed on practical training, in the laboratories and workshops as well as on the college farm and ranch. All students are expected to obtain appropriate field experience during at least one long vacation.

The College has an annual admission capacity of 160 students. (See Table 11.) During the 15-year period ending in 1982, the College granted 1,472 diplomas. Of these 352 were in crop science, 212 in livestock production, 282 in agricultural business management, 192 in nutrition, and 43 in fisheries. The remaining 69 were in other programmes which have been discontinued.

The College admits two categories of students: direct entry and in-service. The latter are those who have worked for some time and are recommended by the Heads of Department for a diploma course. There are no differences in the course of study for the two categories of enrollees.

The minimum admission requirements for each of the seven programmes offered by the College is a full Cambridge School Certificate or its equivalent in approved subjects, including English. The Cambridge Certificates must contain at least four O-level passes. Since admission is on a competitive basis, the possession of minimum qualifications does not guarantee acceptance.

c. Human resources

There are 29 professional staff at NRDC, of which 18 are expatriates. There are 27 diplomates and three certificate-holders on the staff.

d. Training facilities

The College is located on a 300-ha site which is 12 km from Lusaka. This is essentially a teaching farm with an irrigated area and swine, poultry, and dairy units. An adjacent 1500-ha ranch is stocked with indigenous and exotic breeds of cattle and with sheep and goats.

e. Financial resources

The GRZ budget for the College in 1983 was K 871,000 for salaries and emoluments and K 1,683,000 for recurrent expenses. Substantial support for staff salaries and other costs was received from several donor organisations.

3. Zambia College of Agriculture

a. Organisational structure and purpose

The Zambia College of Agriculture is also operated by the training wing of the MAWD. It has two campuses, one at Monze and the other at Mpike. Both campuses are involved in training personnel, most of whom are employed by the Department of Agriculture as extension workers at the field level.

b. Training programmes

Form III and Form IV school-leavers with passes in English, mathematics and science are recruited after they have worked in agricultural extension for at least one year after secondary school. The programme is a two-year course, at the end of which certificates in agriculture are given. Fields of study include principles and practices of crop production, animal production, home economics, farm machinery, farm management, and agricultural extension. About 220 students are recruited by both campuses annually.

c. Human resources

There are about 14 professional staff for both campuses, of which about one-half are expatriates. A large proportion of the expatriate staff are supported by donors. There are four administrative staff, 15 support staff, and a total of 36 technical staff members.

d. Training facilities

Training facilities include 12 modern classrooms, 20 staff offices in good condition, a boardroom at each campus, and a library with a capacity of 60 readers. Other teaching facilities include science laboratories, engineering workshops, and home economics classrooms. All are in good condition. At each campus there also is a student centre with recreational facilities.

e. Financial resources

Total capital expenditure in 1983 was K 300,000 for Monze and K 600,000 for Mpika. In both cases, this expenditure was fully supported by a SIDA grant. Estimates for 1984 are one-half the amount of 1983.

4. Zambian Institute of Animal Health

a. Organisational structure and purpose

The Zambian Institute of Animal Health (ZIAH) falls under the training wing of MAWD. Technically, it is also supervised by the Department of Veterinary and Tsetse Control Services. Its objectives are to train field-level staff in animal health and tsetse control, so that they may assist farmers in devising and implementing adequate animal disease prevention and control programmes in their localities. The Institute is also part of the CVRI at Balmoral.

b. Training programmes

ZIAH recruits its enrollees from students of the Zambia College of Agriculture at Monze after they complete one year's training in general agriculture. The training programme, which takes another year, concentrates on the prevention, diagnosis, and treatment of common animal diseases found in Zambia. Graduates are awarded certificates in animal health. The annual average recruitment is about 100 students.

c. Human resources

There are four professional staff, one administrator, and nine technical staff at the college. This excludes other general support staff.

d. Training facilities

ZIAH, once a veterinary research centre for Zambia, has good laboratories for animal disease research and student practicals, three classrooms, one office block, and a library. The Institute maintains a large herd of cattle.

e. Financial resources

The activities of the Institute are funded by GRZ through the MAWD under its training wing. Capital expenditure for 1983 was K 100,000. The same amount is estimated for 1984.

5. Zambia Forest College

a. Organisational structure and purpose

At present, no degree-level programme is available in Zambia for the training of professional-level foresters. Since 1954, the Zambia Forest College at Mwekera has provided training for diplomates, who serve as foresters, and for certificate-holders, who are employed as forest rangers and forest guards.

b. Training programmes

The College has a capacity of 50 students per year. Emphasis is placed on practical experience in the use of various tools, equipment and machinery. Logging operations and nursery and plantation techniques are taught in the College's own plantations.

Much of the students' training time is spent outdoors on practical work. Considerable emphasis is placed on physical fitness and on the development of leadership qualities.

c. Human resources

The College is served by six professional and technical staff and six administrative staff.

d. Training facilities

The College is a modern forestry training establishment. Workshops for practical classes are equipped with various forestry tools, equipment and machinery. The College runs its own plantations, which are used for students' practicals. Modern hostel blocks house the students and include recreational and sporting facilities.

e. Financial resources

Funding of the College is through the Department of Forestry under the MLNR. The 1983 recurrent expenditure was K 19,700 while capital expenditure was K 46,000, making a total of K 65,700.

6. Farmer Training Colleges

In addition to the diploma- and certificate-granting institutions discussed above, the MAWD also operates five farmer training colleges at Kalulushi, Palabana, Chapula, Chipembi, and Popota. These offer production-oriented courses of one- to two-year duration, as well as short courses of varying lengths which might be considered as part of the training activities of the Extension Service. The Palabana centre deals with dairy; the Chapula unit is focused on horticulture; and the Popota centre offers a certificate in tobacco production. Each centre has a capacity of 30-50 students.

C. Total Human Resources Available for Training in Zambia

Altogether, there are about 20 administrative, 82 professional, 83 technical and 78 support staff members in training institutions which offer at least certificates. There are a large number of expatriates at the professional level--constituting 62 percent of the total current professional staff. (See Table 12.) The institutions are almost self-sufficient in Zambian staff at the other levels. There are vacant posts only at the professional level. The academic preparation of the administrative and professional staff, based on the highest degree held, is shown in Table 13. There is an even balance in the number of staff trained in plant/soil sciences and animal sciences. There are six Zambians and eight expatriates with Ph.D.s and 18 Zambians and 23 expatriates with MSc degrees. The return of Zambians out on training would replace expatriate staff completely. (See Table 14)

The GRZ continues to recruit staff, especially at the technical level, beyond the authorised and established posts because of its commitment to employ graduates of Zambian training institutions.

D. Total Financial Resources Available for Training in Zambia

For the year 1983, the government spent about K 1.6 million for recurrent and K 1.8 million on capital costs for the training institutions. K 1.4 million of the latter were grants from SIDA, the Netherlands, and the EEC. The expanding capital projects cannot be adequately supervised and accomplished, due to static or diminishing resources for recurrent expenditures.

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Table 12: Total Agricultural Training Staff, 1984

	<u>Administrative</u>	<u>Professional^a</u>	<u>Technical^b</u>	<u>Support Staff</u>	<u>Total</u>
<u>Total Authorised Posts</u>	20	105	87	78	290
<u>Positions Vacant</u>	-	2	-	-	2
<u>Nationals (Citizens)</u>					
Staff in training	-	21	4	-	25
Staff on long-term leave ^c	-	-	-	-	-
Number of nationals currently in posts	18	31	80	78	207
Expressed as a percentage of authorized posts	90	30	92	100	71
<u>Expatriates</u>					
Serving in authorized posts ^d	2	51	3	-	56
Expressed as a percentage of authorized posts	10	49	3	-	19
Total number of expatriates	2	51	3	-	56
<u>Total Number of Staff</u>	<u>20</u>	<u>82</u>	<u>83</u>	<u>78</u>	<u>288</u>

^aProfessional = BSc or above.

^bTechnical = diplomate.

^cLong-term leave is leave of three months or more.

^dIrrespective of source of funds.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

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Table 13: Disciplines of Teaching Professionals, 1984

<u>Discipline Areas</u>	<u>Nationals</u>				<u>Expatriates</u>				<u>Total</u>
	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>Subtotal</u>	<u>BSc</u>	<u>MSc</u>	<u>PhD</u>	<u>Subtotal</u>	
<u>Plant/Soil Science</u>									
Crop science, general	6	-	-	6	1	1	-	2	8
Agronomy	-	1	-	1	2	1	-	3	4
Crop physiology	-	1	-	1	-	-	1	1	2
Entomology	-	1	-	1	-	1	-	1	2
Horticulture	-	2	-	2	-	-	-	-	2
Plant breeding	-	-	1	1	-	-	1	1	2
Pathology	-	-	-	-	-	-	-	-	-
Soil science	<u>1</u>	<u>1</u>	<u>2</u>	<u>4</u>	<u>-</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>7</u>
Subtotal, Plant/Soil Science	<u>7</u>	<u>6</u>	<u>3</u>	<u>16</u>	<u>3</u>	<u>4</u>	<u>4</u>	<u>11</u>	<u>27</u>
<u>Animal Science</u>									
Animal science, general	3	1	-	4	2	2	-	4	8
Animal breeding	-	-	1	1	-	1	-	1	2
Animal nutrition	-	2	1	3	-	1	-	1	4
Animal physiology	-	-	1	1	-	1	-	1	2
Animal production	2	-	-	2	1	-	1	2	4
Animal health	<u>2</u>	<u>-</u>	<u>-</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>1</u>	<u>4</u>	<u>6</u>
Subtotal, Animal Science	<u>7</u>	<u>3</u>	<u>3</u>	<u>13</u>	<u>5</u>	<u>6</u>	<u>2</u>	<u>13</u>	<u>26</u>
<u>Other Discipline Fields</u>									
Agric. education	2	-	-	2	2	1	-	3	5
Agric. economics	3	4	-	7	2	3	-	5	12
Agric. engineering	2	3	-	5	4	8	1	13	18
Agric. extension	1	2	-	3	1	1	-	2	5
Food sciences	1	-	-	1	1	-	-	1	2
Rural sociology	1	-	-	1	-	-	1	1	2
Forestry	<u>4</u>	<u>-</u>	<u>-</u>	<u>4</u>	<u>2</u>	<u>-</u>	<u>-</u>	<u>2</u>	<u>6</u>
Subtotal, Other Discipline Fields	<u>14</u>	<u>9</u>	<u>-</u>	<u>23</u>	<u>12</u>	<u>13</u>	<u>2</u>	<u>27</u>	<u>50</u>
TOTAL	<u>28</u>	<u>18</u>	<u>6</u>	<u>52</u>	<u>20</u>	<u>23</u>	<u>8</u>	<u>51</u>	<u>103</u>

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

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Table 14: Training Plans for Staff of the Training Institutions, 1984^a

<u>Level</u>	<u>Crop Science</u>		<u>Animal Science</u>		<u>Veterinary</u>		<u>Economics</u>		<u>Other</u>		<u>Total</u>
	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	<u>M</u>	<u>F</u>	
Doctorate	4	-	3	-	-	-	1	-	-	-	8
Masters	1	1	1	-	-	-	1	1	1	-	6
Bachelors	1	1	2	1	-	1	-	1	-	-	<u>7</u>
											<u>21</u>

^aThese are number of staff that are currently in training.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

V. AGRICULTURAL EXTENSION INSTITUTIONS

A. Overview of Agricultural Extension in Zambia

There are four major agricultural extension institutions in Zambia: the Extension Branch of the Department of Agriculture, the Field Services Division of the Department of Veterinary And Tsetse Control Services, the Extension and Development Division of the Department of Fisheries, and the Extension Division of the Forestry Department. The first three belong to MAWD, while the last one falls under the aegis of the MLNR. (See Figure 9 which shows the organisational structure of each at the national, provincial, district and field levels.) The location of the headquarters and professional staff of each are shown in Table 15. All of them are funded by GRZ through their respective ministries and departments, but each also receives substantial technical assistance and funding from various donors. The amount and source of funding and level of staff effort by programme area of each is shown in Table 16.

The liaison between research, extension and producers (small-scale farmers) is limited. Research workers conduct field crop trials on farmers' fields with the assistance of extension workers. Each research station also holds at least one annual field day during which extension workers and farmers review current research efforts. However, this reaches only a limited number of small-scale farmers, since many live quite far from the research stations. Extension personnel and some large-scale commercial farmers are invited to participate in the research programmes' committee meetings on various commodities. In addition, research personnel are invited to teach during seminars organised and conducted by extension staff.

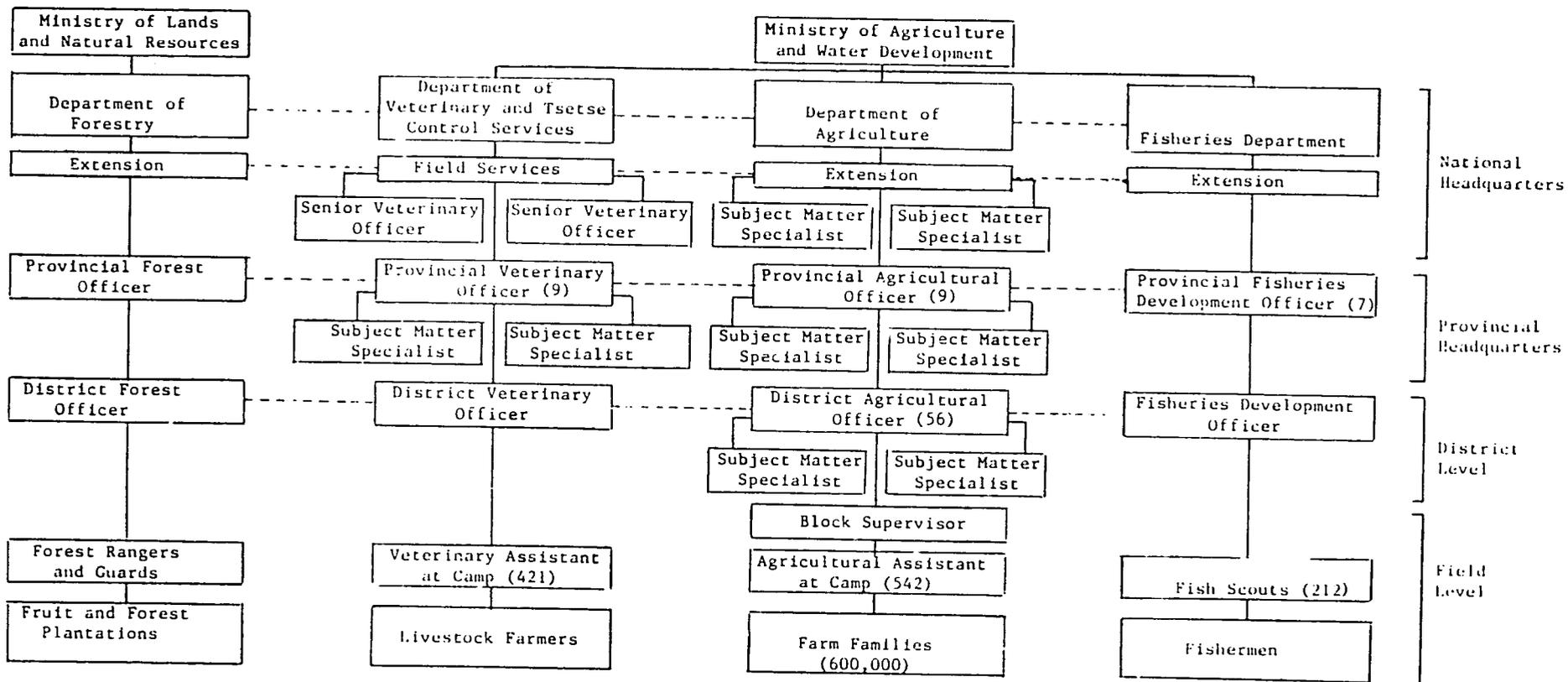
Despite these positive efforts by all parties, many departments with an extension function have not institutionalised an effective, formal linkage between research and extension. At present, the gap is wider between research and extension than between extension and producer. The Department of Agriculture, however, has instituted Adaptive Research Planning Teams (ARPTs) to improve this linkage, and also has established posts for research-extension liaison officers.

B. Agricultural Extension Institutions

1. Agricultural Extension Branch of the Department of Agriculture

a. Organisational structure and purpose

The organisational structure of the Extension Service is shown in Figure 9. The Extension Branch is headed by an Assistant Director of Agriculture who is supported by a team of section heads referred to as Subject Matter Specialists (SMSs). These include:



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Figure 9: Organisational Structure of Agricultural Extension Institutions

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

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Table 15: Agricultural Extension Institutions: Locations and Staff, 1984

Name of Institution	Location of Headquarters	Authorized Posts	Professionals ^a	Technical		Total
				Diplomate	Certificate	
Dept. of Agricultural Extension and Training	Lusaka		71	328	1,317	1,716
Field Services of the Department of Veterinary and Tsetse Control Services	Lusaka		33	54	247	334
Fisheries Extension Development and Training	Chilanga		2	57	-	59
Extension and Publicity of Forestry Dept.	Ndola		1	6	2	9
TOTAL			<u>107</u>	<u>445</u>	<u>1,566</u>	<u>2,118</u>

^aProfessional = BSc or above.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

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Table 16: Summary of Extension Staff Effort and Funding by Programme Area, 1984

<u>Institution/ Programme Area</u>	<u>Funding Source</u>	<u>1983 Budget (K,000)</u>	<u>FTE^a</u>	<u>Percentage of Total Staff Time^b</u>
Dept. of Agriculture - Extension Branch				
Crop husbandry	GRZ, SIDA	8,474	1,101	33.6
Livestock production	GRZ, Netherlands	2,527	331	10.1
Horticulture	GRZ	2,203	298	9.1
Home economics	GRZ, UNICEF, SIDA	1,864	256	7.8
Extension training	GRZ, SIDA	1,882	155	4.7
Youth extension	GRZ	593	78	2.4
Fisheries Extension Development & Training	GRZ	489	151	4.6
Field Services of Veterinary and Tsetse Control	GRZ, Belgium, Netherlands, Arab League	7,172	892	27.2
Forest Extension and Publicity of Forestry Department	GRZ, FINNIDA	60	15	0.5
TOTAL		<u>25,264</u>	<u>3,277</u>	<u>100.0</u>

^aFTE = Full Time Equivalent, including support staff.

^bThe portion of total staff effort devoted to extension regarding food crops is 42.7 percent, regarding livestock is 37.3 percent and other areas (home economics extension training, youth extension, fisheries and forestry) is 20 percent.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

- o The Chief Animal Husbandry Officer:
- o The Chief Crop Husbandry Officer:
- o The Chief Horticultural Officer:
- o The Chief Tobacco Extension Officer:
- o The Senior Home Economics Officer: and
- o The Senior Youth Extension Officer.

These chief and senior officers are supported by senior specialists, including dairy, pig and poultry officers in the Animal Husbandry Section and cotton and oilseeds officers in the Crop Husbandry Section.

There is a Provincial Agricultural Officer (PAO) in each of the nine provinces who is in charge of extension programmes. The PAOs are also administratively responsible for Research and Land Use Branch personnel posted in the provinces. Each PAO is assisted by a number of Provincial SMSs who usually report on technical matters to their respective section heads at the Lusaka Headquarters, from whom they obtain guidance and technical advice. The Provincial SMSs are responsible for supervising district and field-level staff.

At the district level, the Agricultural Extension Branch is headed by the District Agricultural Officer (DAO). Each DAO is assisted by a technical staff, consisting of Agricultural Supervisors, and in some districts, by SMSs. The field staff, based at the block level, normally consists of Senior Agricultural Assistants, Agricultural Demonstrators and Commodity Demonstrators. The number of districts per province varies from three to ten; the number of blocks per district varies from four to five, with four to five camps per block.

The overall objectives of the Extension Service are:

- o To promote the adoption of improved agricultural practices among the farming community, particularly among small-holding farmers, so as to achieve optimum production of agricultural commodities:
- o To promote the efficient and widespread use of various inputs: and
- o To bring farmers' problems to the attention of researchers for solution.

h. Extension programmes

To achieve these objectives, a number of activities and programmes have been initiated covering all the provinces. These

programmes are carried out by the following sections: crop husbandry, animal husbandry, horticulture, agricultural mechanisation, home economics, youth extension, and extension training. Each of these sections offers practical advice to farmers on a regular basis when advice is sought.

(1) Training and Visit Programme

The Training and Visit (T&V) Programme was first introduced in Zambia for the 1979-1980 season. Its implementation was undertaken the following season in all provinces. Its main objective was to increase the frequency and efficiency of extension worker-farmer contact while, at the same time, offering a continuous in-service training programme for extension workers. Although the T&V Programme was implemented in every province, transport and housing problems have rendered it unsuccessful except in the Eastern and Southern Provinces, where it is being funded by the World Bank's Eastern Province Agricultural Development Programme (EPADP) and Southern Province Agricultural Development Programme (SPADP). Under this latter project, the T&V Programme has been implemented in the Katete, Petauke and Chipata South Districts. In the Eastern Province, motorcycles, bicycles, and vehicles have been provided. Funds also have been provided to train staff and farmers and to construct camp houses for extension workers.

No special or extra personnel have been deployed to the Programme, apart from utilising those staff members already employed as extension workers. As the T&V system involves some significant changes from past approaches, additional organisational expertise would be useful. It is estimated that the Programme will invest K 20 million in each province for the five-year period starting in 1982 and ending in 1987. As there are four other components within this project, it is estimated that only one-fifth of the total funding will go to the T&V Programme.

(2) The national LIMA programme

The LIMA system is based upon a package of inputs and practices designed to increase yields of plots of an average size of 1/4 ha. A national LIMA programme was initiated in Zambia in 1982. It covers all provinces except the Luapula Province, where similar activities are supported by FINNIDA. The programme's main objective is to demonstrate on plots in farmers' fields the advantages of efficient use of fertilisers and other related inputs. The demonstration plots are distributed throughout all districts; they are supervised by local extension workers, who report the results obtained and farmer responses. The LIMA programme is headed by a Senior LIMA Extension Officer at the National Headquarters of the Department of Agriculture. The programme was allocated K 1.0 million by FAO and is scheduled to run for four years.

The LIMA extension and farmer training programme, funded by SIDA, started in 1980. It initially was implemented in the Luapula and Northern Provinces; in 1982 it was extended to all other provinces. It is intended to minimise the constraints which operating costs and subsistence allowances pose to the training of both extension workers and farmers in the LIMA system. Some money has been used to construct extension workers' houses and to purchase motor vehicles, motorcycles and bicycles. Funding by SIDA since 1980 has totalled K 3.3 million.

(3) Women's programmes

The Home Economics Section of the Agricultural Extension Branch has three current programmes: the village women's appropriate technology programme, the women's participation programme, and the people's participation programme. The first was implemented in 1982 with a national centre at Keembe in Central Province, and is funded equally by UNICEF and the GRZ. Its main objective is to introduce simple devices that will assist rural women in their domestic and agricultural activities. In 1983, K 50,000 was expended for this programme. Its activities are expanding each year to other provinces. The women's participation programme is funded by SIDA, except for GRZ-supplied personnel. It seeks to encourage rural women to become involved in income-generating activities such as crop and poultry production. The programme provides small seasonal loans to groups of women for such activities. Since 1981, SIDA has provided K 340,000 for this programme which is now operating in three adjacent districts of the Southern Province, in three of the Central Province, and in two of the Lusaka Province. The people's participation programme was initiated in 1982 in the Western Province, with support provided by the Netherlands Government through FAO. Its primary goal is to assist low-income rural families, particularly those headed by women.

(4) Animal husbandry activities

The Extension Service's livestock efforts include development work with small stock, poultry, cattle and dairy. Its small stock development work focusses on helping small farmers increase their incomes through the production of sheep and goats. It may involve supplying breeding stock in areas where such are not available. In the cattle development areas in the Western, Southern, Central, and Eastern Provinces, farmers are taught improved methods of herd management and the techniques for routine tick and disease control for their indigenous cattle. The project is supported by the Netherlands Government in the Western Province and by EEC in other provinces. Poultry improvement efforts are also focussed on small-scale farmers, and include the introduction of improved breeds of chickens and instruction of flock management.

(5) Youth extension activities

Youth extension work is done through the Young Farmers Clubs. The movement began in 1959 with a few clubs of both school- and non-school-going youth; by 1975 it had grown to a membership of over 52,000. Since that date, school-based clubs have been discontinued and membership has been limited to youth not in school. Membership is now about 16,500. The extension staff provide technical assistance to the clubs on crop and livestock production projects.

(6) Results of the extension programmes

The Agricultural Extension Service does not contain an evaluation component. Results of its efforts could be gauged indirectly through increases in crop and animal production. The T&V system has not yet been successful in increasing extension worker-farmer contact or in training. The SIDA programme appears to have had some success, based on increased off-take rates in areas where it is operating. The women's programmes of the Home Economics Section have had staffing problems, with the result that programme implementation has been limited to small areas. The liaison between extension and research has not been effective at the block and camp levels, except in few areas where ARPTs have become operational.

c. Human resources

The Extension Services include 71 professional staff, 27 of whom are expatriates. (See Table 15.) There are 1,645 technical staff at the diploma and certificate levels, of which only three are expatriates. These staff are assisted by 131 administrative and support staff.

d. Extension facilities

The Extension Services facilities include national, provincial and district blocks of offices, accommodating more than 340 officers. There is at least one farm institute and one farmer training centre in each province and district, respectively, where farmers and extension staff receive refresher courses. The capacity of each is about 30 participants. Each province has a fleet of vehicles, most of which presently are not operating.

e. Financial resources

The Extension Service is financed by the GRZ through the Department of Agriculture. The funds are thereafter allocated to different projects. The total budget for 1984 is estimated at K 16.9 million with crop husbandry activities taking more than one-half of the total. (See Table 16.) Estimated approved funding for this unit for 1983 included K 8.9 million for wages and salaries, K 5.5 million for capital projects, of which K 2.4 million was funded by donors, and

K 1 million for recurrent expenditure. The unit's total budget (K 16.9 million) is 68.8 percent of the government's total allocation to all extension institutions. A considerable part of this amount is funded by donors.

2. Field Services Branch of the Department of Veterinary and Tsetse Control Services

a. Organisational structure and purpose

As indicated in Figure 9, the Field Services Branch of the DVTCS is in the same Ministry as the Department of Agriculture's Agricultural Extension Branch. This division provides the major extension service to farmers on animal disease prevention and control. The Field Services Branch is headed by an Assistant Director at National Headquarters who, in turn, is assisted by Senior Veterinary Officers who are specialists in livestock diseases and in tsetse control. There also is a provincial officer for each of the nine provinces. At each provincial headquarters, veterinary field services are directed by a Provincial Veterinary Officer, who is assisted by various SMSs in the fields of veterinary medicine and tsetse control. These specialists receive technical guidance from the National Headquarters and supervise staff located at the district level. Extension services at the field level are conducted by the branch's field staff.

b. Extension programmes

The main activities of the DVTCS's Field Services Branch are the monitoring and control of livestock disease, the monitoring of tsetse infestation, and the implementation of spray programmes. The Branch also enforces livestock movement restrictions and quarantine measures in disease-affected areas. At both the national and provincial levels, there is close cooperation and liaison between the DVTCS and the Animal Husbandry Section of the DOA's Extension Branch, in identifying disease and tsetse outbreaks in the country and in implementing livestock quarantine programmes.

The unit has been successful in restricting diseases to particular areas and/or provinces whenever there have been outbreaks. Recently, however, there has been a reinfestation by tsetse flies of agricultural areas which had been tsetse-free in past years. Trypanosomiasis has been recorded in blood samples taken from animals in areas of high cattle population. The reasons for this reinfestation are not clear.

c. Human resources

There are 33 professionals, 54 diplomates and 247 certificate level veterinary field staff in the Field Services Branch of the DVTCS. (See Table 15.)

d. Extension facilities

Each provincial headquarters has laboratory facilities for the diagnosis of animal diseases, as well as facilities for blood sample collection from suspected animals. Each provincial and district headquarters also has its own office blocks.

e. Financial resources

The branch is financed by the GRZ, with additional assistance from donor agencies. The 1984 estimated expenditure stands at K 7.2 million, or about 29 percent of the total budget of Zambia's extension institutions. (See Table 16.)

3. Extension and Development Division of the Fisheries Department

a. Organisational structure and purpose

Until 1982, the Extension and Development Division of the Fisheries Department was in the MLNR. It currently is in the MAWD, and is funded by the GRZ through the MAWD.

The main linkages between the Fisheries Development Division and other extension institutions are at the national and provincial levels. Because the Fisheries Department concentrated its efforts in areas where fishing is the main activity, there is little need for contact with other kinds of extension staff.

The Division is headed by a Chief Fisheries Officer based at Chilanga, 25 km south of Lusaka. In addition, there is a provincial Fisheries Development Officer (FDO) in every province except the Eastern and Northwestern Provinces. FDOs, who are technical officers with diplomas in fisheries, are assigned to fisheries rather than to districts. Each of the main fisheries--Lake Tanganyika, Luapula-Mweru, Mweru-Wa-Ntipa, Kafue River, and Itezhi-tezhi--has a FDO posted either at a nearby district office or at the fishery itself.

b. Extension programmes

The activities of the Division include collecting statistical data on fisheries, monitoring fish resources, implementing acceptable management practices, developing technical recommendations based on research findings, and carrying out fisheries extension and education through training centres and radio broadcasts. The Division also disseminates improved techniques for both capturing and processing fish. One section of the Division is concerned solely with the design and development of fishing craft. A related programme provides loans to fishermen.

c. Human resources

The division has two professional and 57 technical staff at the headquarters in Chilanga, and 216 administrative and support staff in all its locations. (See Table 15.) At the field level, there are about 19 Assistant FDOs and 212 Fish Scouts distributed throughout all of the main fishing camps, who maintain contact with all types of fisherment. All the staff are Zambians, and all the established posts are currently filled.

d. Extension facilities

There are office blocks at the National Headquarters and at provincial and field fishery stations. Boats and fishing nets are available at each main fishery. Vehicles, though insufficient in number are available for overland transportation.

e. Financial resources

All of the Division's activities are funded by GRZ. The approved budget for 1984 for extension and training include K 233,500 for capital expenditures and K 255,036 for recurrent expenditures, not including wages and salaries. (See Table 16.) The approved recurrent expenditure for the entire Department of Fisheries was K 390,000 for 1984.

4. Extension Division of the Department of Forestry

a. Organisational structure and purpose

The Department of Forestry is part of the MLNR. The departmental headquarters is at Ndola, 321 km north of Lusaka. The present extension unit at the headquarters consists of one chief extension officer who serves as assistant conservator, one senior forester, and one forester. The Extension and Publicity Section operates nurseries at Ndola Nursery and at Lusaka. Extension work is conducted through provincial and district officers. There is a provincial forest officer in each province and one additional officer who has responsibility for the Zambia Teak Forests in the south. Each district has its own district forest officer with a staff of forest rangers and forest guards. There are no special staff for extension at the provincial or district level, although in some provinces extension work has been assigned to a forester who does extension work in addition to his other duties. The most important task of the Department of Forestry thus far has been to take care of Zambia's forest reserves.

b. Extension programmes

The Extension and Publicity Section has been releasing wall charts and posters on forestry and related subjects to schools, villagers, local councils, and farmers. It also conducts seminars on

forestry and forestry products for party and government leaders, teachers, and chiefs. Last year, 50 people attended these workshops. Thirteen radio and television programmes on forestry are broadcast every year.

An effort has been made in conjunction with the Department of Agriculture to encourage farmers to plant 1/4 ha of trees beside their food crop fields. Tree seedlings and fertilisers are provided free to cooperators. About 200 farmers have benefitted from this project since its inception in 1983. Funding, provided by FINNIDA, has totalled K 6,000 to date and will continue for the next two years.

Operation Kwacha, launched in 1978, reduces the price of the extension section's tree seedlings each December to encourage the public to make plantings around public buildings, schools, and private homes. The response has been very high. In the Southern Province, the extension section has been unable to meet the demand. Every province and district has a tree nursery; in 1983, a total of 400,000 tree seedlings were raised for Operation Kwacha. Half a million seedlings will be raised in 1984 if more funds become available. Currently the GRZ spends about K 6,000 per year on this programme.

The Department of Forestry is currently proposing that community forestry be undertaken in Zambia as a national strategy for forest restoration and conservation. The project's goal is to involve farmers, councils, schools and local village communities in managing their own forest reserves, which are presently managed by the Forestry Department.

c. Human resources

There are one professional and eight technical staff/members in forestry extension. (See Table 15.) Although there are forest officers at the provincial and district levels, these do not generally perform extension work.

d. Extension facilities

Presently, the small Extension and Publicity Section uses the facilities of the department headquarters at Ndola. A sizeable extension division has been proposed in a document prepared for funding by FINNIDA.

e. Financial resources

The total recurrent and capital expenditure estimates for extension in 1984 totalled K 60,000. A large part of the capital funds are provided by a FINNIDA grant. The rest of the funds are provided by the GRZ through the MLNR.

B. Total Human Resources Available for Extension in Zambia

There is a clear shortage of staff, particularly at the professional level, in all of the Zambia's agricultural extension institutions. Fisheries extension has two professional staff; forestry extension has only one. Although there appear to be more professional staff in agricultural extension and veterinary field services, nearly one-half of these are expatriates. At the diploma- and certificate-levels, the number of expatriates is negligible in all extension institutions. (See Table 17.) Dealing effectively with the enormous demand for extension services will require increases in the number of established posts.

No extension institution currently has a long- or short-term training programme aimed at upgrading and/or increasing staff in the present established posts, despite an abundance of training opportunities in Zambia for basic professional and field level staff. Staff are sent for training without clear attention to those fields which lack specialist personnel. (Current staff in training are shown in Table 18.) There is an immediate need for all institutions to prioritise areas in which trained personnel are most required, and to make long-term plans for training in these areas. At present, graduates from Zambia's colleges are not fully utilised, mainly due to a critical shortage of accommodations and, in some cases, of established posts for them to occupy.

C. Total Financial Resources Available for Extension in Zambia

The overall total expenditure for extension institutions is estimated at K 25.3 million. (See Table 16.) Although this is quite substantial, bearing in mind the economic problems Zambia is facing, the institutions' requirements, especially for operating funds, are not being met. Most of them operate with half of their capacity of available personnel, capital projects, and fixed assets. If more extension staff is to be recruited and more capital projects continue to be initiated, a corresponding increase in operating expenses must occur.

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Table 17: Total Agricultural Extension Staff, 1984

	<u>Administrative</u>	<u>Professionals^a</u>	<u>Technical^b</u>	<u>Total</u>
<u>Total Authorized Posts</u>	57	122	2,046	2,225
<u>Positions Vacant</u>	-	17	-	17
<u>Nationals (Citizens)</u>				
Staff in training	-	9	38	47
Staff on long-term leave ^c	-	-	-	-
Number of nationals currently in posts	57	56	2,008	2,121
Expressed as a percent of authorized posts	100	46	98	94
<u>Expatriates</u>				
Serving in authorized posts ^d	-	41	3	44
Expressed as a percent of authorized posts	-	34	0.2	1.3
Not in authorized posts	-	10	-	10
Total number of expatriates	-	51	3	54
<u>Total Number of Staff</u>	<u>57</u>	<u>107</u>	<u>2,011</u>	<u>2,175</u>

^aProfessional = BSc or above.

^bTechnical = diplomate and certificate.

^cLong-term leave is leave of three months or more.

^dIrrespective of source of funds.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

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Table 18: Training Plans for Staff of Extension Institutions, 1984^a

<u>Level</u>	<u>General Field of Study</u>					<u>Total</u>
	<u>Crop Science</u>	<u>Animal Science</u>	<u>Veterinary</u>	<u>Economics</u>	<u>Other^c</u>	
Doctorate ^b	-	-	-	-	-	-
Masters ^b	3	1	2	-	1	7
Bachelor	-	-	2	-	-	2

^aThese are number of staff that are currently in training.

^bMasters in Agronomy 2, Horticulture 1, Animal Production 1; others not specified.

^cForestry, general 1.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

VI CONSTRAINTS TO AND THE POTENTIAL FOR INCREASED PRODUCTIVITY

A. Major Crops

1. Current and potential yields

In Zambia, the major food crops are produced primarily by small-scale farmers, whose household farms range in size from one-quarter to five ha, averaging about three ha. Yields of major crops, though still low, have increased over the past ten years. The average yields of selected crops in 1981-1982 is given in Table 19.

Yields attained by small-scale farmers are much lower than those obtained by commercial farmers and by research stations. It is hoped that productivity per unit area obtained by small-scale farmers over the next decade will approach levels currently obtained by commercial farmers.

A survey of 32 knowledgeable persons was conducted on constraints to increased agricultural productivity in Zambia for the high-priority food crops: maize, sorghum/millet and cassava. With slight variations, the major constraints are common to all crops. The results of the survey are summarised in Table 20 and are discussed under each of the major kinds of constraints identified.

2. Physical constraints

a. Climate

The majority of respondents did not consider climate an important constraint to increased production of maize, sorghum/millet and cassava. Rainfall distribution is the major constraint to maize production. During the past three cropping seasons, dry spells of four to six weeks have occurred in the middle of the maize growing season, with adverse effects on yields. Variation in the annual total amount of rainfall affects all crops. Although long-term annual rainfall averages range from 1,300 mm in the north to 700 mm in the extreme southwest of the country, these have dropped as much as 45 percent in recent years. Current crop varieties, bred under and for conditions of uninterrupted rainy seasons and high total rainfall, have not performed well in recent years. For small farmers, who generally do not have access to irrigation, the result of inadequate rainfall is a halt to agricultural production for half of the year.

b. Soils

Survey respondents considered soil suitability to be of some importance as a constraint to maize production but of less significance for sorghum/millet and cassava. The major soil problem for maize production is found in the high-rainfall agro-ecological zone covering the Northern, Copperbelt and Northwestern Provinces.

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Table 19: Average Attainable Yields of Selected Crops by Research, Commercial Farmers and Small-Scale Farmers, 1982/83

	Yield (MT/ha)			
	<u>Maize</u>	<u>Sorghum/Millet</u>	<u>Cassava</u>	<u>Wheat</u>
Research	6.8	3.4	12.0	6.6
Commercial Farmers	4.1	1.5	-	4.5
Small-Scale Farmers	2.3	0.8	7.5	-

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

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Table 20: Perceptions of Severity of Constraints to Achieving Higher Crop Yields^a

Constraints	Maize	Millet/ Sorghum	Cassava	Average
<u>Physical/Biological</u>				
Climate	2.8	2.8	2.6	2.8
Annual rainfall	3.6	3.3	2.8	3.3
Rain distribution	4.8	3.6	3.3	4.0
Soil suitability	3.0	2.7	2.8	2.9
Soil degradation	3.3	3.0	3.1	3.2
Soil topography	2.0	2.3	2.3	2.3
Weeds	3.2	3.7	3.1	3.4
Plant diseases	2.3	2.8	3.2	2.8
Pests/Insects	2.6	3.1	2.5	2.8
Predators	1.6	3.3	3.0	2.7
Varieties/Species	3.5	4.0	3.5	3.7
Human power	3.5	3.5	3.6	3.6
Animal power	3.5	3.8	3.2	3.6
<u>Economic/Policy</u>				
Prices	3.6	3.6	4.5	4.0
Marketing	3.3	3.2	4.2	3.6
Short-Term credit	4.1	3.2	2.6	3.4
Long-Term credit	3.2	2.8	2.3	2.8
Government subsidy	3.3	2.8	1.6	2.6
Import policies	1.5	1.7	1.2	1.5
<u>Traditional</u>				
Land tenure	2.1	2.6	3.1	2.7
Farm size	2.1	2.5	2.5	2.4
Education	3.0	3.6	2.5	3.1
Role of women	3.0	3.6	2.6	3.1
<u>Institutional</u>				
Research	3.1	4.5	4.1	4.0
Training	3.3	3.8	4.2	3.8
Extension	4.1	4.2	4.2	4.2
Overall Average	3.1	3.3	3.1	3.2

^a Weighted average of respondent rankings: 1 = Not serious, 5 = Very serious.
Number of respondents for each crop was 8.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

The soils in this zone are highly leached, low in available nutrients, and generally acidic. Under these conditions, maize yields are not economical relative to those of cassava and sorghum/millet.

For all three crops, respondents considered soil degradation to be a constraint to increased production. Such degradation is due, in part, to the continuous growing of cereals on the same land for many seasons without rotation or fallow. Soil topography was not considered to be a constraint to production for any of the crops.

c. Weeds

Weeds were viewed as a serious constraint for all crops, and as being particularly serious for sorghum/millet. Small-scale farmers grow a variety of crops within a short rainfall period, and weeding is done more thoroughly for crops which farmers consider more vulnerable to weeds. A more weed-competitive crop like cassava, however, may be weeded only once a year, during the period of low labour demand for other field crops. In general, the weed problem is associated with a lack of on-farm human and animal power. In maize, it is estimated that as much as a 30 percent reduction in yield is due to weeds.

d. Plant diseases and pests

Although stalk borers and streak virus are the major maize pests and disease, they were considered to be of little importance in hampering increased production. Maize varieties currently under commercial production have been selected for their resistance to pests and diseases. Pest and disease problems, especially bird damage and fungal diseases, were rated more seriously in sorghum/millet production. Cassava mosaic and the recently-introduced green spidermite and mealybug affect crop growth, but are not yet perceived as significant constraints.

e. Varieties/species

Despite tremendous achievements in wheat and maize breeding over the past five years, poorly-adapted or low-yielding crop varieties and species were considered very important constraints to increased production for all three crops. Current high-yielding varieties of maize, mainly hybrids with long maturity periods, are cultivated in most parts of Zambia, but they are poorly adapted to areas of low or short-duration rainfall. Current research efforts are focussed on this problem.

Sorghum/millet improvement through variety selection and breeding is still in its early stages: a majority of farmers still plant low-yielding local selections. The first Zambia sorghum variety was released in 1983. Two red sorghums suitable for brewing have also been released. Sorghum/millet varieties' attainable yields, disease and pest resistance, and suitability for either brewing or home consumption all need to be improved.

At the moment, there are no research-recommended cassava varieties under cultivation, although some short-duration cultivars have been identified in the research programme. Current research work is limited to variety selection for yield, maturity period, and disease and pest resistance.

f. Farm power

For all crops, a lack of on-farm power, both human and animal, was considered to be an important constraint to increased production. In areas of high maize production, oxen are used as a source of draught power by small-scale farmers; however, the planting seasons of nearly all crops fall within the same short period that the demand for draught power within the total farm operation is usually higher than what is available. As a result, some crops are planted late with consequent low yields. In other areas where maize is grown, local communities traditionally have not kept animals, and lack of animal power therefore is a critical constraint. Farmers' use of animal power is also affected by the availability of forage and feed, a constraint noted below.

3. Economic constraints

a. Pricing

Respondents considered pricing of produce to be an important constraint for all three crops, especially for cassava. It was felt that prices for produce are not high enough to encourage farmers to produce more. With the future reduction in the level of fertiliser subsidies, farmers have expected to be paid even more for their produce. Prior to 1982, there were no price incentives for sorghum/millet and cassava production. This meant that it was difficult for farmers to produce for the formal market. Price incentives have since been established; prices for all crops are reviewed yearly and farmers are informed of the figures in advance of the planting season.

b. Marketing

Respondents considered marketing to be an important constraint for all crops. For example, farmers still experience late payments by the marketing agencies. The result is that farmers do not have cash to buy farm inputs for the next cropping season and, therefore are perpetually dependent on short-term credit from lending institutions. Delayed supply of required inputs such as fertilisers and seed has occurred at critical times in the cropping season. Small-scale farmers must often transport their produce for long distances to the nearest sales depots. Improving the processing and utilisation of crops, especially of cassava and sorghum, may favourably affect marketing opportunities and should be considered.

c. Credit

In adequate short-term credit to small-scale farmers is considered to be a major constraint to increased production of maize and, to a lesser degree, of sorghum/millet. Credit for small-scale farmers producing maize is insufficient. Less than one-half of the applications are given credit for maize production. Lending institutions are also willing to provide credit for sorghum/millet; many farmers cannot obtain credit because they lack the necessary security. Those surveyed viewed lack of credit as less important in affecting cassava production. This may be due to the present low demand for cassava on the formal market.

d. Government subsidy and import policies

Government subsidies of crop inputs and products were considered to affect maize production considerably. Removal of such subsidies of maize inputs led to their decreased use during the 1983-84 cropping season. On the other hand, due to economic difficulties, the GRZ is unable to continue subsidizing consumer food costs. The government imports maize only to meet the shortfalls which occur during droughts; import policy this is not seen as a significant constraint to increased maize production. Neither subsidies nor import policies are considered important in sorghum/millet and cassava production.

4. Constraints related to rural traditions

a. Land tenure

Land tenure was not considered a constraint to increased maize, sorghum/millet or cassava production. Most small scale farmers are settled in traditional land (non-state land) which covers more than half of Zambia's total land area. This land is used in accordance with customary law without lease or formal right of occupancy.

b. Farm size

Survey respondents did not consider farm size to be a limitation to increased productivity of any of the three crops. Additional land is still available; farm sizes can be expanded whenever other requirements, such as labour and farm power, become available.

c. Education

The level of formal education of small-scale farmers was seen as affecting sorghum/millet production to a greater degree than maize or cassava. In general, higher education levels of small-scale farmers are seen as conducive to the efficient use of inputs and quick adoption of new farm technologies.

d. The role of women

The role of women was considered an important factor in increasing sorghum/millet production and, to a lesser degree, maize production. It was not considered an important constraint to cassava production. In small-scale farm households, women contribute significantly to food production and preparation. It has been estimated that about 30 percent of rural households are headed by females. However, it is doubtful that women participate significantly in decision-making regarding farm plans, credit acquisition, produce sales and use of sales proceeds.

5. Institutional constraints

Institutional constraints related to research, training and extension were all considered important in increasing maize, sorghum/millet and cassava production. A lack of adequate extension was perceived as being more uniformly constraining for all three crops, while research and training were seen as somewhat less constraining for maize production. The agricultural research, training and extension programmes are said to be not addressing themselves to the problems and priorities of small-scale farmers. Past research has been oriented towards solving the problems of the commercial farmers who have, as would be expected, benefitted. Only recently have the programmes been reoriented towards adaptive research for small-scale farmers. The training of agriculturists has also emphasised problems related to commercial cash crop and animal production, especially at the diploma and degree levels. Furthermore, the Extension Service is currently faced with shortage of transport and operational funds, limiting its effectiveness in passing on research to farmers. The posting of a research-extension liaison officer in each province should facilitate increased use of appropriate research findings by extension personnel.

B. Livestock

The most important livestock commodities in Zambia are beef and dairy cattle and poultry. Characteristics of production in the traditional and commercial sectors have been discussed briefly in Chapter II. Due to logistical problems faced during data collection, very few respondents were surveyed regarding poultry and dairy cattle. For this reason, constraints related to increasing beef cattle productivity will be emphasised in the following discussion. (See Table 21.)

1. Physical constraints

Natural forage, other fodder, and feed supply were considered the most important constraints to increased livestock production. In the case of beef cattle, these and the almost equally important constraints of water supply and access, are clearly related

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Table 21: Perceptions of Severity of Constraints to Achieving Higher Livestock Productivity^a

Constraints	Beef Cattle	Poultry	Average
<u>Physical/Biological</u>			
Climate	4.0	2.3	3.2
Annual rainfall	3.5	3.0	3.3
Rain distribution	4.2	3.0	3.7
Soil suitability	2.3	2.3	2.4
Soil degradation	2.3	2.3	2.4
Soil topography	2.2	2.3	2.3
Nat. forage supply	4.0	2.0	3.1
Fodder supply	4.8	4.0	4.5
Other fodder supply	4.5	4.3	4.5
Water supply	4.3	3.7	4.1
Water access	4.0	3.7	3.9
Disease prevention	3.8	3.7	3.8
Curative problems	4.3	4.3	4.4
Pests/Insects	4.0	4.0	4.1
Predators	1.8	3.0	2.5
Species/Breeds	1.8	2.3	2.1
<u>Economic/Policy</u>			
Input prices	4.0	4.7	4.4
Animal prices	3.5	4.3	4.0
Marketing	4.0	3.3	3.7
Short-Term credit	3.0	3.3	3.2
Long-Term credit	3.8	3.3	3.6
Government subsidy	2.8	4.0	3.5
Import policy	2.7	3.3	3.1
<u>Traditional</u>			
Land tenure	3.2	2.0	2.7
Farm size	2.5	2.3	2.5
Farm labor	2.3	2.3	2.4
Education	3.4	2.5	3.0
Role of women	1.5	1.0	1.3
<u>Management Factors</u>			
Herd management	3.7	2.7	3.3
Range management	4.5	2.7	3.7
Health management	4.3	4.7	4.6
Overall Average	3.4	3.1	3.4

^aWeighted average of respondent rankings: 1 = Not serious, 5 = Very serious. Number of respondents for beef was 6 and for poultry was 3.

Source: Data collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

to climate and the distribution of rainfall, which also ranked highly on the list of constraints. The dry season results in livestock's weight loss and, for young animals, retarded growth. Animal diseases and pests are also very important constraints for both beef cattle and poultry, afflicting all parts of Zambia. Foot and Mouth Disease occurs in the south, East Coast Fever in the north and east and African Swine Fever in the Eastern Province. Although these diseases are under control, their effect on animal sales is significant. The DVTCS experiences shortages of essential drugs to treat animals and to check the spread of tsetse flies. Some areas with good agricultural potential are not utilised because of tsetse fly infestation.

The suitability, topography and degradation of soils were not considered important constraints to livestock production. Predators are considered a moderately important constraint for poultry production, but were not seen as serious for cattle. The species and breeds produced are not thought to seriously constrain the production of either cattle or poultry.

2. Economic constraints

Prices of inputs, prices of animals and marketing were considered to be very important constraints to increased production. For beef cattle, long-term credit was also seen as a constraint; for poultry, government subsidy was considered a serious constraint. Although it was accepted that short-term credit and import policies could affect production, they were not considered to be very serious constraints.

3. Constraints related to rural traditions

For beef production, land tenure and education were considered the most important constraint related to rural traditions. None of these constraints, however, were felt to be as serious as the key physical/biological or economic/policy constraints.

4. Management constraints

Herd, range and health management were considered as very important constraints to beef production. The annual off-take rates under traditional herding methods are low. As indicated above, the scarcity of green fodder during the dry season results in animals becoming undernourished. Indiscriminate burning of grazing areas further limits natural forage supply. Health management and input prices were seen as the most constraining factors in poultry production.

VII. STAFF ASSESSMENT OF INSTITUTIONS

During the course of the ARRA, staff members from agricultural research, training and extension institutions were interviewed and asked to complete a questionnaire to determine their perception of the importance of various constraints relating to the effectiveness of the respective institutions. The sample included a minimum of fifteen junior and senior staff from each type of institution. The results of the assessment are presented in Table 22 and discussed below.

A. Agricultural Research Institutions

1. Budget

Respondents indicated that funding levels for research programmes are inadequate. Difficulties in the release of funds and, to a lesser degree, inconsistency of support were also considered to be important constraints.

2. Foreign exchange

Respondents pointed out that research institutions suffer from a scarcity of foreign exchange with which to buy machinery, laboratory equipment and spare parts. A similar lack of foreign exchange to purchase journals, books and periodicals was perceived as a slightly lesser constraint.

3. Quality and training of staff

Some respondents felt that additional training for all levels of staff is necessary. However, survey results suggested that, while all staff are interested in further training, senior staff have more opportunities for training abroad than junior staff. Training for support staff is available locally, although opportunities are limited. Results also indicated that a lack of experience and motivation is a constraint for senior, junior or support staff.

4. Facilities

Respondents felt that while the number and capacity of conference rooms are adequate, the rooms are poorly equipped for their intended purposes. The number of laboratories is adequate, but their capacity, in terms of size and equipment, is inadequate to handle the volume of work. The number of offices is not adequate, although those which are available are adequately equipped.

In general, the condition of equipment is indicated as one of the most serious constraints to agricultural research. Maintenance facilities for much of this equipment are not available locally.

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Table 22: Staff Assessment of Research, Training, and Extension Institutions^a

Problems/Criteria	Research	Training	Extension	Overall Average	Number of Respondents		
					Research	Training	Extension
Budget:							
Consistency of support	3.9	4.4	4.2	4.2	15	24	16
Level of funding	4.5	4.4	4.7	4.5	15	25	16
Release of funds	4.3	4.5	4.6	4.5	15	24	16
Foreign Exchange Difficulties:							
For purchase of parts	4.1	3.9	3.7	3.9	15	24	16
For purchase of equipment	4.3	4.3	3.8	4.1	15	15	16
For purchase of books/journals	3.3	3.6	2.9	3.3	15	14	16
For purchase of special supplies	4.2	3.4	2.9	3.5	15	14	16
Senior Staff:							
Lack of training opportunities	2.4	4.1	3.6	3.4	14	14	16
Lack of interest in further training	1.3	2.4	2.2	2.0	15	14	16
Lack of experience/background	2.7	3.2	3.1	3.0	15	15	16
Lack of motivation	2.8	3.9	3.7	3.5	15	14	15
Lack of leadership	2.8	3.0	2.9	2.9	15	14	16
Junior Staff:							
Lack of training opportunities	3.2	4.6	4.3	4.0	15	14	16
Lack of interest in further training	1.6	2.4	2.3	2.1	15	14	16
Lack of experience	2.9	3.1	3.1	3.0	15	15	16
Lack of motivation	3.0	3.9	4.1	3.7	15	14	16
Support Staff:							
Lack of training opportunities	3.9	4.2	3.8	4.0	15	13	15
Lack of interest in further training	1.9	3.4	2.1	2.5	15	13	15
Lack of experience	2.4	2.9	3.0	2.8	15	14	15
Lack of motivation	2.8	3.2	3.0	3.0	15	14	15
Conference/Meeting Rooms:							
Number of conference rooms	2.3	2.8	3.3	2.8	15	14	15
Capacity of conference rooms	2.6	3.4	2.9	3.0	15	14	15
Adequacy of conference rooms	3.1	3.0	2.8	3.0	15	15	15
Classrooms:							
Number of classrooms	NA ^b	3.2	NA	NA	NA	14	NA
Capacity of classrooms	NA	3.1	NA	NA	NA	14	NA
Adequacy of classrooms	NA	3.1	NA	NA	NA	15	NA
Laboratories:							
Number of laboratories	2.9	3.6	NA	NA	15	14	NA
Capacity of laboratories	3.6	3.3	NA	NA	15	15	NA
Adequacy of laboratories	3.9	3.4	NA	NA	15	14	NA

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Table 22: Staff Assessment of Research, Training, and Extension Institutions^a(cont.)

Problems/Criteria	Research	Training	Extension	Overall Average	Number of Respondents		
					Research	Training	Extension
Offices:							
Number	3.1	3.8	4.0	3.6	15	15	16
Capacity	2.3	3.4	3.0	2.9	15	14	16
Adequacy	2.4	3.1	2.5	2.7	15	14	16
Equipment:							
Insufficient number/Obsolescence	4.5	4.2	4.3	4.3	15	14	15
Lack of repair/maintenance	4.7	4.8	4.2	4.6	15	14	15
Funds for essential equipment	4.7	4.9	4.6	4.7	15	15	15
Transportation:							
Budget for operations	4.4	4.0	4.3	4.2	15	14	15
Availability/Access	3.6	4.5	4.4	4.2	15	15	15
Adequacy of allocation	--	4.4	4.7	4.6	NA ^b	NA	14
Maintenance/Care	4.1	4.1	4.2	4.1	15	13	15
Number of vehicles/bicycles	4.2	4.9	4.6	4.6	15	14	15
Staff Housing:							
Number of houses	4.5	4.5	4.9	4.6	15	15	15
Adequacy of staff housing	3.6	3.6	4.4	3.9	15	15	15
Salary Scales/Levels:							
Not sufficient to hold staff	4.3	4.3	4.3	4.3	15	15	15
No differentiation for remote posts	--	--	4.5	4.5	NA	NA	16
Competition from the government sector	2.3	2.3	3.9	2.8	15	15	16
Competition from private sector	4.6	4.6	3.3	4.2	15	15	16
Promotion System:							
Promotion schedule	4.2	4.2	4.7	4.4	15	15	16
Rewards for superior service	4.3	4.3	4.4	4.3	15	15	16
Without higher training certificate	--	--	4.4	4.4	NA	NA	16
Staff evaluation procedure	4.2	4.2	4.2	4.2	15	15	16
Tenure System:							
Tenure security rules	1.5	1.5	4.2	2.4	15	15	16
Tenure for superior young staff	1.7	1.7	2.8	2.1	15	15	15
Other Benefits:							
Leaves of absence schedule	1.5	1.5	2.8	1.9	15	15	16
Health benefits	2.9	2.9	2.1	2.6	15	15	15
Retirement benefits	3.1	3.1	3.1	3.1	15	15	16

^a Key to seriousness of Problems/Criteria: 1 = Not serious, 5 = Very serious.

^b NA = Not Available, Not Applicable, or No Answer.

Source: Data Collected from the DEVRES/SADCC Agricultural Research Resource Assessment, 1984.

5. Transportation

The majority of research staff indicated that inadequate transport is a constraint, especially for research personnel responsible for conducting research in several different agro-ecological zones.

6. Terms of service and benefits

Research staff noted several inadequacies in the terms of service and the benefits provided, including:

- o An inadequate number of houses to accommodate the increasing number of research personnel;
- o Lower salary levels than those of the parastatals and the private sector; and
- o Inadequate staff evaluation procedures.

Research staff indicated greater satisfaction with other aspects of the terms of service and benefits, including the present tenure system and the free medical benefits provided by the GRZ through the Ministry of Health. Although respondents felt that retirement benefits were low and that the employers should contribute more to the benefits, they did not consider them to be important constraints. Such factors as communication facilities (telephones and transport) and social and economic incentives, however, were considered important to the welfare of research personnel.

B. Agricultural Training Institutions

1. Budget

Many respondents felt that funding levels for training programmes are inadequate and suffer from occasional, extreme fluctuations.

2. Foreign exchange

The scarcity of foreign exchange with which to buy equipment, parts and books was identified as a constraint.

3. Quality and training of staff

Respondents in all training institutions indicated the need for more training opportunities. Nearly all staff were felt to have the requisite experience to perform well, but junior staff, in particular, were seen as lacking motivation.

4. Facilities

The lack of inadequate equipment was perceived as a very serious constraint. Respondents viewed laboratories as being insufficient in number and inadequately equipped; libraries were considered to be inadequately equipped to meet staff and student needs. The number of conference/meeting rooms was not considered to be an important constraint, although some felt their capacity was not adequate in all cases.

5. Transportation

Transportation was viewed as a major constraint, affecting staff and student practical training programmes which have to be conducted away from the colleges.

6. Terms of service and benefits

Training staff responded much the same as did research staff regarding terms of service and benefits.

C. Agricultural Extension Institutions

1. Budget

Respondents from the extension institutions indicated that inadequate funding has been the most serious constraint, especially in the last three years, resulting in curtailment of many extension programmes.

2. Foreign exchange

The scarcity of foreign exchange was considered an indirect constraint affecting procurement of certain equipment.

3. Quality and training of staff

Respondents felt that additional training opportunities are needed. A lack of motivation was seen as a problem with junior staff.

4. Facilities

The availability, condition and maintenance of equipment were seen as major constraints. The number of offices, especially at district and lower levels, was considered inadequate for the smooth running of extension services.

5. Staff housing

Many respondents considered the lack of adequate housing for staff at all levels to be the single most important constraint to extension. The housing problem has affected the appropriate distribution of staff at all levels.

6. Transportation

The problem of transport was ranked second to that of staff housing. The number of vehicles available is insufficient.

7. Terms of service and benefits

As did staff in research and training institutions, respondents in extension institutions noted that salary levels are lower than those in the private sector. They indicated that allowances for extension staff posted to remote areas would assist in improving staff morale. The inadequacy of staff evaluation procedures, promotion schedules and tenure security rules also ranked as important constraints. Health benefits, leave-of-absence policies and retirement benefits were not considered important constraints. However, it was felt that the retirement system could be improved. Respondents further indicated that social and economic incentives were important considerations.

D. Summary

The main constraints perceived as common to the research, training and extension institutions were budget, transport, housing, equipment, staff training and the staff evaluation and promotion system, as highlighted below:

- o Recurrent budget funding by government is inadequate and subject to intermittent fluctuations, resulting in hampered implementation of planned programmes and projects.
- o The insufficient number of houses is perhaps the most frustrating constraint for staff in these institutions, particularly for extension staff.
- o The quantity and condition of the equipment servicing the various institutions is inadequate. Locally-available maintenance and repair facilities for equipment are often not adequate. Different research institutions, in part, due to the nature of their operations, have different types of equipment. This lack of standardisation constrains the pooling of equipment and the effectiveness of maintenance and repair services.
- o In all the institutions, it was indicated that there is no formal system to reward superior service. Staff evaluation

procedures are weak in determining suitability for senior posts. This demoralises those who work hard and deserve promotion. Frequent transfer of staff from one section or station to another further retards staff efficiency.

- o With the exception of extension institutions, about half of the total professional staff currently serving in Zambia's agricultural institutions are expatriates. (See Tables 5, 12 and 17.) Most of the key positions--programme coordinators, heads of departments and team leaders--are held by expatriates. The turnover among expatriate staff creates discontinuity in programme implementation, especially when donor funds are withdrawn upon the departure of the particular expatriate staff member. Present efforts to train nationals, both on the job and at advanced formal levels, should be accelerated to stabilise staff placement as soon as possible.

VIII. CONCLUSIONS AND RECOMMENDATIONS

Constraints to agricultural productivity have been discussed in Chapters VI and VII and will not be repeated. This chapter will propose some actions to deal with those constraints.

A. Strengthening Zambia's Agricultural Institutions

In addition to the actions recommended below, a formal body should be established to provide for closer collaboration among research, training and extension institutions. This will assist in coordinating programme planning among the three sets of institutions. Furthermore, each set of institutions should take steps to focus their activities on the goals of the current national development plan. Such steps would include creating high-priority programmes, targeting the allocation of funding and personnel to specific areas and commodities, and establishing monitoring and evaluation mechanisms to ensure that priorities are addressed.

1. Research institutions

There are six research institutions in Zambia which conduct agricultural research. As this assessment focussed on their common constraints, the following recommendations are applicable for all the research institutions except where specific cases are cited.

a. Funding

Funding should be made available to cover the recurrent costs of major research programmes which are designed to address the needs and priorities of small-scale farmers engaged in food crop production. The present arrangement of bilateral and multilateral funding of research programmes should continue and possibly be expanded to cover more areas and programmes.

b. Equipment

A centre for agricultural laboratory and repair services should be established to provide commonly-needed analytical services for a large number of agricultural stations and programmes. This centralisation would enable such services to be provided at a lower cost to the many institutions doing similar work, thus helping to alleviate foreign exchange deficiencies resulting from the costly purchase and repair of research equipment. Such a centre should be administered jointly by the MAWD and the MHE. Funding could be sought from interested donors.

c. Staff training

Each research institution should undertake a critical examination of its present and future programmes, determining the numbers and levels of Zambian professional, technical, and support staff that will be required to carry out its projected programmes. Based on these examinations, five- to ten-year staff training programmes--both on-the-job and formal academic advanced training-- should be devised. As much as possible, further training should be done within the SADCC region where specialised training facilities are available. The training programmes should be monitored and evaluated regularly. Until such training programmes are implemented, reliance on expatriate personnel is inevitable.

d. Transport

Each institute should develop plans for maximising the use of its currently available transport, since it is unlikely that funds for transport will be increased in the near future. Many of the vehicles currently in operation are donor-funded, especially those found in the Agricultural Research Branch. Administrators should continue to press government for the funds necessary to purchase and run an effective transport system. Perhaps donors could also help.

e. Housing

A balance should be worked out between recruitment of staff and the availability of adequate accommodations. The policy regarding this is presently "no accommodations--no recruitment." However, recruitment, especially of new college graduates, has taken place regardless of availability of accommodation in order to accommodate program needs.

In the absence of more funds for accelerated construction of housing a phased building project should be developed for those who cannot take advantage of the owner-occupier housing arrangement allowances provided by the GRZ because they are not able to purchase or build their own houses. Also in view of high rents for private accommodation, the government may not be in a position to raise housing allowances to attractive levels that enable individuals to opt to rent private accommodation.

f. Staff evaluation procedures

Staff evaluation procedures should be carried out by an evaluation committee in each institution rather than by senior individuals. This arrangement would prevent individual biases, and, equally important, the perception by staff that such biases exist. In addition, a system should be developed which would enable professional research officers in specialised fields to have salary increases without necessarily being promoted to higher administrative posts, as is the current practice. This could generate a strong base

of specialists within a decade. These changes would provide fairer compensation for superior service and help maintain a high standard of performance among staff.

2. Training institutions

a. Curricula

The curricula in each training institution should be examined with respect to its relevance to the basic needs and problems of small-scale farmers. Additional courses with farming systems perspectives should be offered, emphasising methodologies of investigating the problems of small-scale farmers. Practical, field-oriented training programmes should be stressed at all institutions.

b. Staff training

A consistent intermediate and long-term training programme to upgrade and increase the number of training staff should be developed for each institution, according to its teaching programme priorities. In the long term, expatriate staff should be replaced to a significant extent. The recommendations on training for research institutions should be applied to training institutions as well.

c. Housing and staff evaluation procedures

The recommendations regarding housing and staff evaluations proposed for research institutions are equally applicable to the training institutions.

d. Funding

Increased funding should be made available to the training institutions, to assist them in meeting recurrent costs.

3. Extension institutions

a. Transport

Funding for vehicle operations and maintenance and for travel allowances should be increased to improve extension workers' access to transport, especially at the district and field levels. Transport is the key to facilitating extension worker-farmer contact and, hence, needs adequate support.

b. Staffing levels and housing

The number of established posts must be increased to effectively deal with the enormous demand for extension services. Graduates from Zambia's training colleges currently are not fully utilised, mainly due to critical shortages of accommodations and, in some cases, of established posts for them to occupy. The development

of a phased building project for all levels of extension staff is highly recommended.

c. Staff training

Short- and long-term training plans for Subject Matter Specialists and field staff should be developed for all extension institutions. These should correspond to the areas and commodities on which government policy has placed a high priority. In addition, effective in-service staff training programmes should be established to provide extension workers in supervisory capacities with short-term training in management, programming and extension methodologies. The present extension staff at the supervisory level do not have the management tools to effectively organise extension efforts. Research personnel should be involved in these programmes, to share new technology applicable to a given area's farming systems.

d. Training and visit system

The already adopted but unsatisfactorily executed T&V system in the Department of Agriculture should be strengthened. General and continuing orientation to the T&V approach is needed at all levels. Block supervisors and camp officers should be incorporated into preplanned, regularly scheduled training programmes and visits to farmers. Initial efforts should be concentrated on high-priority crops or animals in a few selected provinces and districts. As experience is gained, more areas can be added to the programme.

e. Staff evaluation procedures

Staff evaluation and promotion procedures should be improved as was proposed for research institutions. In particular, a system should be developed which would provide merit increases in salary without necessarily promoting a person to a new position. This would contribute to increased experience and competence at all levels.

F. Dealing with Constraints Affecting Crop Production

1. Varieties and species

For most major food crops, varieties under cultivation need to be further improved in terms of yield, disease and pest resistance, and adaptation to different agro-ecological zones and to rainfall and soil fertility variations within the zones. More effort should be focussed on improving open-pollinated varieties which may be more beneficial to small-scale farmers.

2. Farm power

Animal draughtpower should be promoted more strongly. Programmes for training and providing oxen to small-scale farmers should be revitalised through the Extension Service. More funds should be made available for oxen training; likewise, farmers' financial ability to acquire oxen should be strengthened through the provision of medium-term loans. Low-energy-input equipment for small-scale farmers should be made more widely available. This would include hand- and animal-powered planters, weeders, cultivators, and threshers. In Zambia it has not been possible for local companies to manufacture these because of the limited size of the market. However, a company within the SADCC region could produce and supply such equipment to the whole region.

3. Soil and water resources

Further work on soil and water conservation needs to be done, particularly in relation to cultural practices in crop production. Special attention is needed to enhance women's knowledge of the role that cultural practices play in air, soil and water conservation inasmuch as they perform many of the tasks in food crop production.

4. Economic policy

Research is needed to provide policy-makers with clear alternatives for strengthening pricing, marketing, and credit policies and/or incentives. Producer prices should be conducive to farmers' increased production. The effects of various price incentives should be studied. In addition, the marketing system should be made more efficient in terms of input delivery, payment for produce, and expanded markets for produce. With respect to the latter, research should be conducted on industrial uses of cassava and sorghum/millet. Short-term credit facilities must be improved; furthermore, research needs to be undertaken to resolve a number of issues related to credit. Such research could focus on determining whether financial support, in the form of credit and efficient marketing services, should be concentrated in areas where rainfall is more reliable to counterbalance poor yields in marginal areas of the country. Another potential area for research would be the question of why, despite an increase in the number of lending institutions, real credit for improving agricultural production appears not to be expanding.

C. Dealing with Constraints Affecting Livestock Production

The following recommendations are for beef cattle only, as information on other livestock was not collected.

1. Feed and forage

Programmes for pasture improvement should be initiated in major cattle-rearing areas. Planting of improved grasses and legumes should be included in the programme. Research into cheaper sources for supplementary feed should continue. Wild legume tree and shrub species currently eaten by animals should be investigated to determine the possibility of improving their yields and of incorporating them into supplementary feeds.

2. Water supply

The current programme of dam construction in low rainfall areas should be expanded. Water conserved in these dams may also be used also for pasture and crop irrigation projects. Other water-conserving techniques should be developed and evaluated.

3. Pest and disease control

More funding is needed for the veterinary department to effectively carry out preventive and curative programmes. These funds are needed both to purchase drugs and to improve the mobility of veterinary staff. In addition, a regional tsetse control programme must be initiated if the re-infestation of formerly tsetse-free areas and the recurrence of trypanosomiasis is to be effectively controlled in problem areas. The FAO-funded tsetse control training programme, which draws participants from southern and central Africa, should be expanded to incorporate field operations on a regional basis.

4. Economic policies

Policies should be enacted to increase the current off-take rate of 16 percent from traditionally-managed herds. These could include actions to increase the local demand for beef. At current prices, beef is beyond the reach of most middle- and low-income workers, thus suppressing demand. The construction of simple, yet hygienically-managed, abattoirs in areas of concentrated cattle population for use by local cattlemen would help make beef more economically available.