

# **SOUTHERN AFRICA: FOOD SECURITY POLICY OPTIONS**

Correct citation:

Mandivamba Rukuni and Richard H. Bernstein, eds. 1988. *Southern Africa: Food Security Policy Options*. Proceedings of the Third Annual Conference on Food Security Research in Southern Africa. 1-5 November, 1987. University of Zimbabwe/Michigan State University Food Security Research Project, Department of Agricultural Economics and Extension, Harare.

Library of Congress # HD9017.567

# TABLE OF CONTENTS

Foreword	v
Acknowledgements	vii

## OFFICIAL OPENING:

BUILDING RESEARCH CAPACITY AND COOPERATION IN SADCC UNIVERSITIES Professor W.J. Kamba	3
---	---

SADCC'S FOOD SECURITY ACCOMPLISHMENTS AND CHALLENGES S.G. Muchena	7
---	---

## SECTION 1: SADCC'S FOOD SECURITY PROGRAMME

SADCC'S EARLY WARNING SYSTEM FOR FOOD SECURITY A. Todorov and T. Ngara	13
---	----

THE ROLE OF AGRICULTURAL RESOURCE BASE INVENTORIES IN NATIONAL AND REGIONAL PLANNING M. Walsh, J. Samki, and H. Kamwendo	19
--	----

SADCC'S FOOD SECURITY PROGRAMME: FOOD PROCESSING AND PRESERVATION A.C. Mosha	31
--	----

REVIEW OF GRAIN STORAGE AS AN ACTOR IN POST- PRODUCTION SYSTEMS IN SADCC T. Rukuni	37
--	----

THE SADCC REGIONAL FOOD RESERVE PROJECT G.W.J. Almond, K.J.M. Dhliwayo, and F.H. Drane	43
---	----

## ACKNOWLEDGEMENTS

This proceedings of the Third Annual Conference on Food Security Research in Southern Africa is the product of close cooperation between social scientists, technical scientists, government officers, and donor agencies in Southern Africa. The studies reported in the proceedings are part of a comparative analysis of food security in Sub-Saharan Africa that is directed by Michael Weber of Michigan State University's Department of Agricultural Economics. The UZ/MSU food security research programme is being carried out through a sub-contract with Michigan State University.

In the Ministry of Lands, Agriculture, and Rural Resettlement, we acknowledge the generous support provided by Sam Muchena and John Dhliwayo who are responsible for the close collaboration between the food security research project and the SADCC Food Security Technical and Administrative Unit--responsible for developing and managing SADCC's Food Security Programme. They have been particularly helpful in identifying relevant research themes that complement the SADCC programme.

The research supporting the preparation the proceedings papers was financed by the U.S. Agency for International Development, Bureau of Science and Technology; Bureau for Africa; and the Southern Africa Regional Programme; under a *Food Security in Africa* cooperative agreement (DAN-1190-A-00-4092-00) with the Department of Agricultural Economics, Michigan State University and a sub-contract with the Department of Agricultural Economics and Extension, University of Zimbabwe. We are grateful to the following present and former USAID officials for their support to the project's efforts to strengthen indigenous research capacity for food security policy research: Don Anderson, Curt Reintsma, Thomas Mehen, Calvin Martin, David Atwood, Ernesto Lucas, Michael Yates, Roy Stacy, Dale Pfeiffer, Pamela Hussey, and Janet Schulman. We are particularly appreciative of the support provided by Allison Herrick, Eric Witt and Joshua Mushauri of the Southern Africa Regional Programme, Harare.

We convey special thanks to Thembi Sibanda for an excellent job in organizing the Third Annual Conference, and to the many individuals who helped to make the conference a success: Murie Hutchison, Lovemore Nyabako, Maxwell Chiwashira, Samson Maguhudze, George Nyamatemba, Ronald Sagwete, Pete Hopkins, and Andrew Barnes.

We are especially indebted to Mrs. Corinne Smith for her patience, skill, and dedication in word processing the numerous drafts of the chapters included in this proceedings. Her persistence in mastering the word processing and laser printer technology has been exceptional.

Finally, we thank Chris Wolf and Elizabeth Bartilson for providing technical support for the laser printing technology used to print the proceedings.

# **THE ROLE OF AGRICULTURAL RESOURCE BASE INVENTORIES IN NATIONAL AND REGIONAL PLANNING**

M. Walsh, J. Samki, and H. Kamwend<sup>1</sup>

## **INTRODUCTION**

The Regional Inventory of Agricultural Resource Bases (RIARB) is one of several projects under SADCC's Food Security Programme. These closely-linked projects are designed to provide a comprehensive assessment of factors affecting agricultural production, food supply, and food security in the region. For example, the RIARB will inevitably develop strong connections with the Regional Resources Information System.

The RIARB is responsible for cataloguing physical resources at the regional level, drawing upon national inventories being established simultaneously. Therefore, the project will act as a catalyst to consolidate all land resource information at a single place at both the regional and national level. This paper discusses the concept underlying the regional inventory, its functional relationships with related national inventories, and the anticipated roles the inventories will play in national and regional planning.

## **INVENTORY OF REGIONAL RESOURCE BASES**

Developing a regional inventory involves collecting, cataloguing, and presenting information about national agricultural resources, using a standardised approach to data gathering, classification, and presentation.

The agricultural resource base is the physical characteristics of the land, one of the basic factors of agricultural production. However, land consists of several elements such as the soil, climate, landform, and vegetation. In addition, it includes several factors used to modify the naturally occurring conditions, such as water for irrigation or fertilisers to improve soil fertility. An agricultural resource base inventory includes information on several of these important aspects of the natural environment.

### **Objectives of the inventory**

The objective of this project is to establish an agricultural resources inventory at both the national and regional level<sup>1</sup> to:

---

<sup>1</sup>Project coordinator, soil scientist, and land-use planner, respectively, Regional Inventory of National Agricultural Systems, SADCC.

- o assess the crop and livestock production potential, based largely on physical parameters such as climate, topography, and soil characteristics;
- o assess the population-supporting capacity and its impact on crop and livestock potentials;
- o construct both a SADCC land-use legend and land-use map and establish land utilisation types relevant to the SADCC region;
- o compile a SADCC soil map using common terms for all countries;
- o derive agroecological zones for interpreting crop suitability and crop production potential; and
- o propose projects for SADCC consideration which will fill data gaps identified through the above activities.

By comprehensively documenting SADCC's agricultural resource base, the inventory should assist the Food Security Programme to achieve its aims in widely differing environments in the region.

The inventory should assist regional agricultural policy makers to answer key questions such as:

- o Which crops can be grown?
- o Where can they be grown?
- o What yields can be expected?
- o What variation in yield might be expected from year to year?
- o How is land presently used?
- o How much land is available for further expansion of agricultural production?
- o What are the physical constraints limiting agricultural land-use?

### **Functions of an inventory**

Although compiling an agricultural resource base inventory is justifiable in its own right as a stocktaking exercise, it is of most value if information collected is used effectively. Therefore, the function of an inventory is to ensure that appropriate information is readily available to guide natural resource management, planning, and research. This information must be timely, relevant, accurate, and easily accessible to the user.

In SADCC countries, there exists extensive but scattered information about the natural resource base. These data have resulted from various *ad hoc* research surveys and projects development activities. Thus, one aim of preparing an inventory of the agricultural resource base is to systematically compile and collate data so that relevant information is documented and accessible to planners and policy makers.

Efforts to prepare a regional inventory should also help stimulate greater coordination between scientists and planners, in terms of survey and

research programmes. Natural resource data is used for a variety of purposes, such as:

- o storing and updating topographic and natural resource maps, which may be combined to produce land capability maps;
- o relating land-use and population to land capability to indicate population pressure;
- o assessing erosion hazards as determined by slope, land-use, vegetative cover, rainfall erosivity, and soil erodibility;
- o defining agroecological zones based on the total climatic environment, soil, and terrain characteristics;
- o determining the degree of environmental suitability for different crops, based on soils and climate characteristics;
- o comparing satellite images with mapped information to measure changes in vegetation, erosion, and green biomass over time; and
- o correlating mapped information with information gathered on the ground, such as comparing estimated crop area and yield data from crop-cutting experiments with remote-sensing estimates.

These uses of natural resource information can be made at the country level from national inventories. However, a regional inventory compiled from national inventories would provide the basis for a regional planning capability. Regional users require a broad overall assessment of environmental conditions, with less detail than is usually required at the national level, but with more detail than existing continental or global inventories provide.

Resource information must be presented in a standardised way throughout the region to allow direct comparisons of environmental conditions in different parts of the region, such as growing-season length, average annual rainfall, rainfall patterns (bimodal or unimodal), ruggedness of terrain, and vegetation. In the longer term, a regional inventory should assist to define the scope for regional cooperation in food security and to formulate policies to rationalise agricultural production as a means of achieving regional self-sufficiency. Planners should also use a regional inventory to help define priority areas for development projects and to select environmentally suitable projects. Standardised presentation of these data will enable planners to identify projects and to assess the region's potential for development as a whole.

While regional inventory data has a wide range of uses, this project is primarily concerned with the first stage of agricultural resource appraisal (i.e., establishing an inventory of the agricultural resource base by compiling and presenting basic resource data). In the future, planners will carry out the various interpretive and land-use planning procedures outlined above.

### **Data requirements for the inventories**

The main entries required to compile regional and national inventories are:

- o topographic maps that are up to date, using a 1:1 million contoured base map;
- o climate data for each station, including average seasonal rainfall, average monthly rainfall, length of growing season, average annual temperature, average monthly maximum temperature, average monthly minimum temperature, rainfall and temperature on a pentad basis, and a description of each meteorological station using World Meteorological Organisation format;
- o national soils maps (1:1 million) according to the FAO/UNESCO legend;
- o agroecological information derived from soil, topographic, and climatic data, based on a common approach;
- o population maps showing population distribution and density, and estimates of the rate of population change;
- o land-use information indicating current land-use;
- o irrigation statistics documenting the extent and type of irrigation, and area with irrigation development potential;
- o fertiliser information on proven and estimated quantities of fertilisers used; and
- o livestock information indicating livestock distribution and density, and a map of tsetse distribution.

Additional natural resource data being compiled at the country level include information on range resources and carrying capacity, geology, surface and groundwater resources (especially availability for irrigation and livestock), landform/physiography, and information about areas of land degradation and soil erosion.

## **IMPLEMENTATION**

### **Administrative arrangements**

The RIARB is staffed by a team of specialists at the central coordinating unit. The unit includes an agroecologist (project coordinator), a soil scientist, and a land-use planner. In addition to its coordinating role, the unit has a technical function to correlate and standardise the data. The project operates primarily with existing state and parastatal bodies within the SADCC region and with related SADCC sectors and programmes.

Member states are responsible for preparing their data in an agreed standard manner. This function is undertaken by the technical liaison officer nominated by each country. He is the contact person for the project and has now been officially appointed by all of member states.

### **Contents of the existing inventory**

The regional data, which the RIARB project is compiling and intends to make available, is derived from much more detailed data being compiled at the country level. The work is ongoing during this phase of the project. Below is a sketch of the present state of implementation at the regional level.

### **Maps**

A catalogue of most maps which are produced in the region is virtually complete. Copies of most small-scale maps have been procured and catalogued.

### **Climate and soils**

These data are being compiled and correlated and a SADCC soil legend is being prepared.

### **Agroecological zones**

A preliminary review of agroecological assessments and a comparison with FAO's agroecological zone approach has been made.

### **Population**

Total population, age, and geographic distribution; and rate of change data are available for most countries.

### **Irrigation**

Statistics documenting the extent and type of irrigation and the potential for irrigation development are available on a limited basis for some countries.

### **Fertilisers**

Limited data on proven and estimated quantities of fertilisers, in relation to the increasing requirements of the region, are available.

### **Livestock**

Tabulations of livestock numbers, structure, and distribution are available for most countries. The overriding problem is the quality of the data. Some information on tsetse distribution and limited information on dip tank distribution are available.

In addition to the above, data are being compiled at the national level on range resources and carrying capacity; geology; surface and groundwater resources; landform/physiography; vegetation; and areas affected by soil erosion.



## **Methods used in compiling the inventory**

### Inventory units

Policy and decision makers find it easier to relate development programmes or ideas to well defined administrative units. Therefore, country level natural resource data will be compiled on the basis of administrative units, be they districts, regions, or provinces.

A well documented administrative unit will be chosen within each member country as a pilot area to determine the structure and workability of the inventory. In this way, the inventory will provide resource and socio-economic data which are essential to many agricultural development projects and to interpretive procedures for determining agroecological areas/zones.

### SADCC soil resources and land-use maps

The project will produce SADCC soil and land-use maps. The possibility of each country producing its share of these maps is being explored. The process for compiling the SADCC soil map will be finalised at a meeting scheduled for March 1988 in Harare.

### Land-use mapping using satellite imagery

To provide an up to date assessment of land-use and land cover in the region, the RIARB project is procuring the most recent band 5 (0.5-0.6 UM) of Landsat MSS cloud-free scenes as a first step. Samples of Landsat TM and NOAA AVHRR will also be procured to allow for comparison and extrapolation of results. The information will be presented at a scale of 1:1 million which should allow easy integration of land-use data with agricultural, climatic, and soil data in order to assess land-use potential and suitability in the region.

### Data base creation

As the inventory is established, a natural resource data base is created. The data in the inventory will be computerised to speed storage and retrieval and to facilitate updating. Correlation of the data is essential for this purpose.

The team coordinator, through the computer staff of the Agricultural Institute in Ireland, is reviewing suitable computer storage and retrieval systems for the inventory. Results of this review will be presented to the SADCC Food Security Programme and, if accepted, will be utilised for the regional inventory. The extension of the system to the national level will then be explored.

Systematic collection of the resource data will help to identify areas requiring further documentation or research. This will assist in initiating and formulating projects for SADCC's consideration.

Literature procurement

Key words which describe the RIARB project identified over 9,000 references for the region. The project has acquired these references and abstracts, has categorised them by discipline and by country, and is distributing them to the RIARB technical liaison officers in all member states.

Air photograph coverage

While member states possess considerable up to date air photo coverage, their dates and scales are variable. The central unit is aware that negatives for air photographic coverage of some member states are held outside the SADCC region. This deprives institutions and personnel within member states of ready access to a very valuable aid to planning research and development activities.

Visits to member states

Central unit staff make regular and occasional visits to member states. This helps to maintain close links between the regional and national inventories and to ensure a coordinated approach.

## ROLE OF THE RIARB IN SADCC'S DEVELOPMENT: SOME OUTCOMES

Table 1 illustrates a declining trend between population and area. It is obvious that steps should be taken to strengthen national and regional land-use planning to support increasing population by increasing productivity per

---

Table 1. SADCC's population and area.<sup>a</sup>

---

Year	Population (000)	Hectares/person
1970	43,369	5.29
1980	60,466	3.79
1990	80,658	2.84
2000	107,481	2.13

---

<sup>a</sup>Total land area: 477,122,000 ha; potential rainfed agricultural area, 229,330,000 ha (IIMI, 1986).

Source: FAO (1985)

unit area. This will require adopting a satisfactory, relevant, and clear methodology for evaluating land and population support capacity.

A land resource inventory is fundamental to assessing crop and population potentials. At present the RIARB project views this in the form of land (mapping) units whose agroecological conditions have been quantitatively characterised. This ecological characterisation should enable planners to determine the suitability of the various land units for all existing and potential food crops in the region. This is the idealised final use of the inventory. At that stage, the information derived should be made available to regional and national policy makers so that regional agricultural production programmes can be devised which directly contribute towards achieving food self-sufficiency.

### **Development programmes**

Establishing the inventory is an on going process. At the same time, the RIARB project's central unit staff are initiating distinct programmes directly related to the inventory. SADC-wide studies in progress include assessments of:

- o the potential for rangeland livestock production in relation to inputs and environment;
- o the capacity to carry out routine soil fertility and plant analyses in relation to farmer requirements and standardisation of methods;
- o soil productivity to standardise crop production potentials in relation to inputs and environment;
- o basic agricultural statistics to help standardise data collection and reporting methods to facilitate comparisons between member countries and;
- o the socioeconomic potential of agricultural resources to provide planners and policy makers with realistic estimates.

For the first two areas, regional programmes are being compiled from discrete national projects, as outlined below.

### **SADCC's rangeland programme**

*Objectives.* The objectives of the programme are to develop the regional rangeland resources and to increase livestock carrying capacity.

*Description* Despite the rising numbers of livestock, the region is increasingly becoming a net importer of livestock products. Both number of small-scale farmers and the total number of livestock which they manage are increasing. While livestock numbers are too great for the fodder base to sustain, there are also too few livestock to satisfy the requirements of all farmers. Thus, the rangeland is deteriorating and livestock nutritional levels are falling.

Several problems which urgently require solutions include:

- o low nutritive value and dry-matter yield during the dry season, across all climatic zones, due to lack of water and overstocking;
- o bush encroachment and intrusion of noxious plants, due to overstocking, indiscriminate cutting of trees, or uncontrolled burning;
- o insufficient availability and poor use of crop residues and supplementary feed, due to monocropping and inadequate integration of livestock into farming systems;
- o trypanosomiasis in the more humid parts of the region, due to inadequate control measures and the absence of trypanosomiasis-tolerant breeds;
- o erosion due to the degradation of the vegetative cover as a result of overgrazing;
- o poor grazing management, as a result of ill-defined accountability for communal rangelands; and
- o low livestock offtake, as a result of insufficient market and transportation facilities.

A number of technical and socioeconomic solutions to these problems have been proposed, including rangeland rehabilitation, improved rangeland management, improvement of livestock feed resources, easing constraints to increased livestock offtake, and improving community participation in range improvement.

Four regional programmes are designed to achieve the rangeland improvement objectives:

- o range inventory and monitoring of rehabilitation measures at three sites in each country with an area of approximately 1,000 km<sup>2</sup>, each selected to represent the region's major rangeland resources;
- o integrated land-use planning and management in a number of communities and monitoring attitudes to integrated land-use;
- o a review of training needs for extension officers, planners, decision makers, and the broad spectrum of land-users; and
- o efforts to increase farmers' awareness of the need for rangeland conservation and improvement, and to establish accountability.

#### SADCC's soil fertility programme

*Objectives.* The objectives of the programme are to guide the efficient use of artificial fertiliser by improving the capacity and efficiency of soil laboratory and analysis services; and by meeting the current and projected demand for soil analyses.

*Description.* In the region, inorganic fertiliser is the largest single foreign exchange expenditure in agriculture. Of the 0.75 million metric tonnes consumed annually, over 80% is imported from outside the region. Therefore,

the soil analysis services must be capable of quickly and efficiently meeting the present and growing future demand, and be able to monitor soil fertility trends--particularly in intensively cultivated areas with high rural population densities. The latter would assist in the planning and developing the fertiliser industry.

An efficient soil fertility service plays a significant role in proper soil management. Several constraints have already been identified, including the need to improve soil sampling services, fertiliser recommendations and research backup, staff development, and the availability of facilities, equipment, and chemicals.

The proposed regional programme to achieve these objectives includes:

- o establishing proper soil sampling techniques by training and through mass media communication;
- o maintaining adequate applied-research backup for fertiliser recommendation;
- o providing farmers access to fertiliser;
- o modernising equipment in some of the services and providing adequate facilities and chemicals;
- o providing adequate budgets for running and maintaining the analysis service;
- o identifying and establishing training facilities for staff at all levels and possibly Portuguese and English-language courses to facilitate better communication within the region; and
- o arranging short term exchange visits of staff between the analysis services.

As part of the programme in Zimbabwe, the RIARB project is establishing a unique microcomputer link-up with the Soil Fertility Service and the Planning Department of AGRITEX (the extension service). This will help the Soil Fertility Service keep long term records necessary to evaluate gradual changes in crop yields associated with soil fertility and fertiliser application and composition. These data will enable the Planning Department and other sections of AGRITEX to monitor soil fertility trends throughout the country and use this information to develop farmer recommendations. In addition, this information will be of indirect use to the fertiliser industry to plan the production and distribution of its products.

The link-up will assist the RIARB project to assess regional crop production in terms of fertiliser inputs and help to estimate fertiliser requirements as a result of population increases.

## FUTURE DEVELOPMENTS

As the present phase of the project is being implemented, distinct complementary programmes are being initiated. These programmes will be managed and sustained by the countries themselves, with the RIARB project possibly playing a coordinating role. The RIARB project hopes to initiate several more programmes through the cooperation of existing institutions and personnel. The agricultural resource base programmes will help to refine and orientate the data base to meet the needs of planners.

Phase I of the RIARB project is projected to last from four-to-five years. It emphasises the collection and evaluation of data to identify gaps. Also, the data will provide basic information needed to evaluate the region's natural resources and the potential for agricultural development. The RIARB project is about midway through Phase I and has already initiated some development programmes during the course of compiling the inventory.

Phase II will focus on the long term development and use of the inventory, after satisfying the minimum requirements. Information of a more transient nature (for example, land-use) will need to be updated each five-to-ten years. A central unit will probably be required to update the inventory by incorporating new and improved data, to continue to evaluate the region's natural resources, and to promote use of the information by planners.

Provided the facility continues to exist, countries should be encouraged to submit more detailed information. Information obtained from systematic surveys is particularly valuable. For example, semidetained and detailed soil survey data used to compile national inventories could readily be incorporated into a computerised data base.

In summary, possible Phase II activities include:

- o initiating relevant development programmes;
- o updating, expanding, and computerizing the data bank;
- o analysing, evaluating, and interpreting the data; and
- o developing analytical techniques for regional planning.

## CONCLUSION

The chief aim of the RIARB project is to assist the SADCC Food Security Programme to achieve its objectives by providing a comprehensive information base required for agricultural planning. This consists of an inventory of land resources and interpretation in terms of the crop/farm system suitability of the region's agricultural resources. The inventory, which is partially constructed, has led SADCC to initiate two programmes vital to the

development and management of two significant areas--soil fertility and rangeland management.

The agroecological conditions in the SADCC region provide an environment with enormous agricultural potential. The region can support about five times its present population at low input levels and about 12 times that at intermediate input levels (FAO, 1982). However, agroecological conditions in the region are varied and complex. Because of the large size of the region (about 5 million km<sup>2</sup>), accurate and reliable data is often difficult and expensive to collect. Yet, collection and tabulation of relevant data is fundamental to agricultural planning. The assessments of agricultural production described above have all been conducted on a general scale and there is often insufficient experimental data to validate these estimates.

Maps representing agroecological conditions or zones at a 1:1 million scale are suitable for planning regional land-use and interpreting information at a high level of generalisation. Elements of the landscape which play a significant role in agricultural production, especially in drought years, cannot be shown. For example, dambos--low-lying seasonally waterlogged areas--while individually small, are collectively extensive in Zambia, Zimbabwe, and Malawi.

Thus, the RIARB is beginning to assess the agroecological conditions by tabulating these conditions on an administrative unit basis, with the flexibility to expand to smaller agricultural planning units. It should be stressed that when assessing agricultural production, the socioeconomic conditions in the planning units must also be considered.

## REFERENCES

- Food and Agriculture Organization. 1985. *SADCC agriculture towards the year 2000*. FAO, Rome.
- International Irrigation Management Institute (IIMI). 1986. *An African strategy for IIMI*. Kandy, Sri Lanka.
- Food and Agriculture Organization. 1982. *Potential population supporting capacities of lands in the developing world*. Technical Report of the Project FPA/INT/515. FAO, Rome.