1 OF 4

26594

National Library
of CanadaBibliothèque nationale
du CanadaCANADIAN THESES
ON MICROFICHETHÈSES CANADIENNES
SUR MICROFICHE

NAME OF AUTHOR/NOM DE L'AUTEUR William E. Dickins

TITLE OF THESIS/TITRE DE LA THÈSE A Plan for the Recovery and Long-term Development of Beef
Cattle in the Sahel

UNIVERSITY/UNIVERSITÉ The Norman Paterson School of International Affairs, Carleton U.

DEGREE FOR WHICH THESIS WAS PRESENTED/
GRADE POUR LEQUEL CETTE THÈSE FUT PRÉSENTÉE Master of Arts

YEAR THIS DEGREE CONFERRED/ANNÉE D'OBTENTION DE CE DEGRÉ 1976

NAME OF SUPERVISOR/NOM DU DIRECTEUR DE THÈSE Professor A.R.M. Ritter

Permission is hereby granted to the NATIONAL LIBRARY OF
CANADA to microfilm this thesis and to lend or sell copies
of the film.

*L'autorisation est, par la présente, accordée à la BIBLIOTHÈ-
QUE NATIONALE DU CANADA de microfilmer cette thèse et
de prêter ou de vendre des exemplaires du film.*

The author reserves other publication rights, and neither the
thesis nor extensive extracts from it may be printed or other-
wise reproduced without the author's written permission.

*L'auteur se réserve les autres droits de publication; ni la
thèse ni de longs extraits de celle-ci ne doivent être imprimés
ou autrement reproduits sans l'autorisation écrite de l'auteur.*

DATED/DATE 15 January 1976

SIGNED/SIGNÉ

JE thank for W.E. Dickins

PERMANENT ADDRESS/RÉSIDENCE FIXE

23 Langholn Crescent, Ottawa, Ontario, K2J 1H1

INFORMATION TO USERS

THIS DISSERTATION HAS BEEN
MICROFILMED EXACTLY AS RECEIVED

This copy was produced from a microfiche copy of the original document. The quality of the copy is heavily dependent upon the quality of the original thesis submitted for microfilming. Every effort has been made to ensure the highest quality of reproduction possible.

PLEASE NOTE: Some pages may have indistinct print. Filmed as received.

Canadian Theses Division
Cataloguing Branch
National Library of Canada
Ottawa, Canada K1A 0N4

AVIS AUX USAGERS

LA THESE A ETE MICROFILMEE
TELLE QUE NOUS L'AVONS RECUE

Cette copie a été faite à partir d'une microfiche du document original. La qualité de la copie dépend grandement de la qualité de la thèse soumise pour le microfilmage. Nous avons tout fait pour assurer une qualité supérieure de reproduction.

NOTA BENE: La qualité d'impression de certaines pages peut laisser à désirer. Microfilmée telle que nous l'avons reçue.

Division des thèses canadiennes
Direction du catalogage
Bibliothèque nationale du Canada
Ottawa, Canada K1A 0N4

A PLAN FOR THE RECOVERY AND LONG-TERM
DEVELOPMENT OF BEEF CATTLE
IN THE SAHEL

BY

(C) William Edward Dickins

A thesis submitted to the faculty of
Graduate Studies in partial fulfilment
of the requirements for the degree of
Master of Arts

School of International Affairs

Carleton University

Ottawa, Ontario

1975

The undersigned hereby recommend to the Faculty of Graduate Studies and Research acceptance of this thesis, submitted by William Edward Dickins, in partial fulfilment of the requirements for the degree of Master of Arts.

Michael G. Fry, Associate Director,
Norman Paterson School of International Affairs.

A.R.M. Ritter, Supervisor.

TABLE OF CONTENTS

<u>CHAPTER No.</u>	<u>TITLE</u>	<u>PAGE No.</u>
	Abstract	i
	Acknowledgements	ii
	Index of tables	iii
	Index of maps, charts and diagrams	v
	Abbreviations	vi
I	Introduction	1
II	Nomadism in the semi-arid Sahel: A systemic view	17
III	Geography and Economy of the Sahel	41
IV	Causes of the recent drought and the emergency responses	76
V	World trade in beef and the potential for the Sahel nations	94
VI	The basic requirements of a beef cattle industry	120
VII	Some research undertaken which could have valuable application in the Sahel	149
VIII	The beef cattle development strategy	194
IX	Ranch operating method and financing	235
X	Implications for agricultural and social development	251
XI	Proposed new organisation for strategy implementation	261
XII	Summary and conclusion	272
	Bibliography	279

ABSTRACT

This Thesis tackles one of the major problem areas of the World, the Sahel. The economies of this huge semi-desert region of West Africa were devastated by the recent catastrophic drought, with the nomadic herdsmen being by far the most affected. Thus, a Plan is proposed herein, for the recovery and long-term development of a self-sustaining beef cattle industry in the region. The Beef Cattle Development Plan is designed to employ and be managed by the nomads in a system of co-operative Ranches. In addition, it is shown that the beef cattle industry can become a significant economic sector for the Sahel countries with important linkages to the other sectors.

ACKNOWLEDGEMENTS

It is with a great deal of pleasure that I acknowledge the help and advice of a large number of people. Unfortunately, they cannot all be named herein. However, I should like to take this opportunity of listing, in alphabetical order, those who have provided the greatest assistance: Mr. Kekebewa Ashagrie of Ethiopia; Dr. David Hopper, President of the International Development Research Centre; Dr. Gordon MacEachern, President of the Agricultural and Economic Research Council of Canada; Mr. Robert McKinnell, Canadian International Development Agency; Dr. Ian Pool, Professor, Carleton University; Dr. Archibald Ritter, Professor, Carleton University; and last, but not least, my wife Ellen, who painstakingly read and corrected everything that I wrote.

INDEX OF TABLES

<u>TABLE No.</u>	<u>TABLE TITLE</u>	<u>PAGE No.</u>
2-1	Livestock Production in 1972.	33
2-2	Selected exports of processed meat and lives animals from the Sahel.	35
3-1	Land utilization and population densities of the Sahel countries.	44
3-2	Population estimates, annual rate of increase and population projections.	46
3-3	Débit des grands fleuves du Sahel.	49
3-4	Gross National Product per capita (1972) for the developing nations of the World.	56
3-5	Gross Domestic Product, per capita GDP, annual growth rate of per capita GDP and population.	57
3-6	Structural components of Gross Domestic Product.	59
3-7	Agricultural population 1970.	60
3-8	Comparison of the average annual growth rates between food and agriculture.	62
3-9	Total value, balance and growth of exports and imports for the Sahel 1969/1971	64
3-10	Share of livestock exports in GDP and total exports.	65
3-11	Share of food imports in total imports.	68
3-12	Net flow of loans and grants to the Sahel countries.	70
5-1	Beef and veal: Production, consumption, and trade balances for 1970 and 1980 projections.	96
5-2	World imports of live cattle and processed beef.	102

5-3	Cattle production of live animals.	104
6-1	Average water consumption during the dry season.	124
6-2	Numbers enrolled in, and growth rate of, the educational institutions.	141
8-1	Estimated cost of fence construction.	206
8-2	Estimated stock numbers.	207
8-3	Data for well requirements.	210
8-4	Start-up herd: Composition and cost estimate.	213
8-5	Estimated annual payroll and staff requirements.	228
9-1	Nomadic families in each Ranch operation annually.	238
9-2	Estimated Real Property: Capital requirements.	243
9-3	Capital investment required.	244
9-4	Estimated annual operating costs.	245
9-5	Estimated annual revenue from livestock sales.	247
9-6	Profit and loss summary.	248
11-1	Estimated annual costs of the Regional Range Management Organisation.	271

INDEX OF MAPS

<u>Map No.</u>	<u>MAP TITLE</u>	<u>Page No.</u>
1.	The countries which form the Sahel.	43
2.	The main climatic zones based on rainfall distribution as delineated by isohyets.	48
3.	Percentage of normal for the 1973 rainfall.	52
4.	The main cattle raising area of the Sahel countries.	54
5.	Australian Research Station.	152
6.	Ideal Ranch lay-out.	204

INDEX OF CHARTS AND DIAGRAMS

<u>Chart No.</u>	<u>TITLES</u>	<u>Page No.</u>
3-1	Lac Chad: Variation interannuelle du niveau à Bol.	50
5-1	The relationship between income and meat consumption: selected countries.	100

<u>Diagram No.</u>		
8-1	Economic linkages.	202
10-1	Development needs of sector integration.	253
11-1	Organisation for Range Management of the Sahel countries.	266
11-2	National Office Organisation.	268.

ABBREVIATIONS

A.I.D.	Agency for International Development
A.S.E.C.N.A.	Agence pour la Sécurité de la Navigation Aérienne en Afrique
C.C.T.A.	Commission of Technical Co-operation in Africa
C.I.D.A.	Canadian International Development Agency
ECOSOC	United Nations Economic and Social Council
F.A.O.	Food and Agriculture Organisation
G.A.T.T.	General Agreement on Trades and Tariffs
G.D.P.	Gross Domestic Product
G.N.P.	Gross National Product
I.A.R.S.S.	Institute for Agricultural Research and Special Services
I.B.E.D.	Inter-African Bureau of Epizootic Disease
I.B.R.D.	International Bank for Reconstruction and Development
I.C.A.O.	International Civil Aviation Organisation
I.E.M.V.T.	Elevage et de Médecine Vétérinaire
I.F.A.N.	Institut Fondemental D'Afrique Noire
I.L.O.	International Labour Organisation
I.L.R.A.D.	International Laboratory for Research on Animal Diseases
I.R.A.T.	Institut de Recherches Agronomiques Tropicales
O.R.S.T.O.M.	Office de la Recherche Scientifique et Technique Outre-Mer

O.S.R.O.	Office of Sahelian Relief Operations (FAO)
P.G.A.A.	Office of Political and General Assembly Affairs
S.E.D.E.S.	Société d'études pour le Développement économique et Social
S.S.O.	Special Sahelian Office (United Nations)
U.N.	United Nations
U.N.E.S.C.O.	United Nations Education Scientific and Cultural Organisation
U.N.D.P.	United Nations Development Programme
U.N.I.C.E.F.	United Nations International Children's Education Fund
W.F.P.	World Food Programme
W.H.O.	World Health Organisation
W.M.O.	World Meteorological Organisation

CHAPTER ONE

INTRODUCTION

The Aim of the Thesis

A Summary of the Plan

The Thesis Organisation

- a. Part I
- b. Part II
- c. Part III

Other studies concerned with beef cattle development in the Sahel

- a. Etude sur la situation actuelle de l'élevage dans les pays du Sahel et des mesures de sauvegarde à envisager (1974)
- b. Ranching/Mixed Agriculture Program in Niger

Summary

CHAPTER ONE

INTRODUCTION

THE AIM OF THIS THESIS

The aim of this Thesis is to present a "Plan for the Recovery and Long-Term Development of a Beef Cattle Industry in the Sahel", which can be implemented in the region, thus making a useful contribution to solving one of the major development problems of the World.

While the Plan, herein presented, is concerned with what is really the development of a more efficient 'food chain system' (the Beef Cattle Industry) in the Sahel, it is more important, at the beginning, to understand something of the conceptual framework within which the Plan was developed. This framework may be simply described as 'Management by Objectives'. However, before it is possible to further define the conceptual framework of 'Management by Objectives', it is essential to clarify a basic precept of the author. This precept can best be comprehended through consideration of the following two questions.

Is economic development an application of economic theory to, and the management of, the Planning Process?

Is economic development really the management of the implementation of the Plan?

Many Plans can, and have been produced, dealing with one or more aspects of economic development. However, unless they have been clearly prepared with strong consideration being given to the management of the Plan's implementation, they have become just more 'dust collectors' in a library. Hence, the first point of consideration must be that the Plan must not be overloaded with theory, because theory per se, cannot be managed. In this regard, therefore, the Plan must be kept simple without reducing the quality of the final objectives. A less sophisticated Plan should make it easier to establish objectives for each of the stages of implementation, thereby simplifying the management of the Plan's implementation.

The above paragraph referred to the establishment of objectives for each phase of plan implementation and the management of the plan to obtain these objectives. Hence, this system of Plan Development may be said to be using the concept of 'Management by Objectives' since that is the method needed for implementation.

Within this conceptual framework, the author has examined the problems of the Sahel as they pertain to the development of a beef cattle industry economy in the region. After which, the appropriate objectives for beef development have been established in a Plan (chapter VIII) as well as some criteria for measurement and implementation (chapter IX).

A SUMMARY OF THE PLAN

The Plan presents a system of Ranches to be established throughout the entire Sahel region. This is based on the premise that a Multi-national Beef Development Strategy is paramount. This premise is not unreasonable since presently the nomadic herdsmen do not respect any national frontiers. While the Ranch approach is not new, a Multi-national Ranch Strategy leading to a self-sustaining beef industry within 15 to 20 years is believed to be a fresh idea.

Specifically, this Plan would establish Ranches at a minimal cost, at least when compared to the cost of other aid projects, and at the same time it would seek to have the Ranches run, almost totally, by the indigenous people within five years. By the twentieth year, it is conceivable that the system of Ranches could be owned by the ex-nomadic herdsmen on a co-operative basis.

These Ranches are not being proposed as small scale examples of what can be accomplished in the arid and semi-arid regions of the Sahel, as has sometimes been the case with smaller Ranches. They would be, instead, large profitable Ranch complexes encompassing a full range of operations from breeding, range management, forage and fodder production, slaughter and marketing. Each Ranch, being of approximately 400,000 hectares, is planned to

eventually provide a livelihood for 42,000 people (7,000 nomadic families). Thus, the initial Ranch system of six locations will provide a livelihood for about 250,000 nomads directly, and many more indirectly.

Though 250,000 may not seem many when compared to the total nomadic population of the Sahel which has been variously reported from 2 to 6 million, a 'concrete' base for 250,000 and a potential for growth because of a solid foundation is, in the view of the author, more useful than a Plan to employ 1 million nomads, but built on 'sand'.

Ostensibly, developing a Plan to assist the recovery and development of a particular industry within a developing economy would seem to be a straightforward case of modernisation. However, while 'modernisation' implies technological change, the knowledge of the people involved must likewise be up-dated. It is this process of changing peoples' ideas which then becomes the problem of social development. Obviously, therefore, without social development, technical modernisation must be doomed to failure.

The Plan presented herein, clearly reflects the underlying assumption that social progress, or development, is the key to the future success of the Plan. It is recognized that the process

of changing peoples' ideas and ways of thinking is a difficult and long-term task. This is particularly hard in the Sahel, since the traditional approaches and value systems have been handed down through the tribes for hundreds of years. These factors of social change will not be listed here, however, they will be summarised in chapter XI of this thesis. Suffice to suggest that through education and work the nomads will eventually own the Ranches on a co-operative basis, although, the idea of co-operative ownership may take a number of years. Hence, the concept of social change in this Plan is accepted as being the slow road to modernisation, as opposed to the fast road to disaster. Furthermore, it may well be that the initial group of nomadic Ranch workers never do completely adopt the concept of a more modernised beef industry. After all, traditional ideas and values die hard. Thus, the success of the Plan of this paper more truly lies in the ability to educate and up-date the ideas and attitudes of the second and third generations, namely, those born in the Ranch environment.

THE THESIS ORGANISATION

The thesis organisation is really clearly sub-divided into three sections. Part I, containing chapters II to VI inclusive, is concerned with defining the countries, problems and the

evolution of the problems. Part II, consisting solely of chapter VII, may be viewed as a bond between Parts I and III. In light of the problems and barriers to beef cattle development shown in Part I, chapter VII summarizes some of the research undertaken elsewhere which could aid the Sahel. Part III, being chapters VIII to XII, deals with the Plan and the practical implementation of that Plan in the real environment of the Sahel.

- a. Part I: Chapter II, provides a brief summary of the historical and social aspects of the development of nomadism, with particular reference to the Sahel, after which, chapter III bring nomadism into focus by detailing the geographic location and the economic background of the six countries which form the Sahel region. Certain problems are highlighted where they are of historic origin such as climate, population division, the economic situation with reference to World trade, domestic agriculture, manufacturing, and skilled personnel, or the lack thereof. This chapter endeavours to provide a complete picture of the Sahel area as it existed prior to the recent major drought. To this end, pre-drought statistics have been used (also being the only ones available).

With chapter III being concerned with the pre-drought economic situation, chapter IV sets out to explain, in some detail, the causes of the recent economic plight in the Sahel.

Here it is more important to note that the causes of the recent drought crisis are not solely climatic, but that the catastrophe is partly rooted in poor agricultural development policies. Further, this chapter shows some information about the World's response to the drought disaster which struck the region.

After this total view of the Sahel economies, chapter V examines the situation of livestock in World trade with particular emphasis on the problems of the beef industry, past, present and future. Then there follows a description of the importance of beef cattle in the Sahel countries, thereby clarifying why a beef industry development plan is a worthwhile aim for both the Sahel and this thesis.

On the premise that these early chapters all accomplished their respective objectives, chapter VI then sets about the task of examining the fundamental elements which are needed for the successful development of a beef cattle industry. Such elements being reviewed consisting of the water requirements, disease control, feed and grazing needs, education, manpower, markets and transportation.

- b. Part II: This section was mentioned as consisting solely of chapter VII, thus forming a bond between Parts I and III. This chapter is separate because it does not refer to the

Sahel in a direct manner. Instead, it seeks to summarise some of the research which has been undertaken in other areas of the World which, in the view of the author, could prove helpful to the beef cattle industry of the Sahel.

It is for this chapter that considerable work had to be done in order to evaluate the experimentation of the scientific experts; these being geologists, soil scientists, botanists, and biologists to mention but a few. Hence, this chapter is sub-divided into many parts, commencing with soil evaluation and information following through fodder crops with other forms of cattle feed, details of some cattle breeds, cattle diseases, and concluding with a brief examination of the industry or manufacturing side of beef production, including abattoirs.

This chapter will show a distinct bias in favour of a vast amount of experimentation undertaken in the Northern Territories of Australia. The reason for this bias will be clear when the Australian research is summarised. However, here it can be stated that the experiments so documented are selected on the basis of easy adaptability to the Sahel. There is a limited amount of documented research in Spanish and Portuguese, pertaining to the Argentine, Uruguay and Brazil. However, while the author must admit to a language problem when dealing with research from South America, it was possible to determine that this research would not be useful to the Sahel for the following reasons: Climatic problems are different;

nomads do not exist in South America; markets for South American beef have been developed with the developed nations; South American experimentation related more to the problems which exist for the cattle industry in South America. It is also for this last reason that the Canadian and United States research and development on beef cannot be considered as being too useful to the Sahel countries: Climate, soil, feeds and cattle types are different.

- c. Part III: Following the fairly comprehensive listing of some of the relevant scientific research, it is then possible to propose a beef cattle development plan using the data of chapter VIII. The Plan attempts to cover all phases of beef development from Ranch site selection and layout, through grazing, feed, the herd, the feedlot operation, the abattoir section, transportation modes, disease control, employment of the nomads and the long term possibilities of such a scheme.

With the Plan having been proposed in chapter VIII, it behooves the writer to clarify how such a Plan may be implemented, thus, turning a very theoretical scheme into a very practical application. To this end, tables and calculations, though primarily for illustrative purposes, have been produced with as much accuracy as is possible without actually visiting the Sahel.

Needless to say, the development of a substantial beef cattle industry in the Sahel could have many implications for other sectors of the economy. Hence, chapter X, tries to explore these implications as they apply to the agricultural farming sector and the sociological aspects of the nomadic change.

Having presented the Plan and a method for implementation in a 'neat package', such a proposal in no way guarantees that this concept and approach will be utilised. After all, the suggestion was made that all six countries of the Sahel plan and develop a Ranch system along almost identical lines. This can be somewhat difficult unless some form of co-ordinating body is established. Hence, chapter XI discusses an idea for a supra-national organisation which would have the total responsibility for Range Management and the related sectors of the economies, thereby being able to co-ordinate the beef cattle development throughout the Sahel.

OTHER STUDIES CONCERNED WITH BEEF CATTLE DEVELOPMENT IN THE SAHEL

There have only been two other studies made concerning beef cattle development in the Sahel region. Both will be described here since the approaches suggested by these two reports, while not in conflict with this thesis, are somewhat different.

- a. Etude sur la situation actuelle de l'élevage dans les pays du Sahel et des mesures de sauvegarde à envisager. (1974)

Commission des Communautés Européennes sur le direction du Fonds Européen de Développement.

This Report was prepared by a five-man team of experts on matters pertaining to the Sahel, providing the most comprehensive analysis of the region. Their study covers the entire livestock industry as it existed in all the Sahel countries up to July 1973.

While the team examined the total situation, they did not develop a single Plan for any specific sector of the economies. But, instead, the Report proposed a Supra-national Committee such as presently exists for Sahelian Drought Relief (Comité permanent inter-états de la lutte contre la sécheresse - CILSS). The Committee would be responsible for working with each country in order to provide some rationalisation of resources and development funds.

In addition to the above proposal, the Report examined all the development schemes, both emergency and long-term, that have been approved for the Sahel countries (123 projects in total).

From the total mass of data the Report makes numerous recommendations which should be incorporated into the Development Plan of each of the countries, thus, ensuring some form of Regional Co-Operation. These suggestions might be considered as forming a total Regional Development Strategy.

With the overall strategy being suggested and all the individual projects being listed, one is presented with a huge 'jig-saw puzzle' since because of the scope of the Report, at no time is the complete picture presented in terms of the final benefits to any individual sector. Rather the Report goes on to point out that experts in each field should now develop the separate sectoral Plans, under the overall strategy suggested, so that the final mosaic can be developed.

On the whole, it is an excellent document which should be seriously considered by the Planners in Ouagadougou, Upper Volta.

b. Ranching/Mixed Agriculture Program in Niger. (1974)

A feasibility study for Africaire prepared by Texas Tech. University, Lubbock, Texas.

This second Report, produced by a team of experts, provided a comprehensive feasibility study which was concerned with the establishment of a cattle ranching/mixed agriculture enterprise in Niger. The enterprise is proposed as a small scale model designed to demonstrate the merits of employing modern methods for range management, combined with techniques to reclaim drought ravaged areas and restore them to productivity.

It is small scale only in that only 500 nomadic families will be involved in the project with annual production of cattle for slaughter being a more 4,000 head after five years. While

the figures of 500 families and 4,000 head of cattle might be reasonable if only a small amount of financial aid were needed, in light of the \$23,641,000 needed for this demonstration model, at \$47,282 per family the scale would seem hard to justify.

In addition to the two weaknesses of high cost and small scale, there is a further problem in the suggestion and that is the need for the nomads to run their own show as soon as possible. The impression from the Report is that external experts would operate the model, but this leaves open the question of, "What about similar schemes?" "Who will set them up?" "Who will run them?"

Nonetheless, despite the short-coming mentioned above, clearly a lot of data has been collected which can be very useful for any Planners considering cattle development combined with mixed agriculture.

This Thesis in no way conflicts with the two studies just described. The Beef Cattle Development Plan of Part III of this paper clearly fits under the overall Regional Strategy proposed in the first study commissioned by the Fonds Européen de Développement. Thus, it may be considered as one of the details sectoral studies which the first Report actually recommends.

With regard to the Texas Tech. study, again the suggestion of this Thesis does not conflict. This Thesis is looking towards an entirely different set of objectives. The Texas Tech study aims at the development of a model for cattle raising in conjunction with agriculture. The aim is not so much to provide a major economic contribution to the Sahel, so much as to provide an example of a livelihood for the nomads which can be considered as one means of providing them with self-sufficiency so that they can withstand climatic catastrophe in the future.

However, by comparison, this Thesis seeks to make a substantial impact on the economies of the Sahel. A fact to be accomplished by providing a livelihood for over 42,000 families, who will provide 1,200,000 head of cattle for slaughter annually in later years. All, for an initial investment of \$4,157 for family, although the sum of \$1,857 would be repaid to the aid donor nations, leaving a net investment of only \$2,300 per family. This latter investment figure would seem reasonable in light of the fact that such an investment would, over a twenty-year period develop a self-sustaining beef cattle industry for all six countries of the Sahel. In addition, there would be a number of other economic benefits from such a scheme through the basic economic linkage mechanism which would develop (see Diagram #8-1 and chapter VIII for discussion of the linkage benefits).

SUMMARY

In summary, it should be re-emphasised that the Plan proposed in this Thesis, while it may not be the final project, most assuredly has a number of points which should be considered by the Development Planners working in the region.

It is also worth reiterating that the Plan is a large scale Ranch system concerned with the entire Sahel as one vast cattle raising integrated region. However, while the technical aspects of this proposed Beef Cattle Plan present few problems for the implementation, the major problem of 'social change' is really the key to success. Hence, the watchword for the implementation managers should be: PATIENCE and UNDERSTANDING.

CHAPTER TWO

NOMADISM IN THE SEMI-ARID SAHEL

A SYSTEMIC VIEW

Introduction

Animal Husbandry - historical and social aspects

The Importance of Beef Cattle in the Sahel

Emphasis on Beef Production in the Development
Plans of the Region

Summary

CHAPTER TWO

NOMADISM IN THE SEMI-ARID SAHEL:

A SYSTEMIC VIEW

INTRODUCTION

In this chapter the historical and social aspects of nomadism in the Sahel are considered, particularly with reference to the evolution of animal husbandry and the traditional beef cattle industry, as it more recently exists in the region.

ANIMAL HUSBANDRY - HISTORICAL AND SOCIAL ASPECTS

Since the earliest history of man, animals have been domesticated; they represented an important aspect of the economic structure and also had a significant effect on the social systems of primitive societies. Animal husbandry was, and still remains, the most important form of land use in the semi-arid zones of the "Old World".¹ There has, in fact, been little change in its characteristics and management in these regions over the centuries.

While it is acknowledged that there may be many reasons why animal husbandry throughout the Old World could, or should be improved, the concern of this paper is solely for the Sahel.² However, it is undoubtedly true that all the areas of the Old World deserve far more attention in relation to the improvement of

social conditions and the regeneration of a long over-taxed grazing resource.

The modern types of animal husbandry are favoured by research and other facilities with comparatively less competition for the existing or potential resources. For these reasons, some of the techniques developed in the more advanced countries may, with appropriate adaptations, be transferred to the less developed zones.

The history of agriculture and land use has not yet been written, but certain fragmentary information may be found in a number of published works. Sauer³ reviewed the problems of agricultural origins and dispersals, indicating that the origins of crop cultivation and animal husbandry in pre-historic times, and therefore of early civilisation, are closely related to the major climatic changes, and more particularly to increased desiccation. These conditions led to the abandonment of the former hunting grounds in and around the deserts. Toynbee's interpretation is that, while some hunting tribes, for example, changed their habitat in order not to change their habits and moved into Equatoria, others settled in the marshy Nile Valley and evolved a civilisation based on the cultivation of crops.⁴

The nomadic form of animal husbandry, so characteristic of the arid and semi-arid lands of the Old World, also had its

origin in pre-historic times. In Toynbee's terminology it represented a response to the challenge of the further increase in desiccation. Toynbee argues that, in the face of this climatic change, the animal husbandmen of the area reacted in different ways. Some migrated to regions with environmental conditions similar to those to which they were accustomed. Others, abandoned the untenable oasis, they abandoned their former staple of agriculture and staked their existence on their latest acquired art, that of the stockbreeder, they became nomads.⁵

The systems of land use evolved by the animal husbandmen in arid zones, and more particularly by the nomads, in response to these major changes in climate have, according to many authorities induced further desiccation with the excessive removal of the vegetative cover. It has been suggested that these man-induced types of desiccation may themselves have led to major migrations of peoples such as the two Arab waves across North Africa - the Sons of the Prophet who created the Moorish civilisation of southern Spain and Morocco, and later the Bedouins. These and other nomad irruptions may however, have been due to one of the rhythmic alternatives between periods of relative desiccation and humidity, the occurrence of which seems to be indicated by meteorological evidence (see chapter IV). These fluctuations may also have led to the occasional encroachment of the cultivators on the land of the nomads when conditions became more humid and favourable for crop cultivation (see chapter IV).

The history of the vegetative cover of the lands in which these events in human and agricultural history took place is, of course, closely related to the animal husbandry. But the plants were not only grazed and browsed by livestock, the woody vegetation was also cut for fuel and other purposes. In addition, the burning of the vegetation in semi-arid environments has been a major factor in producing and maintaining the existing vegetation cover (see chapter VII). Although it has probably been induced to some extent by natural causes, fires have also been employed by the hunter in search of his game, by the tribesmen in raids on his neighbour, and by the herdsman who wishes to eliminate fibrous and unpalatable growth and produce new shoots for his animals (see chapter VII). While fire has been a major factor in the vegetation history of Africa for thousands of years, the degree to which fire operates as a contributing factor for vegetation retrogression naturally varies according to the type of vegetation.

The combined effects of the factors mentioned as having been in effect for centuries in the Old World, namely, the development of systems of social structure, the adaptation of forms of animal husbandry to arid and semi-arid conditions, and the reduction, largely by them, of an existing vegetation cover to a type much lower on the ecological ladder, together provide the basic environment for animal husbandry in the arid zones of the Old World

as they exist today. There still exist the many forms of nomadic grazing, the distinction and often the antagonism between the nomad and the cultivator (see chapter IV), and the tribal as distinct from the village type of social and agrarian structure. The nomadic desert tribe might be considered to live in a mobile as opposed to a permanent village, which is adapted to living in a critical environment where freedom of movement means survival. Later in this paper (see chapters VIII and IX), discussion will consider the extent to which settlement of such nomadic peoples is either possible, or desirable, in a programme for the improvement of the animal industry and of the grazing resources on which the people and their livestock exist.

The history of modern forms of animal husbandry in arid and semi-arid zones can be written in terms of the past few hundred years. This period represents the implanting of European communities with relatively high standards of living and practical knowledge in areas where the indigenous peoples may not have progressed much beyond the hunting stage. There has been no long interim period for the gradual development of social systems and grazing practices. Mistakes have been made, and the grazing resources have been misused owing to the lack of full appreciation of the critical nature of the new environment. But gradually, with the increased knowledge of the science of management of vegetation

and livestock in such an environment, and of the principles of conservation of vegetation, soil and water, more suitable forms of enterprises have been involved.

The livestock industries of the arid and the semi-arid zones are carried on within the limits imposed by an environment composed of the usual factors of climate, soil and vegetation. The most important factors influencing the present nature and extent of a livestock industry and the degree to which it can be improved are, however, biotic in nature. The actual existence of man and his grazing animals in arid and semi-arid zones affects not only these habitats themselves, but also extends the areas of aridity into zones which are not originally of this type (see chapter IV). In the Sahel region, which is the consideration of this paper, the extensive area of true desert and semi-desert would seem to have been gradually extended by misuse, or rather, by excessive use of the land and its vegetative cover. A distinction might be made between the true desert and the man-made semi-arid land, since it is the latter which should be the most susceptible to improvements (see chapter VII). Research on desert reclamation must be given high priority so that the new desert regions of the southern Sahel can once more be brought into more efficient use for agriculture and grazing.

In line with desert reclamation just suggested, ecol-

ogical management of the natural vegetation through the intelligent control of the grazing practices would seem the most important method of improving and maintaining resources (see chapters V, VI, VII, VIII and IX). However, intelligent ecological management really means it is necessary to appreciate and apply the principles and techniques of plant geographers and ecologists.⁶

In order to plan grazing systems and forms of nomadic and migratory grazing, it is necessary to know the vegetation in all its aspects; the ecology and the biology of the different species, with reference to their general physiology, drought resistance, relative palatability and liability to damage grazing, and the characteristics of seed germination under the extreme conditions in which the plants are growing. In fact, in the improvement of desert ranges, animal husbandry practices should be directed towards the welfare of plants (see chapter VII).

The faunal components of the biotic complex or bione of the arid and semi-arid Sahelian area must also be considered, particularly the natural wild life and its grazing and browsing habits. What little wild life as exists in the Sahel has different grazing habits to that of the domestic animals. Though the wild life may graze an area heavily it is not continuous since they soon move on to another spot. This is in sharp contrast to the continuous and sometimes very heavy grazing of the domestic livestock. Evidence appears to confirm this natural practice of the indigenous

wild life in the arid areas of the World, and, the desirability of avoiding continuous grazing with the ensuing destruction of vegetation by a concentration of large numbers of starving animals, throughout prolonged drought, at waterpoints⁷. There may be differences of opinion between experts on the effects of concentrated heavy grazing even if only for a short time. The effects of large numbers of animals, or of a concentration of animals on an unrestricted area, are often soil compaction, reduced infiltration of water, reduced run-off and erosion (see chapters VI and VII).

Besides the questions of vegetation and fauna, it must be remembered that the domestic animals of the Old World desert regions are adapted to living in an environment characterised, in most cases, by great extremes of temperature combined with low availability of food and water. In addition to being adapted to wide seasonal variations in fodder reserves, desert livestock must also be able to move great distances in their seasonal migrations in search of fresh pastures. Any marked improvements in the ecotypes of the domestic animals on arid and semi-arid lands could tend to make them less able to find and utilize the available fodder and so survive under these conditions. In other words, any tendency to breed semi-desert livestock away from the existing or potential levels of the fodder reserves must be avoided, unless it is clearly possible to provide a less erratic supply of grazing and fodder of superior quality to meet the demands of improved stock (see chapter VII).

The men who live with and by livestock in arid regions are also an important, if not the dominant factor of the total environment. It is for the Governments to decide, in association with sociologists, livestock specialists and the plant ecologists, whether this primitive and rigorous way of life is to be regarded as a permanent feature of the modern age, or whether the freedom of the nomadic life should ultimately be replaced by a more prosaic and settled form of existence based on improved livestock and a larger quantity of high quality cultivated fodder (see chapters VII, IX, X and XI). It is perhaps doubtful if any major change can be visualised from a land use point of view, owing to the increasing pressure of population on the limited cultivable land available.

Any plan for the economic management and the development of the arid and associated semi-arid zones must be based on surveys of the environment in all its aspects.⁸ The area to be covered is enormous, while the resources of finance, technical staff and transportation are very limited. It is also possible that the relatively slight increase in the total returns of livestock products in some of the Old World desert areas may not justify extensive and detailed surveys of the type that have been carried out in more favourable agricultural regions.

As to the economic basis of a beef cattle industry, and

particularly the extent to which investment is likely to prove economic, this varies widely throughout the arid and semi-arid lands, and specifically, between the traditional and modern types of beef cattle industry. The efficiency of the cattle industry may be raised by the improvement of cattle through breeding and selection,⁹ the increasing productivity of grassland and fodder crops and the adoption of measures for improved animal health (see chapters V, VI, and VII). For the cattle owners, all these methods call for an increased outlay of funds for investment in their enterprise, and the incentive for such investment will not be found unless the return is at least equal to that which can be obtained in alternative investments.¹⁰ Arable farming is, in general, farming this year for next; grassland farming must be regarded as farming for the future, a long-term activity which may not show adequate return on investments for ten or fifteen years.

Under a modern system of land use based on the conservation of natural resources and their improvement, costs are necessarily higher than under an exploitative system. The cheap food era, which was possible only with uncontrolled exploitation of the natural resources of the producing countries of the World, has now been replaced by a period in which there is an increasing realisation of this fact, and the urgent necessity to restore the damage which was done. The next stage is the building up of a

productive capacity of the land to meet the needs of the growing human and cattle population. The main items of cost under an improved system are: (a) interest on invested capital; (b) wages; (c) depreciation and obsolescence of equipment; (d) rent, taxes, insurance and other general costs (see chapter IX).

However, with reference more particularly to the cattle of the Old World, it can be said that production is of necessity quite inefficient, employing animals, the primary selection requirement of which is survival. The main virtue of this type of cattle industry is that it utilises land and vegetation which could not otherwise be used, and does so with the minimum of capital and running costs. Therefore improved measures which could add, even slightly, to these costs may be impracticable; simplicity and cheapness should be the prime necessity in any improvement schemes. It should also be stressed that any improvements which are undertaken must be accompanied by measures to maintain or increase the off-take of animals, otherwise the improvements will be cancelled out by an increase in stock numbers (see chapters V, VI, VII and VIII).

The extent to which improvements can be effected depends on the economic and social structure of the industry, primarily, on the ownership of the land. However, in the Sahel the individuals do not own the land over which their daily grazing

0 routines and nomadic movements take place.

The cattle industry of the arid and semi-arid regions has, until recently, accepted the fact that the critical seasons and years mean considerable loss to the herds of the nomads. However, now there are increasingly effective steps being taken to reduce these losses in some desert areas. For example, in the southern part of Algeria, the natural vegetation suffers considerably from the rigours of the climate in which extreme conditions of drought, heat and cold are combined and intensified.¹¹ The stock owners of the region, whose ideas, like those of the Sahelian nomads, were to a great extent fatalistic, have apparently come to admit the value of having fodder reserves available for the periods of shortage (see chapters VI and VII).

The aforementioned is not intended to imply that drought is the only reason for the periodic cattle losses by the nomadic herders. While stockmen who do not make provisions for the leaner time tend to keep excessive numbers of cattle so as to allow for the percentage losses, in many cases these losses have often been more due to epizootic diseases than to drought, a fact that is particularly true of the Sahel (see chapters V, VI and VII). Other factors which militate against the standard methods of improving a beef cattle industry: namely, reductions in numbers in relation to the potential grazing and fodder resources, combined

with the improvements in quality through better health and by selection and breeding; arise where cattle represent wealth and are used in barter for food grain or other requirements such as a bride price (see chapters V, VI and X).

THE IMPORTANCE OF BEEF CATTLE IN THE SAHEL

Animal husbandry has been a key feature of the Sahel region for many hundreds of years. In pre-biblical times the Sahara was once lush with vegetation from the heavy rains,¹² and the people were dependant on hunting and fishing for their livelihood. However, with the drying of the Sahara, these people migrated both north and south changing their life styles at the same time. As was mentioned earlier, they adopted animal husbandry and other cultivated the indigenous millet and sorghum found in their environments.¹³ During these early times the civilizations of this region began to show clear divisions with pastoralists and oasis cultivators inhabiting the northern region (the sub-Saharan zone of chapter III, Map #2); pastoralists and agriculturalists occupying the middle or Sahelian zone; and agriculturalists inhabiting the southern region (the Sudanian zone and further south on Map #2) where, because of the tse-tse fly, cattle have difficulty surviving. Clearly therefore, livestock has been a major factor in the continued survival of the people of the six nations of the Sahel. This is particularly

important because, by virtue of the cattle, this vast land area has been used in a productive manner when it could not be used for farming or anything else.

Though it has been possible to say how, from earlier history, the population was divided between livestock and agriculture, it is not possible to state the number of people in the Sahel countries who are dependent on livestock for their livelihood. The only figures which can be presented are those of the totals involved in agriculture (see chapter III, Table #3-7). Beyond that, the conclusion may be drawn that there are about 6.1 million people in the Sahel countries dependent on livestock, though not all are nomads. This fact has been deduced from two statements which appeared in a United Nations Secretariat publication.¹⁴ The first states, "...about 6.1 million people of those countries (the drought inflicted Sahel) live in the zone situated north of the 600mm average isohyet line as follows: Chad 700,000; Mali, 2,000,000; Mauritania, 400,000; Niger, 1,600,000; Senegal 800,000; Upper Volta, 600,000, for a total of 6.1 million." The second statement, "...the 600mm isohyet can safely be taken as the dividing line between the sedentary agriculture zone and the nomadic stock-raising zone", (see chapter III, Map #2).

It must also be remembered that, besides the estimated 6.1 million people who may be directly dependent on the live-

stock, there are a number of others in the economies, including the sedentary farmers, who may be considered as being indirectly dependent on cattle. These would also include a small percentage of the urban population who may be engaged in the processing side of the beef industry,¹⁵ such as the numbers employed in the abattoirs, the meat packing plants, the tanning and leather industries.

While there are no truly accurate figures for the people dependent on cattle, neither are there any true figures for the actual numbers of livestock in the Sahel region, even though various attempts have been made at calculations and census for some parts of the continent.¹⁶ For the purpose of this paper, the only figure which will be accepted with any credence will be that of the FAO in the 1972 Production Yearbook, Vol. 26, since this is an official publication. Table #2-1, shows the FAO estimates for livestock in the Sahel region for the year 1972 as being 20.7 million cattle, 16.5 million sheep and 20.5 million goats.

There may be a temptation to assume all cattle belong to the nomads but this point should be clarified. In times of drought the nomads entrust many of their cattle into the care of the sedentary farmers for safekeeping, and certainly since 1969 they have also slaughtered a large number in order to spare them the effects of the prolonged drought.

Table #2-1:

LIVESTOCK POPULATION IN 1972 (1,000 head)

	<u>Cattle</u>	<u>Horse</u>	<u>Camel</u>	<u>Sheep</u>	<u>Goats</u>
World	1,165,413	64,905	14,552	1,056,691	396,241
Africa	159,252	3,862	10,241	143,301	120,248
Sahel Countries	20,700 (10,000) (a)	825 (1,500) (a)	1,670 (1,500) (a)	16,500	20,500 (22,000) (a)
Chad	4,600	150	370	1,800	2,400
Mali	5,000	170	215	5,500	5,350
Mauritania	2,300	25	720	3,800	3,050
Niger	4,000	200	350	2,600	5,800
Senegal	2,400	180	30	1,350	1,300
Upper Volta	2,400	100	5	1,450	2,600

Source: FAO Production Yearbook, Vol. 26, 1972.

(a) These figures represent data developed after the 1972-73 drought year as presented in a recent report prepared for the International Bank for Reconstruction and Development, August, 1974, p.3.

While the size of the cattle population in the Sahel is important to this paper, the true economic value¹⁷ can only be ascertained by examining the financial contributions made by the cattle herds. This importance can be clearly seen from chapter III, Table #3-10, "Share of livestock exports in GDP and total exports" and also from Table #2-2 which shows in excess of 20 million head of cattle in the Sahel.

The data in these two tables represents a degree of cattle for the processing industrial sector, though to what extent the processing takes place it is not possible to verify. Certainly, there is some processing as Table #2-2 indicates with the value of "Selected exports of processed meat and live animals from the Sahel, 1970."

The livestock figures, in terms of their significant share of the total export market, are made all the more remarkable because, so far, very little has been undertaken to organise the marketing of animal products even though all the Sahel countries seem to appreciate the potential for cattle in their recent development plans. This last point just mentioned will be substantiated in the next section.

EMPHASIS ON BEEF PRODUCTION IN THE DEVELOPMENT PLANS

During the ten year period 1971 to 1980 the Government of Chad intends to give priority to cash crops which are likely

Table #2-2: SELECTED EXPORTS OF PROCESSED MEAT AND LIVE ANIMALS FROM THE SAHEL - 1970 ('000's US\$)

Products	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta
Total Exports	34,700	31,800	95,930	42,000	152,000	20,000
Exports of livestock and other products (a)	13,630	19,880	14,400	15,630	400	7,370
Live Animals (b)	575	12,165	-	5,004	180	5,684
Cattle	501	9,108	-	4,477	-	3,096
Meat: Fresh, chilled or frozen	4,903	197	-	557	-	726
Meat: Dried, salted or smoked	166	-	-	-	-	-
Crude hides and skins	301	109	-	783	683	269

(a) This figure includes the unrecorded exports of live animals

(b) This figure includes only those official exports of live animals as reported to the United Nations.

Source: United Nations Yearbook of International Trade Statistics, 1970-1971. New York, 1973.
"Livestock" ST/SSO/10 published 9/Nov/1973.

to bring about rapid increases in the incomes of Chad farmers. However, since livestock accounts for over 30% of Chad's exports (see chapter III, Table #3-10), "The Government intends to give more importance to animal husbandry in the 1970s. It has set itself the target of doubling refrigerated meat exports by 1980 to reach the level of 25,000 tons. To this end projects have been prepared for integration within the Second Development Plan",^{18.} covering the development of cattle tracks, water, pastures, ranches and animal health.

Niger is another country of the Sahel which enjoys considerable benefits from the exports of cattle to the tune of 28.8% of total exports in 1970.^{19.} Thus, "The government of the Niger is giving priority, in the stock-raising sector, to qualitative improvement of the herd, on which over-all production growth depends".^{20.}

The situation in Mali with regard to beef is even more critical because cattle is the mainstay of the Mali exports (see chapter III, Table #3-10). "Henceforth, greater efforts must be devoted to the economic and commercial aspects in order to encourage producers to respond to consumer demands for meat..."^{21.}

Upper Volta clearly subscribes to the importance of beef cattle by providing for substantial investments to develop

the industry in the 1972-1976 Plan. Such investment would help develop abattoirs, storage refrigeration, feed-lots, markets, cattle runs and pastures.²²

Senegal will be concentrating on improving the quality of cattle, developing stock farms and the organisation of markets and exports during the Ten Year Plan 1970-1980.²³ This is being done, "In order to restore animal husbandry to a position more in keeping with its economic importance."²⁴

All the statements quoted in the previous paragraphs were statements of 'intent' taken from the individual development Plans. Unfortunately, no policy measures have been taken in the countries thus far, nor have monies been allocated or spent. A situation which may be considered to be entirely due to the drought emergency which has claimed all the available resources to stem the probables, at least in the short run.

However, these same statements do indicate the emphasis which each of the nations is planning to place on beef cattle. It is interesting to note that these same plans make little, or no mention about the production of, sheep and goats. Clearly, Table #2-1 shows the importance of these types of livestock which are raised by both the nomads and the sedentary farmers. But, not too much has been done thus far to further develop the industry of goats and sheep, and it is not the intention of this paper

to even consider them. However, it should be mentioned that parallel to beef industry development, there would also be an opportunity to introduce improved breeds of sheep and goats since they too would be able to benefit from the improved pastures, water resources, infrastructure, health regulations, and markets.

SUMMARY

This chapter provided a synopsis of the historical and social aspects of animal husbandry in the Old World areas, with particular reference to the Sahel. After which, the "Importance of beef cattle in the Sahel" was considered with the inclusion of substantiating quotations taken from the Development Plans of the Sahel countries.

Having thus provided an introduction to the nomads of the Sahel and their dependence upon cattle, it is now possible to examine the situation in the Sahel region in more detail. Hence, the next chapter will discuss the geography and the economies of the Sahelian countries of West Africa, thereby setting the stage for an evaluation of the possible development of a substantial Beef Cattle Industry in the six countries of the region.

FOOTNOTES

1. "The Old World" is that area around the Sahara and the deserts of Arabia, Sind, Central Asia and the Gobi.
2. The region called the Sahel, for the purposes of this paper, is defined in chapter III.
3. Sauer, C.O., "Agricultural Origins and Dispersals", Bowman Memorial Lectures, American Geographic Society, 1952. p.110.
4. Toynbee, A.J., A Study of History, Oxford University Press, 1947. p.689.
5. Ibid., p.164 ff.
6. D. Brown, "Methods of Surveying and Measuring Vegetation", Commonwealth Bureau of Pastures and Field Crops: Bulletin #42, 1954. p.223.
7. Similar experience would be the buffalo of the North American plains and the seasonal migration of game from the southern Sudan to Uganda and Kenya.
8. This point will be discussed more fully later in this paper since it is of key importance for successful development of any economy.
9. K.L. Sjorberg and S. Persson, Cattle Production in Africa, Rural Development Study No. 2, College of Agriculture, Sweden, March, 1974.
10. F.A.O. Report of the Third FAO Meeting on Livestock Production in the Americas, Rome, June 1955. p. 170.
11. M. Schaefer, "Conserving Fodder and Building up Fodder Reserves for the annual Periods of Drought in the Pre-Sahelian Steppe". Paper presented at the 2nd Meeting of the FAO Working Party on Mediterranean Pastures and Fodder Development (unpublished 1953).
12. Neolithic negroid groups spread into the fertile Sahara from the Sudan about 5,000 years ago. See Lloyd Cahot Briggs, Tribes of the Sahara, Harvard University Press, 1960. p.37.

13. Social Institutions, published by the UN, ST/SSO/23, March, 1974. p.10.
14. Livestock, published by the UN, ST/SSO/10. November 1973. p.2.
15. No figures were available from any source as to how many people work in the meat processing industry for the Sahel countries.
16. The census of Bernus for Niger 1970-1972 and the calculations of Michel Baumer for Sudan 1968. Both are cited in Livestock, op.cit.
17. The term "true economic value" has been used although it might be said that, in more-or-less non-or-semi-monetary tribal economy based around cattle the "true economic value" of the herds relate only in small part to their financial contribution.
18. Country and Inter-country Programming - Chad, published by the UN, UNDP/GC/CHD/R.1. December 1971. p.22.
19. Country and Inter-country Programming - Niger, published by the UN, UNDP/GC/NER/Rev. 1. October 1973. p.15.
20. Ibid., p.16.
21. Country and Inter-country Programming - Mali, published by the UN, UNDP/GC/MLI/R.1. October, 1973. p.15.
22. Country and Inter-country Programming - Upper Volta, published by the UN, UNDP/UPV/R.1. March, 1973. p.22
23. Country and Inter-country Programming - Senegal, published by the UN, UNDP/GC/SEN/R.1. September, 1973. p.20.
24. Ibid., p.20.

CHAPTER THREE

GEOGRAPHY AND ECONOMY OF THE SAHEL

Introduction

Geographic location and population

Climate and vegetation

- a. The Sub-Saharan zone
- b. The Sahelian zone
- c. The Sudanian zone

Economic background

- a. National Accounts
- b. Agriculture and manufacturing
- c. Exports, imports and the balance of payments
- d. Savings, investments and aid
- e. Sector and regional integration

Summary

CHAPTER THREE

GEOGRAPHY AND ECONOMY OF THE SAHEL

INTRODUCTION

This chapter is an attempt to provide a picture of the Sahel as it existed prior to, and during the early years of the recent major drought (details of the drought are provided in chapter IV). The region of Africa known as the Sahel is defined both geographically and climatically with some information being provided concerning the population, vegetation, land use and water systems. After this description of the 'God given' natural aspects of the Sahel, the chapter then proceeds to describe what 'Economic Man' has managed to do with this somewhat harsh climatic area of the World. In order to assess the contribution of Man, it is deemed necessary to view such measurable areas as National Accounts, Agriculture and Manufacturing, Exports, Imports and Balance of Payments, Savings, Investments and Aid. During the course of describing each facet of the economy's of the Sahel countries it has been possible, for the most part, to provide reasons for the poor showing of these countries when compared to other developing nations.

GEOGRAPHIC LOCATION AND POPULATION

The Sahel is that vast area which extends along the

southern fringe of the Sahara desert incorporating major portions of the countries of Senegal, Mauritania, Mali, Upper Volta, Niger and Chad (all statistics presented herein pertain to the whole country since it is not possible to separate only those figures which relate to the Sahel portion). Globally it may be designated as being between 18W to 24E longitudes and latitudes 4N to 24N (see Map #1).

MAP #1

THE COUNTRIES WHICH FORM THE SAHEL

The land area of the Sahel countries comprise one-sixth of the total land mass of the African continent. However, in this, large, fairly arid land mass are to be found only one-eighteenth of the total population of the entire continent of Africa. In Table #3-1,

Table #3-1

LAND UTILIZATION AND POPULATION DENSITIES OF THE SAHEL COUNTRIES: ^{1.} (1972 data)

Countries	Total Land Area (1,000 ha.)	Agricultural Area (1,000 ha.)		Population (1,000)	Density per km ²
		Arable	Permanent crop		
Chad	128,400	7,000		3,889	3.0
Mali	124,000	11,600		5,344	4.3
Mauritania	103,070	258	5	1,227	1.1
Niger	126,700	15,000		4,088	3.2
Senegal	19,619	5,564		4,122	21.0
Upper Volta	27,420	5,315	62	5,611	20.4
SAHEL TOTAL	529,209		136,705	24,281	4.5
African Continent	3,031,000	214,000		363,322	11.9

Source: 1972 Production Yearbook Vol. 26. Published by the FAO, Rome, 1973.

1. These statistics include the non-Sahel portions of the countries listed.

is shown the corresponding population density as being only 4.5 persons per km² while the remainder of the continent has a density of 11.9 km².

Table #3-2, shows the relevant population data with which 'development economists' must concern themselves when they are planning the future development of the Sahel countries. It will be noted that the population growth rate has been fairly constant during the period shown. This may be considered to be a reflection of the fact that all the figures listed are estimates, with the exception of Upper Volta in 1960 when a census was undertaken. The population for the Sahel countries is predicted as being close to 30 million by 1980¹, which is an increase of 6 million from that of 1970. Of the present population, only about 20% live in the area actually referred to as the Sahel (a point more properly clarified when describing the nomads in chapter IV), though 88% of the total population is rural and engaged in agriculture (see Table #3-7). With what is known of the past performance of the regional economy², these figures raise disturbing questions about the capacity of these countries to cope with the anticipated demands of future development.

CLIMATE AND VEGETATION

The countries of the Sahel may be clearly sub-divided into three main climatic zones which are based entirely on the

Table #3-2: POPULATION ESTIMATES, ANNUAL RATE OF INCREASE, AND POPULATION PROJECTIONS

Population (1,000)	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta	Total
1960	2,975	4,089	950	2,913	3,110	4,400(a)	18,799
1965	3,306	4,530	1,050	3,328	3,490	4,858	20,562
1969	3,571	4,967	1,144	3,735	3,873	5,266	22,556
1970	3,640	5,088	1,171	3,848	3,925	5,376	23,048
1971	3,796	5,214	1,198	3,966	4,022	5,491	23,687
1972	3,889	5,344	1,227	4,088	4,122	5,611	24,281
1975(b)	4,195	5,765	1,320	4,485	4,452	6,007	26,224
1980(b)	4,785	6,580	1,507	5,266	5,083	6,770	29,991
Annual Average Rate of Increase %							
1960-65	2.1	2.1	2.0	2.7	2.3	2.0	1.8
1965-70	1.9	2.3	2.2	2.9	2.4	2.0	2.3
(1960-1972)	2.2	2.2	2.1	2.8	2.4	2.0	2.2
1970-75	2.9	2.5	2.4	3.1	2.6	2.2	2.6
1975-80	2.7	2.7	2.7	3.3	2.7	2.4	2.7

Source: 1972 Production Yearbook Vol. 26. Published by the FAO, Rome, 1973
Labour Force Projections-Africa. Published by the ILO, Geneva, 1971

(a) Official census figure for 1960.

(b) The figures are the projected estimates for 1975 and 1980. However, they are subject to change when considerations of the drought are realised.

annual rainfall distribution (see Map #2). Through the use of isohyets three ecological zones can be delineated:

- a. The Sub-Saharan Zone
- b. The Sahelian Zone
- c. The Sudanian Zone

It is really the first two zones which are the concern of this paper; in fact, more specifically that region lying between the 100mm and the 600mm isohyets which has been most severely affected by the current drought.

It should be stated that the rainfall really only occurs during approximately a sixty day period from early July to early September (slight rains do fall in June). The remaining months of the year form the long, hot, dry season during which time the Harmattan blows.³

Though this would conjure up a picture of a totally arid zone punctuated by a brief period of rain each year, the area is not totally devoid of hydraulic resources. These water resources include the Lake Chad system, the Volta rivers, the Senegal river and the Niger.

Unfortunately, the rains have been considerably reduced during the past few years leaving the rivers much below their normal levels, (see Table #3-3); the lakes having suffered in a similar manner as is indicated by Chart #3-1, representing Lake Chad.

Map #2: THE MAIN CLIMATIC ZONES BASED ON RAINFALL DISTRIBUTION AS DELINEATED BY ISOHYETS

Source: Developed from Drought Relief Fund Project Map published by IBRD, October 1973, and the map Pluviométrie Normale published by Commission des Communautés Européennes, February 1974.

Table #3-3: Débit des grands fleuves du Sahel

<u>Débit moyen annuel</u>		<u>SENEGAL</u>		<u>NIGER</u>		<u>CHARI</u>	
		à Bakel	à Bamako-Kou Koro	à Niamey	à N'Djamena		
ans d'observation		(60)	(66)	(38)	(37)		
	³ m /s.	% de la normale	³ m /s.	% de la normale	³ m /s.	% de la normale	
Moyenne	770	100	1,540	100	1,016	100	1,280 100
1970-1971	542	70			691	68	
1971-1972	600	78			785	77	
1972-1973	263	34	1,080	70	728	72	578 45
<hr/>							
Débit maximal (crue).							
Moyenne	4,900	100	6,250	100	1,860	100	3,540 100
1973-1974	2,550	52	4,150	66			2,130 60

Source: Etude sur la situation actuelle de l'élevage dans les pays du Sahel et des mesures de sauvegarde à envisager, publiée par la Commission des Communautés Européennes, fév. 1974. p.2.

N.B. ³ m /s. égal mètres cubique par seconde.

Chart #3-1: Lac Chad

Variation interannuelle du niveau à Bol

(Office de la Recherche Scientifique de
Technique Outre-Mer)

Source: Etude sur la situation actuelle de l'élevage dans les pays du Sahel et des mesures de sauvegarde à envisager, publiée par la Commission des Communautés Européennes, fév. 1974. p.23.

May #3, shows the rainfall decline for 1973 with a table appended for the 1972 rainfall decline. The vastness of the area affected is also clearly indicated by May #3.

It should also be noted however, that despite the lack of rainfall there would seem to be a more than adequate sub-surface water table in the region.⁴ More mention will be made of the water resource later in the appropriate chapter of this paper when its relevance to the livestock development strategy is considered.

Concerning the vegetation of the three zones defined, a brief description of each will be provided thereby allowing the development of a more accurate picture of the total region.

- a. The Sub-Saharan Zone: This northern section of the drought stricken area is really total desert having less than 100mm of rainfall per year (see Map #2). The zone is mostly very hot and dry being characterized by sandy, pebbly soil with sparse natural vegetation which is barely able to support human life. Nevertheless, some farmers do exist and they are able to produce dates and cereals around the scattered oases. The population consists of nomadic herdsmen for the most part, who depend on animal husbandry (camels, cattle, goats and sheep) for their livelihood. This nomadic population is entirely dependent on their herds for their needs, trading with the farmers for grain, and as a consequence their

Map #3: Shows the percentage of normal for the 1973 rainfall

Tabulation of the 1972 percentage of the normal rainfall		Chad		Niger	
		Mali	77%	Senegal	66%
		Mauritania	72%	Upper Volta	59%
			45%		86%

Source: World Animal Review, No. 8, 1973, published by the FAO, Rome. p.3, and Pluviométrie 1973
 - Pourcentage à la normale published by Commission des Communautés Européennes, February, 1974.
 p. 19.

diet, while high in protein, is nevertheless unbalanced and low in calories.⁵

- b. The Sahelian Zone: This zone is located between the 100mm and 500mm isohyets (see Map #2). The natural vegetation runs from a sandy soil in the north to scrubby savanna in the southern part of this zone. However, the entire has, in the main, a sparse covering of thorny or drought resistant trees. During the rainy season the whole area becomes covered with short grasses which are more than adequate to allow extensive grazing for more than two-thirds of the livestock of the Sahel countries.⁶ In addition to this being the main cattle raising region of the Sahel (see Map #4), there is some seasonal farming throughout the zone with permanent agricultural cultivation in the irrigated areas adjacent to the main rivers and their tributaries.

Much of this zone is a plateau over 500 feet above mean sea-level. It is this elevation combined with the arid climate which means freedom from a number of the insect-borne diseases which plague other areas of Africa. This is one of the main reasons that this ecological zone supports so much livestock. However, it is the long dry season which necessitates the nomadic existence of the herdsmen, since they must constantly be on the move to new pastures and water points.

Map #4: The main cattle raising area of the Sahel countries

Source: World Animal Review No. 8, 1973. Published by the FAO, Rome. p.2.

- c. The Sudanian Zone: While climatically the zone stretches south from the 500mm isohyet to the 1,000mm isohyet, the area which is of concern in this paper only extends to the 600mm isohyet (see Map #2).

The zone consists mainly of agricultural and sedentary farmers. However, the pastoral land is more abundant and of better quality for grazing than in any other area. This is due to the wet lowlands and the scrubby savanna. But the lower elevation and the condition of higher humidity is more conducive to disease, both for humans and cattle, and thus livestock are found in considerably less numbers than in the Sahelian ecological zone. It should also be noted that most of the large towns and the majority of the population of the Sahel countries live in this climatic zone.

ECONOMIC BACKGROUND

The countries of the Sahel, with the exception of Senegal and Mauritania, rank among the poorest in the World having per capita Gross Domestic Product's (GDP) of below \$100 (see Table #3-4).

- a. National Accounts: For the majority of the population, per capita income has not increased since 1960, in fact for many it may even have declined. While the GDP shows varied growth rates (see Table #3-5), the increment in GDP has not been strong enough to generate an overall increase in the per capita

Table #3-4: GROSS NATIONAL PRODUCT PER CAPITA (1972) FOR THE DEVELOPING NATIONS OF THE WORLD; below \$500 U.S.

<u>Country</u>	<u>GNP per Capita</u>	<u>Country</u>	<u>GNP per Capita</u>		
China, Rep. of	490	Cameroon	200		
Iran	490	Bolivia	200		
Dominican Rep.	480	Sierra Leone	190		
Nicaragua	470	Mauritania	180		
Cuba	450	Viet-Nam Rep.	170		
Malaysia	430	China, People's Rep.	170		
Algeria	430	Togo	160		
Guatemala	420	Central African Rep.	160		
Colombia	400	Uganda	150		
Angola	390	Malagasy Rep.	140		
Mongolia	380	Kenya	170	Upper Volta	70
Zambia	380	Nigeria	130	Burundi	70
Tunisia	380	Pakistan	130	Bangladesh	70
Iraq	370	Laos	130	Rwanda	60
Turkey	370	Haiti	130		
Ecuador	360	Khmer Rep.	120		
El Salvador	340	Sudan	120		
Ivory Coast	340	Tanzania	120		
Rhodesia	340	India	110		
Korea, Dem. Rep.	320	Dahomey	110		
Honduras	320	Sri Lanka	110		
Paraguay	320	Viet-Nam, Dem. Rep.	110		
Syria Arb Rep.	320	Zaire	100		
Korea, Rep.	310	Yemen, People's Rep.	100		
Mozambique	300	Malawi	100		
Ghana	300	Niger	90		
Congo, People's Rep.	300	Indonesia	90		
Papua New Guinea	290	Yemen Arab Rep.	90		
Jordan	270	Burma	90		
Morocco	270	Chad	80		
Senegal	260	Ethiopia	80		
Liberia	250	Nepal	80		
Egypt, Arab Rep.	240	Afghanistan	80		
Philippines	220	Somalia	80		
Thailand	220	Mali	80		

Source: World Bank Atlas, published by the International Bank for Reconstruction and Development, 1974. p.7.

Table #3-5: GROSS DOMESTIC PRODUCT; PER CAPITA GDP; ANNUAL GROWTH OF PER CAPITA GDP AND POPULATION

Country	Gross Domestic Prod. (million US \$)			Per Capita GDP at 1970 constant Market Prices (US\$)			Growth Rate in Per Capita GDP (percentage)			Annual Population growth rate (percentage)		
	1969	1970	1971	1969	1970	1971	1960	1969	1970	1960	1969	1970
Chad	284.3	288.1	294.2	80	79	78	-1.8	-1.2	-1.3	2.0	1.9	4.3
Mali	251.4	267.4	277.2	51	53	53	3.0	3.9	0.0	2.2	2.4	2.5
Mauritania	180.8	191.6	200.4	158	164	167	4.6	3.8	1.8	2.1	2.4	2.3
Niger	355.8	363.3	345.3	95	92	87	0.3	-3.2	-5.4	2.8	3.0	3.0
Senegal	767.7	796.7	736.8	198	203	183	-1.4	2.5	-9.8	2.4	1.3	2.5
Upper Volta	304.8	309.7	314.7	58	58	57	-1.4	0.0	-1.7	2.0	2.1	2.1
Sahel Total				95	96	92	1.2	1.1	-4.2	2.1	2.2	2.8
							1969-1971		-1.6			2.5
Total Developing Countries							2.5				2.6	

Source: Survey of Economic Conditions in Africa, 1972, published by the United Nations.
 1972 Production Yearbook Vol. 26, published by the FAO, Rome, 1973.

income of the population. Despite the efforts of the various Governments concerned, and the massive inflows of foreign assistance during the 1960's, the growth rate remains low.

In the decade of the 1960-1970 the growth rate of the per capita GDP ranged from a low of -1.8% for Chad to a high of 4.6% for Mauritania. Only Mali, with 3.0% showed an apparent increase comparable to Mauritania (see Table #3-5). But both these countries enjoyed their increases from what seems to be a heavy concentration on a relatively narrow segment of the total population (see Table #3-6).

The combined annual rate of increase in the per capita GDP during the decade 1960-1970 was 1.2%, half the rate experienced by the Less Developed Countries as a group. Exact quantitative information is questionable but there can be little doubt that income distribution in the Sahel has been uneven during the decade. Clearly the sharpest disparities would have been between the modern sector (urban) and the traditional agricultural sector (rural), a fact which would seem to have occurred in all the developing economies since it is the urban centres that have shown the greatest growth rate due to the need for increased manufacturing.

- b. Agriculture and Manufacturing: It is interesting to note that 88% of the total population of the Sahel is engaged in agricultural activities (see Table #3-7), including both crop

Table #3-6:

STRUCTURAL COMPONENTS OF GROSS DOMESTIC PRODUCT

	Year	Chad	Mali	Mauri- tania	Niger	Senegal	Upper Volta	Sahel Total	Total Developing Nations
<u>Agricultural Sector</u>									
Agricultural labour as percentage of total labour force	1970	91	91	85	91	76	89	88.	65
Agriculture as share of total GDP	1970	45	40	32	52	22	47	42	27
Average annual growth rate of total prod.	1963-70	0.3	0.8	2.0	3.4	-2.6	2.1	1.0	2.8
Average annual growth rate of food prod.	1963-70	0.0	0.4	2.0	2.4	-3.1	0.8	0.4	2.9
<u>Manufacturing Sector</u>									
Share of manufacturing in GDP	1970	8	8	2	6	16	10	10	18
Growth rate of manu. in GDP	1960-69	5.2	6.5	12.2	4.1	5.3	1.5	5.0	7.1

Source: An Approach to Recovery and Rehabilitation of the Sudano-Sahelian Region. A draft by the Special Sahelian Office of the United Nations, New York, 1974. #74-12093

Table #3-7: AGRICULTURAL POPULATION 1970 (in thousands)

Country	Total Population	Agricultural Population	Percentage in Agriculture	Total Active Population	
				Total	In Agriculture
Chad	3,640	3,381	93	1,310	1,195
Mali	5,088	4,635	91	2,848	2,595
Mauritania	1,171	966	85	366	311
Niger	3,848	3,517	91	1,217	1,112
Senegal	3,925	2,965	76	1,739	1,314
Upper Volta	5,376	4,774	89	2,997	2,661
TOTAL	23,048	20,268	88	10,477	9,188

Source: 1972 Production Yearbook, Vol. 26 published by the FAO, Rome, 1973

and livestock production.

Among the indicators which trace the relative progress of the economy are those for manufacturing and agriculture. From 1960 to 1970, the average growth rate of agricultural production in the Sahel region was only 1% annually. This compares very unfavourably with the 2.8% achieved in the same period by the remainder of the developing nations. However, manufacturing grew at an annual rate of 5.0% which can be considered to be quite favourable in relation to the other developing countries which show a growth rate of 7.1% (see Table #3-6).

A more careful scrutiny of the data, such as is presented in Table #3-8, will show what progress has been made in agriculture. Between 1963 and 1970 the average annual growth rate of food production in the Sahel countries was a mere 0.4%, or less than half the rate of increase in agriculture as a whole. This would seem to indicate a stronger emphasis on cash crops for exports as opposed to food crops for domestic consumption. This situation was reversed between 1968 and 1971 when the growth rate of food production rose to 1.9% compared to the rate for agriculture of 1.7%. There was a subsequent increase again between 1970 and 1972 but even that did not prove enough to offset the increased demand of food imports during the same year (see Table #3-11).

Table #3-8: COMPARISON OF THE AVERAGE ANNUAL GROWTH RATES BETWEEN FOOD AND AGRICULTURE

	Average Annual Growth rates of agricultural production (%)				Average Annual Growth rates of food production (%)			
	1963-70	1968-71	1970-72	1963-70	1968-71	1970-72	1963-70	1970-72
Chad	0.3	-0.7	-1.5	0.0	0.5	-2.6		
Mali	0.8	2.9	1.4	0.4	3.5	0.0		
Mauritania	2.0	1.8	0.5	2.0	1.8	0.4		
Niger	3.4	1.7	-0.5	2.4	1.7	-0.5		
Senegal	2.6	4.0	1.3	-3.1	4.3	0.0		
Upper Volta	2.1	0.5	2.5	0.8	0.0	1.3		
Total Sahel Nations	1.0	1.7	0.6	0.4	1.9	-0.3		
Total Developing Nations	2.8	2.1	1.4	2.9	2.1	0.4		

Source: Based on the draft Report of the Secretary-General to the Fifty-Seventh Session of the United Nations Economic and Social Council, June 1974, Annex Table 2. This report was compiled from various United Nations publications; Implementation of the International Development Strategy, Vol.I; ECA, Survey of Economic Conditions in Africa, 1971; FAO, 1972 Production Yearbook.

Similarly, the data for manufacturing are largely influenced by mining output and to a lesser extent by the processing of cash crops. Manufacturing in the Sahel contributes very little to GNP whilst absorbing only a small share of the labour force. Most of the manufactured products are directly related to the domestically produced agricultural products and import substitution goods. Unfortunately, the manufacturing sector requires imports of machinery and petroleum which helped cause the balance of payments problems.

- c. Exports, Imports and the Balance of Payments: Only in exports did the Sahel countries perform better than the developing countries as a whole. This more rapid growth of exports did not however, do anything to improve the balance of trade deficits. In fact, with the drought situation the exports declined sharply from 1968 whilst imports rose steeply (see Table #3-9).

Table #3-10 displays quite clearly what a large proportion of the total Sahel export volume is derived from livestock. The balance being composed of cash crops such as cotton and peanuts for the most part. However, it must not be forgotten that Senegal exports a significant amount of manufactured products, including processed chemicals, while almost 90% of Mauritania's export revenue is obtained from iron ore and concentrates.

Table #3-9: TOTAL VALUE, BALANCE AND GROWTH OF EXPORTS AND IMPORTS FOR THE SAHEL - 1969-1971

Country	Value of Imports c.i.f. (millions US\$)		Rate of Growth of Imports (percentage)		Value of Exports (millions US\$)		Rate of Growth of Exports (percentage)	
	1969	1970	1969-70	1970-71	1969	1970	1969-70	1970-71
Chad	47	61	29.8	1.6	32	30	-6.3	-6.7
Mali	39	47	20.5	17.5	17	33	94.1	9.1
Mauritania	45	56	24.4	1.8	78	89	14.1	1.1
Niger	49	58	18.4	-6.9	24	32	33.3	18.7
Senegal	200	193	-3.5	12.9	126	152	20.6	-17.8
Upper Volta	48	47	-2.1	8.5	21	18	-14.3	-11.1
Total Developing African Nations			17.5	15.4			10.6	3.2

Source: Survey of Economic Conditions in
Africa, 1972, published by the
United Nations, New York, 1973.

Balance of visible trade (millions US \$)	
1969	1970
Chad	-15
Mali	-22
Mauritania	33
Niger	-25
Senegal	-74
Upper Volta	-27
	-31
	-14
	33
	-26
	-41
	-29
	-34
	-20
	33
	-16
	-93
	-35

Table #3-10: SHARE OF LIVESTOCK EXPORTS IN GDP AND TOTAL EXPORTS (thousand US \$) (a.)

Country	1966	1967	1968	1969	1970	1971	1972
<u>Chad</u>							
(1) GDP	-	225,000	-	284,300	288,100	294,200	-
(2) Total Exports	26,000	30,000	32,500	37,700	34,700	35,900	37,600
(3) Exports of livestock and products	9,150	8,840	7,550	9,380	13,630	13,350	13,060
(4) (3) as percent of (1)	-	3.9	-	3.3	4.7	4.5	-
(5) (3) as percent of (2)	35.2	29.5	23.2	24.9	39.3	37.2	34.7
<u>Mali</u>							
(1) GDP	-	371,000	-	251,400	267,400	277,200	-
(2) Total Exports	19,500	26,500	19,000	29,000	31,800	30,000	30,500
(3) Exports of livestock and products	12,010	14,280	10,800	20,600	19,880	17,530	16,150
(4) (3) as percent of (1)	-	3.8	-	8.2	7.4	6.2	-
(5) (3) as percent of (2)	61.6	53.9	56.8	71.0	62.5	58.4	53.0
<u>Mauritania</u>							
(1) GDP	-	-	191,000	180,800	191,600	200,400	-
(2) Total Exports	69,230	72,020	71,760	77,800	95,930	98,410	-
(3) Exports of livestock and products	14,700	15,000	14,640	14,670	14,400	14,500	14,600
(4) (3) as percent of (1)	-	-	7.7	7.8	7.5	7.3	-
(5) (3) as percent of (2)	21.2	20.8	20.4	18.8	15.0	14.7	-

Table #3-10: (continued)

Country	1966	1967	1968	1969	1970	1971	1972
Niger							
(1) GDP	389,000	395,000	387,000	352,000	363,300	345,300	-
(2) Total Exports	46,700	43,500	39,000	35,000	42,000	50,000	-
(3) Exports of livestock and products	13,490	13,850	14,470	15,060	15,630	16,160	16,680
(4) (3) as percent of (1)	3.5	3.5	3.7	4.3	4.3	4.7	-
(5) (3) as percent of (2)	28.9	31.8	37.1	43.0	37.2	32.3	-
Senegal							
(1) GDP	811,000	787,000	833,000	802,000	796,700	736,800	-
(2) Total Exports	148,900	137,300	151,300	123,600	152,000	130,000	170,000
(3) Exports of livestock and products	1,230	1,010	720	400	400	300	300
(4) (3) as percent of (1)	0.2	0.1	0.1	0.5	0.5	0.4	-
(5) (3) as percent of (2)	0.8	0.7	0.5	0.3	0.3	0.2	0.2
Upper Volta							
(1) GDP	236,000	-	316,000	304,800	309,700	314,700	-
(2) Total Exports	16,600	19,100	22,700	23,000	20,000	20,000	-
(3) Exports of livestock and products	10,790	11,680	12,840	10,010	7,370	9,530	8,260
(4) (3) as percent of (1)	4.6	-	4.1	3.3	2.4	3.0	-
(5) (3) as percent of (2)	65.0	61.2	56.6	43.5	36.9	47.7	-

Source: From Special Sahelian Office publication #74-12093, June, 1974, using data based on: FAO Trade Yearbook 1972; United Nations National Accounts Statistics 1971; Economic Intelligence Unit 1972; International Financial Statistics, May 1973.

(a) Official export data adjusted to include the unrecorded exports of live animals.

Obviously, with this dependence of the Sahel countries upon agriculture and allied exports, the present drought situation had to be catastrophic. However, such exports are not only subject to the climatic vagaries, they are very vulnerable to external demand, international trade prices, and any domestic policies which can have an impact on the level of output. Thus, the primary producers of the Sahel only have marginal control over the conditions which affect their product development. The major factors, which can behave in a most erratic manner, are entirely beyond the control of the primary producers. It should also be mentioned that this overdependence on cash crops and unprocessed exports does not provide the necessary feed-back into the economy and has not generated economic growth. The exports of meat could do much to aid the needed feed-back and is considered to have a vast potential in this regard, provided herds are reconstituted, livestock health is improved, meat processing practices are developed and distribution infrastructure strengthened.

Traditionally one thinks of the importing countries as having control over the amount of their imports. Unfortunately, this is not the case in the Sahel region since a large percentage of the increased imports have been food requirements (see Table #3-11). This increased importation of food products may be explained in part by this severe drought situation, however, agricultural planning may also be partly responsible since

Table #3-11:
SHARE OF FOOD IMPORTS IN TOTAL IMPORTS (thousands US \$)

Country	1968	1969	1970	1971
<u>Chad</u>				
(1) Total Imports	33,595	53,900	61,993	60,000
(2) Total Food Imports	5,418	6,808	8,179	7,037
(3) (2) as percent of (1)	16.1	12.6	13.2	11.8
<u>Mali</u>				
(1) Total Imports	33,893	38,900	38,900	38,900
(2) Total Food Imports	6,597	8,889	9,021	10,966
(3) (2) as percent of (1)	20.5	22.5	23.2	28.3
<u>Mauritania</u>				
(1) Total Imports	75,798	67,674	75,584	-
(2) Total Food Imports	23,184	21,818	21,243	19,296
(3) (2) as percent of (1)	30.6	32.3	28.1	-
<u>Niger</u>				
(1) Total Imports	41,471	48,700	58,368	-
(2) Total Food Imports	5,651	6,547	8,277	-
(3) (2) as percent of (1)	13.6	13.4	14.2	-
<u>Senegal</u>				
(1) Total Imports	181,001	198,784	193,000	193,000
(2) Total Food Imports	72,838	68,629	56,487	72,940
(3) (2) as percent of (1)	40.2	34.5	34.2	37.8
<u>Upper Volta</u>				
(1) Total Imports	41,003	49,834	46,659	-
(2) Total Food Imports	8,815	9,527	9,524	-
(3) (2) as percent of (1)	21.5	19.1	20.4	-

Source: FAO Trade Yearbook Vol. 26, Rome, 1973 and United Nations report #74-12093

Table #3-8 indicates a low average annual growth rate for food products when compared to general agricultural production.

- d. Savings, Investments and Aid: The inflows of foreign aid to the Sahel countries has been larger on a per capita basis than for most of the less developed nations (see Table #3-12). Between 1965 and 1971 this amounted to almost \$7 per head compared to \$4.80 for the other countries. But, as large as this figure may be, it still cannot be considered adequate. This external aid is very badly needed by the Sahel countries, not only to offset the balance of payments, but to fill the savings/investment gap. It is the low level of the per capita income which means a very low ratio of savings/GDP, thereby limiting the domestic resources for capital formation. Only Mauritania may be considered to have an adequate savings/income ratio. However, a large share of the savings, since it comes mainly from mining, is transferred abroad and is thus not available for domestic investment.

The low rate of domestic savings is directly related to the low per capita income and thus any developmental investment funds must come primarily from external sources. This was already the case before the drought situation, although in the pre-drought period it cannot be clearly stated that the aid inflows were necessarily compatible with the needs of

Table #3-12: NET FLOWS OF LOANS AND GRANTS TO THE SAHEL COUNTRIES (a)

Country	Total (\$ million)				Per Capita (\$)			Net flow as % of imports		Net flow as % of Gross Inv.	
	Average 1965-68	1969	1970	1971	Average 1965-68	1969	1970	1971	1971(b)	1971	1971
Chad	23.47	21.99	21.26	29.28	6.9	6.1	5.7	7.7	11.3	47.2	86.1
Mali	20.42	20.82	20.11	36.82	4.4	4.3	4.0	7.2	7.2	66.9	96.9
Mauritania	8.76	18.52	17.63	4.77	8.0	16.2	15.1	4.0	2.7	8.4	8.2
Niger	22.38	36.01	45.06	49.48	6.1	9.2	11.2	12.0	15.7	91.6	76.1
Senegal	50.16	49.12	40.76	58.49	14.0	13.0	10.37	14.5	8.4	26.8	47.9
Upper Volta	19.19	24.03	21.89	29.29	3.8	4.6	4.1	5.3	9.6	58.6	53.3
Total of the above (c)	144.33	170.49	166.71	208.13	6.7	7.5	7.2	8.8	9.2	41.8	55.9
Total Developing Nations					4.80	5.2	5.7	6.5	3.2	18.5	-18.9

(a) Bilateral and multilateral official loan and grant receipts plus guaranteed private export credits (data on a net disbursement basis).

(b) 1970 GNP and Gross Investment figures used as denominator.

(c) Excluding approximately \$40 million per year in recent years from France to Chad, Mali, Niger, Upper Volta and Dahomey. The available data does not show the allocation between them.

the countries. Much foreign aid pre-1970 was bilateral and uncoordinated. Since the drought became World knowledge in early 1973⁷, the many billions of dollars which it is expected will be invested in the Sahel region will likely be very closely coordinated through the Special Sahelian Office (SSO) of the United Nations (UN) in New York.⁸

Besides the heavy dependency of the Sahel countries on financial foreign aid, technical aid is also very important. While technical aid consists of loans, plant and equipment, the technical assistance of outside experts is also very crucial since the present pool of skilled Africans is very small.

- e. Sector and Regional Integration: The integration of the sectors within each of the Sahel countries and the regional integration of all six Sahel nations has been included at the end of this chapter because it is considered to be the locking key for the future of the entire Sahel, a point which will be demonstrated in the livestock strategy of chapters VIII through X inclusive.

The various economic sectors of the Sahel countries suffer from a lack of close internal and external ties. This is even true between relatively close sectors such as agriculture, livestock and water. Relationships between the sedentary agriculturalists and the nomadic herdsmen have historically tended to emphasize independence at the expense of complementary

exchange and co-operative use of mutually advantageous resource capability.

The primary sector, particularly mining in Mauritania, is a classic example of the non-integration of a sector, which perpetuates an export enclave that does not produce a significant feed-back into the economy.

This lack of integration, both internally and regionally, of the economic infrastructure, transportation in particular, has led to some large projects which are not economically feasible, thus diverting resources from a more efficient use.

To overcome the basic problems created by the lack of sector and regional integration, greater emphasis would have to be placed on regional projects of an economically-viable and highly productive nature, combined with a harmonisation of policies that promote, with both an internal and an external orientation, greater inter-dependence of resource use.

SUMMARY

Clearly, it has been shown just how vulnerable the economies of the Sahel countries are when exports and imports were briefly examined. In this chapter, it has been demonstrated how the primary production sector of agriculture and livestock are narrowly and directly dependent on favourable climatic conditions. Although irrigation is practiced to a limited extent, agricultural

and livestock production are obviously constrained by the availability of adequate rainfall in both time and place.

The countries have been shown to be at a distinct disadvantage concerning their highly unbalanced import-export patterns. Imports, particularly of food, but also of petroleum and machinery, when combined with inadequate and undiversified exports clearly clarify the balance of payments deficit shown in Table #3-9.

On aid, it should be mentioned that though much aid is badly needed, as was suggested, it is the perpetuation of the present forms of aid which lead to discontent, and the continuation of the dominance of economic enclaves with the resultant failure of the feed-back mechanism to provide the necessary technical skills for production within the economy. The financing of the Livestock Plan (chapter IX) set forth a method of aid, both financial and technical, which it is believed would be more suitable to the Sahel countries than the means heretofore used.

Before closing this chapter, where the concern has been with the development of a geographic and economic picture of the respective economies of the Sahel countries, it was necessary to dwell briefly on sector and regional integration. This notion of integration is the key factor in the Livestock Plan which will be proposed for the recovery and future development of beef cattle in the Sahel.

0

Having just set out the economies of the Sahel using figures taken mainly from the pre-drought statistical data, it is now possible to proceed on to chapter IV where the recent drought situation will be described along with the emergency measures which are being undertaken.

FOOTNOTES

1. Labour Force Projections - Africa. Published by the International Labour Organisation, Geneva, 1971. Taken from "Population Growth 1970-1980" published by the United Nations, ST/SSO/21/
2. See "Economic Background" section of this chapter.
3. The Harmattan consists of a strong southward surge of fresh, dry, northerly air. Since the wind has had a long trajectory over the Sahara, it is very dry, cool by night and warm by day, and is heavily laden with dust. Thus, a dense and wide-spread haze is characteristic of Harmattan weather, a condition which may persist for several days.
4. "Water Management" published by the United Nations, ST/SSO/11, 6/Nov/1973. p.3.
5. "Public Health Sector Analysis" - World Health Organisation, published by the United Nations, ST/SSO/15, 4/Dec/1973. p.2.
6. "Livestock - A Survey" published by the United Nations, ST/SSO/10, 9/Nov/1973. p.3.
7. The New York Times, 13/May/1973 published the FAO appeal for drought relief for the Sahel countries.
8. Resolution 1759 (LIV) adopted by the United Nations Economic and Social Council at the 1857th Plenary Meeting, 18/May/1973.

CHAPTER FOUR

CAUSES OF THE RECENT DROUGHT AND THE EMERGENCY RESPONSES

Introduction

Primary causes of the drought

- a. Agricultural expansion
- b. The traditional nomadic movement
(Pastoral adaptation)
- c. The below average annual rainfall

Disaster indicators

The emergency response

Conclusion

CHAPTER FOUR

CAUSES OF THE RECENT DROUGHT AND THE EMERGENCY RESPONSES

INTRODUCTION

Chapter III was concerned with the pre-drought economic development of the Sahel countries while, at the same time, detailing the statistical data which reflects the economic crisis during the years of the recent drought. The Press of the western countries has, since 1972, done much to highlight this economic catastrophe which assailed the Sahel region, but the Press has also tended to blame the drought as being the 'cause'. The aim of this chapter is to allay this simplified notion of 'one cause (drought) leading to one result (an economic crisis)'. It will be shown that really, both the drought and the economic troubles are 'results' of a major drama which began, in the Sahel, over a hundred years ago. A continuing drama which really had its roots in the era of early colonialism and the resulting agricultural development policies of recent years.

At the end of chapter III, mention was made about "Sector and Regional Integration". This chapter, having laid bare the root causes of the present economic troubles, will clearly substantiate the need, in future, for such integration.

Subsequently, this chapter examines the early warnings given concerning the drought emergency and also the World response to these warnings, thereby providing some understanding for the heavy involvement of the United Nations (UN) and the Food and Agricultural Organisation (FAO).

In summary, while chapter III provided the economic back-ground data which the Plan of chapter VIII seeks to improve, this chapter provides the physical back-drop for that same Plan, "A Plan for the recovery and long-term development of beef cattle in the Sahel".

PRIMARY CAUSES OF THE DROUGHT

The fact of the current drought in the Sahel has been well known for the last two years, but what is not so well known is, when the present drought really started and its true magnitude.

It is suggested that there are really three reasons which have contributed to the present inflicted economical disaster:

- a. Agricultural expansion
- b. The traditional nomadic movement
- c. The below average annual rainfall

While items (a) and (b) above have been considerably affected by the lack of rainfall, it is felt that the existing economic failure really had its roots in the more recent history of the Sahel region.

It may also be suggested that the economic crisis of today would eventually have occurred anyway, even without the added effects of a prolonged drought.

This last statement may be considered as rather a harsh indictment of the economic management of the Sahel countries. But a brief explanation about "Agricultural expansion" and the "traditional nomadic movement" will show proof of the statement's validity.

- a. Agricultural Expansion: It is really the agricultural expansion which has probably had more to do with the present economic plight than has the recent drought. The rationale for this suggestion may be found in the roots of the colonial history:¹

"The Colonists (French), who exploited certain parts of the area under consideration for two centuries, never worried very much about the future of the lands they occupied and the peoples living there..."

Like many Colonists, during the era of European expansion, particularly where the climate was considered unhealthy (West Africa being called "The whiteman's grave"), it was the 'biggest profits in the shortest time' attitude. This meant extensive cash crops for export such as cotton and groundnuts with almost a total disregard for the domestic needs of good cultivation.² Under this pattern of extensive farming, increased agricultural output was derived from the simple expedient of

land clearance with the additional land being placed under cultivation. It appears that very little research was undertaken directly for the Sahel region with a view to increasing the yield per acre.³ The process of ever increasing land clearance meant that more and more trees were being destroyed, thereby leading to the drying-up and eventually the present erosion of the soil.

Besides the European colonists and their cash crop production, there was a communal colonisation from off-shoots or segments of villages. In this instance, the agricultural expansion is a colonisation resulting from population pressures with an increase in cash cropping. The latter increase being often brought about by reducing the fallow period.

Interestingly enough, this 'land-clearance come farm-expansion' program mostly tended to be in a northerly direction. To expand south was not a practical idea due to the increased humidity and the accompanying higher incidence of diseases affecting both man and livestock.⁴

The spread of the farms northward may be considered as one side of a 'land squeeze'. While the other side of the squeeze clearly may be thought of as the work of the various health programmes and the medical missionaries. The health programmes being designed to reduce the mortality rate and generally

improve the health of the people, thereby contributing to an increased rural population, and an expanding demand for food production. Table #3-8 and #3-9, would seem to confirm that even in very recent years, too much of the expanded agricultural land was devoted to cash crops and too little to the increasing demands for domestic food production.

- b. The Traditional Nomadic Movement (Pastoral Adaptation): It is the cycle of annual rains followed by a long dry period which led to the pattern of pastoral nomadism, a classic example of how man adapted to his environment:⁵

"Pastoral nomadism is a rationale response to a moisture deficient, fragile environment."

Because the region in which they live is characterised by low water availability, seasonal drought (the wet period being only two months a year - chapter III), and widely scattered seasonal forage resources, the nomads make use of resources which are beyond the reach of the sedentary agricultural population. Under the traditional system of movement developed by the nomads, the herdsmen would alternatively concentrate around the 'dry season' wells⁶ or some other 'permanent' resource, or move to some other parts within their tribal territory. During the latter part of the dry season, usually January or February, the nomads would move their herds and flocks southward or towards the rivers. By that time of the year the northern grassland

regions have become very sparse due to lack of moisture. However, during the rainy season, July to September, the nomads then return north.

While this pastoral adaptation of nomadic movement is capable of dealing with most of the climatic fluctuations around the mean condition, extreme events such as the present prolonged drought are always devastating. Under these extreme conditions, which have occurred throughout the climatic history of the Sahel,⁷ the nomads continue to adapt by an adjustment of time in the transhumance. It was earlier mentioned that the southward movement usually takes place in January and February, but during the periods of extreme drought the nomads made further adaptation. The current example being the start of their move south as early as October during the 1972-1973 drought period, as happened in Mali. By the same token, the northerly return, which normally occurs during the wet season, virtually did not take place at all in 1973 or 1974.

This present failure to return may be partly explained by the fact that the northern grazing lands,⁸ where the nomads usually directed their herds for 'salt treatment',⁹ had dried up.

The cessation of the northward return movement has caused an unusually large concentration of animals in the southern Sahelian and northern Sudanian zones during the past few years.

It should be noted that now these animals are concentrated on less land than was the case during previous extended droughts, since much land has been absorbed for cash crop and subsistence cultivation (see previous section "Agricultural Expansion"). In the face of the present drought, purportedly the worst in sixty years,¹⁰ and with less pastureland available than was heretofore the case, millions of animals and people have died and/or faced starvation. The obvious result of the increased livestock concentration on less land means a serious overgrazing situation, a condition which has caused the large herds to further destroy all the trees in their search for food. Hence, more land is being exposed to drying-up and the subsequent erosion, but this time from cattle.

- c. The Below Average Annual Rainfall: The year 1972 marked the first time in sixty years that the big rivers, namely the Senegal, Niger and Chari failed to flood their banks.¹¹ In chapter III, using Table #3-3 and Chart #3-1, it was shown just how reduced these water levels have become, a situation further clarified by May #3 which showed the percentage of normal rainfall received in 1972 and 1973. However, it should be mentioned that the recent period of below average rainfall actually began in 1966 for some areas in the Sahel.¹² During the first few years the effects were not too noticeable because the countries were able to continue most economic activities

using the traditional reserve supplies of water.¹³ Unfortunately, with the continuation of the declining annual rainfall, the reserve water resources were not being replenished as would be the case under conditions of normal rains.

At the beginning of this chapter it was suggested that, "...the economic crisis of today would have eventually occurred anyway, even without the added effects of a prolonged drought." Having briefly explained "Agricultural Expansion" and the "Traditional Nomadic Movement", it would seem clear that even in the absence of normal rainfall, these two factors appeared to form a two-pronged potential for soil erosion.¹⁴ Thus, the Sahel countries would eventually have suffered some degree of economic chaos.

The converse is also true however, in that, given adequate management of the economy concerning cash crop development and farm expansion, the present drought effects would not have been so far reaching in terms of human lives and the loss of livestock.¹⁵

Having explored the primary causes of the current economic state of the Sahel nations, it is now possible to proceed to the detailing of the "Disaster Indicators" and the subsequent World response to the drought crisis.

DISASTER INDICATORS

In early 1973, Belgian Senator R. Scheyven conducted a

a survey for the United Nations and stated that 40% to 80% of the cattle had died,¹⁶ while the UN Secretary-General Kurt Walheim suggested that "...Ten million face starvation..."¹⁷ Even though actual figures are not obtainable, clearly the drought has seriously affected the imbalance between man and the environment.

Due to the inability of the nomads to cope with this particularly long drought in their traditional manner, many have concentrated around the towns and cities in the hopes of obtaining food and water from either their own Government or a relief agency. British Meteorologist Derek Winstanley¹⁸ noted that this congregation has led to further deaths from disease due to the shantytowns thus established which have no water facilities. The development of these additional communities around the existing towns has created social tensions between the pastoral nomads and the sedentary population, both of whom are in competition for the scarce water resources of the town and the inadequate medical facilities.

Though these social tensions are not new in the Sahel, they are not normally noticeable since the two segments of the population have little reason to mix. In addition, during the usual annual dry season, the towns-people are not normally affected. However, with the current drought the entire population of the Sahel has suffered to a considerable degree, not just the nomads... The agricultural cash crop and the domestic food sectors have also

24
OF/DE

been severely affected. The rains which have occurred in 1971,¹⁹ 1972 and 1973²⁰ have been both too little, too late, and maldistributed. The 1974 rains seem to have been a little closer to the annual norm in a few areas.

Despite the continued failures of the rains since 1968, the Sahel economies have been struggling to maintain some semblance of trade in livestock since this has always been a major segment of their exports (see Table #3-10, chapter III). But both the quantity and the quality of the cattle for export has dwindled. Most animals going to market in recent years have been tough and boney from their hard struggle to survive. This in turn has led to reduced weight and the consequently lower prices.²¹ It should also be noted that all grain reserves and seed stocks have long since vanished,²² these normally being only designed to cover a one-year shortage.

This trend of economic decline is also reflected in the small secondary processing industries which are dependent upon agricultural products as the raw inputs for their operations. Thus, some of the plants have had to close their doors causing further unemployment in the urban areas. While the industrial plants of the Sahel may not be considered to be a major segment of the economy, and hence the unemployment caused would seem to have only a marginal effect, it nonetheless, leads to a further exacerbation of the economy plight.

So much for the actual consequences of the drought and the devastating effect it has obviously had on the all too fragile economies of the six Sahel countries. But before an attempt can be made to develop a Plan for the future of the beef cattle industry, it is helpful to see what the emergency response has been in general.

THE EMERGENCY RESPONSE

By September 1972, the worsening situation in the Sahel had reached disastrous proportions²³, causing the FAO and the World Food Programme (WFP) to signal an acute emergency for West Africa because of the endemic nature of the drought. The exceptionally poor harvests of 1972 prompted the Governments of the region to intensify their joint efforts to meet the growing crisis. However, their efforts were in dire need of external help and thus the FAO received a request for emergency assistance from the Inter-State Authority of Mali, Niger and Upper Volta.²⁴ It was this request which led to the UN/UNDP/FAO field task force²⁵ to provide immediate assistance to the livestock population. In response to the task force report²⁶, and a subsequent resolution adopted by the United Nations Economic and Social Council²⁷ (ECOSOC), vast quantities of aid were promised and indeed forthcoming from the many aid-giving agencies throughout the World.

In February 1973, the Director-General of the FAO approved

the highest single contribution of food aid in the history of the WFP,²⁸ initially \$7.7 million. The amount was raised to \$9.5 million by the end of 1973.²⁹

On May 10th, 1973, the FAO Director-General Boerma appealed for additional financial assistance from the international community to the tune of \$15 million.³⁰ This sum was forthcoming from the UN in July 1973 with the requirement being estimated at \$5.5 million to be allocated for animal feed and vaccination, \$4 millions for seed and \$5.5 million for well-digging equipment.

To coordinate this massive relief operation, the FAO Director-General, on May 20th, 1973, established a special office in Rome to be known as the Office of Sahelian Relief Operations (OSRO).³¹ At the same time the United Nations Secretary-General K. Waldheim established a Special Sahelian Office (SSO) under the office of the United Nations Under-Secretary-General for Political and General Assembly Affairs (PGAA) Bradford Morse. This UN Office was to be responsible for the medium and long-term assistance activities in the Sahel region. The SSO was subsequently confirmed by the Ministers of the affected Nations when they met in Geneva, 28/29th June, 1973.³² The recipient nations obviously were making good their pledge to work together as was decided at Ouagadougou in the 26/27th March meeting when they established a Permanent Inter-State Committee on Drought Control.³³

While the emergency response has brought millions of dollars in immediate relief programmes to the drought stricken countries, such a system of 'ad hoc' expenditure can provide no lasting recovery or future development planning. Clearly, it has now become the responsibility of the SSO in New York to provide a development plan for the long-term rebuilding of the devastated Sahelian economies.

In line with the new policy of co-ordination of all aid, so that the results can be more beneficial, the WFP has also modified their policy as regards the Sahel. While in previous years food aid through the WFP has been provided as emergency relief, this assistance from 1974 on will be provided almost exclusively under "Food for Work" projects.³⁴ This idea is to provide incentives to the population so that they will become involved in the drought rehabilitation programmes. It is also a means of obtaining the much needed manual assistance for the various projects which will be undertaken by the aid agencies with regard to the construction of wells, irrigation projects, re-forestation and soil conservation, road maintenance and community development.

CONCLUSION

Having established the general back-ground to the Sahel countries and the emergency measures which have been undertaken, it is now possible to proceed to the analysis of the livestock

situation as it applies to beef cattle. However, it must be re-emphasized that while this paper is concerned with beef cattle, the Plan for beef industry recovery and future development will not, and cannot, be conceived so that the industry will operate in a vacuum. Certain changes, or ideas for development of beef cattle will be very dependent upon changes or investments made in other sectors of the Sahel economies. Hence, the Plan of chapter VIII and the implementation of chapter IX, will place great stress on the inter-meshing of all sectors in order to form a well balanced total economy.

FOOTNOTES

1. Michel C. Baumer, Towards a Strategy for Development in the Sahelian and Sudano-Saharan Zones, published by the United Nations, ST/SSO/Rev. 1, 30/Oct/1973. p.3.
2. This point was confirmed as being the case even during the 1960's as was indicated by Table #3-8, chapter III. The table showed that between 1963 and 1970 the average annual growth rate for food production was only 0.4%, while general agricultural production had a growth rate of 1.0%.
3. While much research has been undertaken by the French and British, it has been carried out mainly in the coastal countries of Ghana, Nigeria, Ivory Coast and Dahomey, having little direct application to the devastated Sahel region. It should be further added, that most of the research is being maintained in Paris, London and Rome, hence the author has not been able to read very much of this research directly, but has had to be guided by references made to it through other sources available in Ottawa.
4. The most troublesome diseases being the cattle ailments of rinderpest and trypanosomiasis. Humans are affected by onchocerciasis (river blindness).
5. Douglas L. Johnson, The Response of Pastoral Nomads to Drought in the absence of outside intervention, p.3. An unpublished paper on file in the United Nations SSO, written in 1972.
6. "Dry season wells" will be more fully explained in Chapter VI of this paper.
7. Official meteorological data only goes back thirty years, but explorers accounts and the colonial administration reports from 1829, confirm the cyclical nature of extreme drought on approximately a twelve year cycle.
8. A key area being the Wan-Irhazer region west of Agades, Niger, where the marshy area is rich with saline-resistant annual grasses.
9. Salt is an important diet factor for livestock as is the case for people. Thus, the nomads ensure that their cattle receive an annual addition to their diet. Salt-licks are provided in most cattle ranches or feed-lots.

10. The last prolonged drought in West Africa began in 1915, lasting for five years until 1920.
11. An approach to recovery and rehabilitation of the Sudano-Sahelian region, draft report of the Special Sahelian Office of the United Nations, #74-12093, 1974. p.5.
12. Michel C. Baumer, op.cit., p.2
13. "Reserve supplies of water" refers to the permanent wells and reservoirs throughout the region. This will be more fully explained in chapter VI of this paper.
14. An exact repeat of the United States 'dust-bowl' in the mid-west during the 1930's.
15. Details concerning the loss of life and livestock are explained under the next section, "Disaster Indicators".
16. The New York Times, 21/May/1973.
17. Ibid., 9/Jun/1973.
18. Ibid., 9/Jun/1973.
19. The Washington Post, 15/Nov/1971 pertaining to Upper Volta.
20. The New York Times, 12/Aug/1973 concerning the total Sahel area.
21. World Animal Review, No. 8, published by the FAO reports of price declines from \$120 per head to \$20 or less in many areas.
22. The New York Times, 21/May/1973.
23. Report by the Director-General of the FAO, Rome, E/5372, 7/Jul/1973. p.3.
24. Resolution adopted by the Ministers of the Sahelian countries at their meeting in Ouagadougou, 26/27 March 1973.
25. United Nations Development Programme (UNDP).
26. Report of the mission of Messrs. Scheyven, Mensah and Reyntjens, 7/20th April, 1973, Inter-Department Working Group on Sahelian problems WS/D 8795, 4/May/1973.
27. Resolution adoption reported in UN publication A/9092, 19/Jul/1973.

28. Drought Relief Plans for Six West African Nations Mapped at FAO Headquarters, press release FAO/2390, 27/Feb/1973.
29. WFP Announces Food Aid to help rehabilitate Sahelian Drought Areas, press release FAO/2473, 21/Feb/1973.
30. "FAO Appeals for emergency relief needs", The New York Times, 13/May/1973.
31. Secretary-General names the Food and Agricultural Organisation as the focal point for aid, press release, S-G/1773 and FAO/2403 both dated 25/May/1973.
32. Meeting for co-ordination of the Sudano-Sahelian Medium and Long-term programme, in Geneva 28/29th Jun/1973. Attended by representatives of all aid-giving agencies and the Ministers of the Sahel countries.
33. Although not present at the 26/27th March Meeting, Chad was an original member of the Committee.
34. Report of the Secretary-General to the 57th Session of the ECOSOC, June, 1974. p.17.

CHAPTER FIVE

WORLD TRADE IN BEEF AND THE POTENTIAL FOR THE SAHEL NATIONS

Introduction

Livestock in World trade

- a. World demand for beef
- b. World supply of beef
- c. Beef Trade Barriers
 - (i) Health Barriers
 - (ii) Economic trade barriers
 - (iii) Continuity of Supply

Recent developments in beef trade strategy

The future for beef

Problems facing cattle development in the Sahel

Summary

CHAPTER FIVE

WORLD TRADE IN BEEF AND THE POTENTIAL FOR THE SAHEL

INTRODUCTION

This chapter will be concerned with proving the value of developing a beef cattle industry in the Sahel; an important idea before much valuable time is spent preparing a strategy which could prove useless. Therefore, the following questions are posed and this chapter will attempt to provide the answers:

Will a beef cattle industry help the Sahel?

Will there be a market for Sahel beef?

In order to answer these two questions it is useful to examine the World trade in livestock with specific reference to beef production. To this end, the World supply and demands for beef are considered with particular reference to the future demands which will be seen to be in excess of the World supply by 1980 (see Table #5-1).

Due to the predicted beef shortage (see Table #5-1), it would seem an easy matter to suggest that the development of a beef cattle industry in the Sahel would mean automatic markets in the European Economic Community, or the other western European nations. However, the production surplus of beef for Africa shown

Table #5-1: BEEF AND VEAL: PRODUCTION, CONSUMPTION, AND TRADE BALANCES FOR 1970 AND 1980 PROJECTIONS

	1970				1980			
	Production(a)		Consumption		Production(a)		Demand	
	Total(a)		Per Capita(b)		Total(a)		Per Capita(b)	
Canada	975	915	42.7	+60	1,258	1,293	52.0	-35
United States	10,269	10,979	53.5	-710	12,835	13,998	61.2	-1,163
EEC	4,045	4,620	24.5	-575	4,830	5,990	29.5	-1,160
Other west European nations	2,745	2,940	17.4	-195	3,360	3,680	20.7	-320
China	2,192	2,130	2.5	+60	2,712	3,139	3.0	-427
U.S.S.R.	4,800	4,915	20.3	-115	5,980	6,765	25.1	-785
Eastern Europe	2,060	1,815	15.6	+245	2,697	2,480	19.3	+217
Africa	1,605	1,517	5.4	+88	2,411	2,266	6.1	+145
Mexico	508	395	7.8	+113	852	645	9.0	+207
South America	5,982	5,141	26.9	+841	8,224	6,648	26.6	+1,576
Australia and N.Z.	1,450	960	62.6	+490	1,941	1,214	64.8	+727
World Total	39,970	39,720	10.7	+250	51,711	53,364	11.7	-1,653

Source: FAO Agricultural Commodity Projections 1970-1980, Vol. 1, Rome, 1971. p.136-137.

(a) Thousands tons

(b) kilograms

would seem to be mainly South African beef, since the FAO suggests that the surplus of beef from East and Central Africa would be exports to West Africa, thereby filling the projected import needs of that region¹. (318,000 metric tons by 1985). Chapter VIII, "The Plan", will consider both the European and the West African markets for beef since, in the future, it is anticipated that there will be free export of beef from the Sahel.

However, at present, free export of beef from the Sahel is not possible, even given that the Sahel presently had a beef surplus, which it does not. There are several barriers to free trade which will also be considered in this chapter, because an understanding of these barriers, particularly those pertaining to health and economics, are important considerations when the Plan is proposed later in this paper.

Once the World beef situation has been understood then it will be possible to look more closely at the problems facing beef cattle development in the Sahel economies.

Having thus examined World Trade in beef and the stock-raising problems in the Sahel, the two opening questions will then have been answered. Therefore, the way will then be cleared for an examination of more fundamental items concerning the development of

a beef cattle industry in the Sahel region.

LIVESTOCK IN WORLD TRADE

Meat, in the World at large, would seem to be produced principally for domestic consumption since only about 5% of all carcass meat enters World Trade.² Of the total World trade, while agricultural production accounts for 25%,³ meat and livestock make up only 1.97%.⁴

Probably the most important feature of World trade which should be noted, is that meat and livestock prices have increased substantially between 1967 and 1972.⁵ Prices increased still further after 1972, and it is expected that such prices will continue to increase since there will be a continued excess of demand over the anticipated supply (see Table #5-1).

Another important fact which will have a direct bearing on a Sahel regional beef cattle development plan, is the statistical breakdown of the World's meat and livestock export trade.⁶ Of the total trade of this commodity, 58.5% is accounted for by 'fresh chilled or frozen meats', a further 17.9% by 'dried and canned meats' with only 23.6% consisting of live animals. These World trade percentages are significantly different from those of the Sahel nations,⁷ where they export no 'dried or canned meat', but

do export 93% as live animals. The balance of the Sahel livestock and meat exports being 7%, which is butchered in the abattoirs⁸ of the region with a small percentage, only 0.5% going on to a meat drying operation.

This trade breakdown is important for the Sahel nations when determining their future markets in terms of countries and the type of beef products which these markets demand. Hence, the World demand will now be examined a little more closely.

- a. World Demand for Beef: It is generally considered that the quality of people's dietary habits are a reflection of their income levels and in this regard there is a definite relationship between the levels of income and meat consumption (see Chart #5-1). With the rising incomes in many countries there is thus a corresponding rise in the World demand for meat and livestock products; the western European countries alone import 66% of the World's total⁹. However, these same developed western European nations are also among the largest exporters of meat and livestock products, with 49.5% of the total World export volume¹⁰. But, it must be realized that much of the European trade is within the region due to the health and economic barriers which have been imposed on the imports of meat products from the developing countries. Nevertheless, some of the new nations are able to export some of their products to Europe, though it is only a small percentage

Chart #5-1: THE RELATIONSHIP BETWEEN INCOME AND MEAT CONSUMPTION' SELECTED COUNTRIES.

Source: World Animal Review, No. 4. 1972. Published by the FAO. p.2.

of their total trade. Presently the developing countries only account for 18.2% of the dollar value of World meat trade, and of that, only a small percentage^{11.} is exported to the European markets.

The above figures are important since it is the demands of the developed countries, particularly Europe, which may be of vital importance to the future of a beef industry in the Sahel. Table #5-2, provides a clear idea of just how that demand for livestock and processed meat has been increased in the few years from 1967 to 1972. The demand is reflected not only in the increased quantity which has been imported, but also by the increased higher per unit prices which the importing markets have been prepared to pay.

Thus, on the demand side there is a very basic economic situation whereby prices have increased in response to the higher demands that suppliers have not been willing to meet at the lower prices.

What then of the supply side?

Are there any points to be observed in order to ascertain if there could be any value to the Sahel countries?

- b. World Supply of Beef: Though pork, poultry, mutton and lamb constitute a significant proportion (32.6%)^{12.} of the World's meat supply, this paper is concerned solely with the beef market potential. Hence, this section will examine only

Table #5-2:WORLD IMPORTS OF LIVE CATTLE AND PROCESSED BEEF

	<u>1967</u>	<u>1972</u>	<u>Percentage Increase</u>
Number of head	16,827,454	24,673,551	46.63%
Dollar value ('000's U.S.)	1,001,015	2,245,010	124.27%
Unit Price	\$59.49	\$90.99	52.95%
Processed Beef (metric/tons)	4,859,831	6,601,941	35.85%
Dollar Value ('000's U.S.)	3,781,010	7,231,475	91.26%
Unit Price	\$77.80	\$109.64	40.93%

Source: Developed from the FAO Trade Yearbook, Vol. 26, 1972.

the supply of beef (67.4% of the total World meat).

It was mentioned in the previous section ("World Demand for Beef") that the developing nations only account for 18.2% of the World's total trade. This figure should be qualified further at this juncture by stating that the developing nations^{13.} only represent 18.1% of the World's beef supply. This small share of the beef export trade is in no way a reflection of the livestock production in the developing countries as is indicated by Table #5-3. While the less developed nations only account for 18.1% of the World's beef exports, they do however, account for over 59% of the cattle population of the World. Since this percentage is so large, the obvious questions are:

With 59% of the World's cattle population, why do the developing nations not have a larger share of the total World meat trade?

Why are the developed nations prepared to pay higher prices for their beef imports rather than open up more trade potential with the emerging nations?

While the number of cattle in India may account for a percentage of the 59% already stated, the answers to these two questions leads to the next section, since there must obviously be some barriers to trade which prevent the developed countries from importing beef that is available in the less developed nations of the World.

Table #5-3: CATTLE PRODUCTION OF LIVE ANIMALS (1,000 head)

World	1,016,249	1,165,413		
Developing economies	594,022	688,039	58.48%	59.03%
Africa (less S. Africa, Libya, Sudan and Egypt)	110,022	129,914	10.82%	11.15%
Chad	4,250	4,600	0.42%	0.39%
Mali	4,040	5,000	0.39%	0.43%
Mauritania	2,244	2,300	0.22%	0.19%
Niger	3,700	4,000	0.36%	0.34%
Senegal	1,760	2,400	0.17%	0.21%
Upper Volta	1,956	2,400	0.19%	0.21%
SAHEL TOTAL	17,970	20,700	1.77%	1.77%

(a) The figure for 1972 is an estimate used by the FAO due to a possible data collection problem as a result of the drought situation.

Source: Developed from the FAO Production Yearbook, Vol. 26, 1972.

- c. Beef Trade Barriers: The problems which will be defined here, while they pertain to the beef industry, are also applicable to the entire meat trade between developed and the developing nations.

The chief problems related to the barriers to trade which have been imposed by the main importing countries of North America and western Europe. The primary trade barriers are concerned with the quality and the continuity of supply from the exporting countries. It is also important at this point to appreciate the reasons for these trade obstruction and the ways in which they operate.

There are two main reasons for the trade regulations; firstly, to protect the consumer from health risks; secondly, to protect the cattle industries of the importing countries from both animal diseases and the potentially lower priced imports.

- 1) Health Barriers: In all the developed countries, imports are subject to licensing. However, in order to obtain a permit, the abattoir facilities of the exportation must satisfy the health requirements of the importing country. In the case of processed meat this applies also to the processing plants of the exporting countries. But, this inspection aspect only takes care of the food poisoning and food-borne disease side of the

import trade. Also under the Health Barriers may be found various veterinary regulations which are designed to prevent the import of animal diseases such as "foot-and-mouth" since these could have serious economic consequences for the farmers of the importing nations.

While such regulations may be seen as a menace to trade for the developing countries, they must also be viewed in the light of the possible problems for any importing countries if such rules did not exist.

Clearly, these health barriers are here to stay. This means that if a livestock policy is to be developed for the Sahel which will involve trade between the Sahel nations and the developed World, particularly western Europe, then the Plan of chapter VIII must include ways by which the beef industry of the Sahel will be able to meet these Health Barrier requirements.

However, besides the health requirements, the more traditional type of economic trade barriers must be examined.

ii) Economic Trade Barriers: In most countries of the World studies have shown that the average annual income of the rural areas is often below the incomes of the urban regions, a fact which would seem to apply as much to the developed as the under-developed economies. Certainly, both Canada and Europe have, in recent years, had problems with their

respective farm sectors in terms of strong demands to correct these income inequalities. In view of this situation, the countries of western Europe have had, as one of their primary objectives, the raising of these farm incomes.

This has been attempted on many agricultural products, including meat and livestock, by introducing measures designed to increase the domestic farm prices above that of the World markets. The methods have included the imposition of tariffs, variable levies and straight quotas on all agricultural products which would be in competition with the domestic supply of the importing countries. These economic barriers were based on the principal of short supply and high demand so that the domestic market producers could ask for, and obtain, higher prices for their produce.

It should be added that not all countries have used this approach in Europe. The United Kingdom relied upon the payments of direct subsidies to the producers, thus maintaining domestic prices at the World level. Clearly, such a situation in the United Kingdom is more able to permit the import of certain agricultural products from the less developed nations since the domestic products are at least price competitive. However, Britain, like

all other developed nations do have health barriers.

There are no barriers from the western European nations which specifically apply only to the Sahel countries, since the barriers which have been established were intended to apply equally to all nations. Thus, it cannot be said that, should the Sahel develop a successful beef cattle industry the Sahel nations will be unfairly penalised, since this is clearly not the case.

However, though the strategy for the development of a Sahel beef industry (chapter VIII) will be able to suggest methods for meeting the health requirements of the importing countries, the economic barriers form another situation entirely. These barriers would have to be negotiated either at the GATT meetings,¹⁴ or, directly by, an Inter-State Committee¹⁵ of the Sahelian Governments dealing with the individual prospective importing countries. In any case, these particular economic barriers cannot be built into the livestock development strategy, since they are purely a problem for diplomatic resolution at the highest levels of the nations involved. However, it may also be that the Sahel nations prefer not to export to the markets of Europe, being instead satisfied with the existing markets of West Africa.

Having set forth the two primary classifications of trade barriers which exist, there is a third item which is of vital concern to the prospective importing countries, and which may also

be thought of as a barrier to trade - Continuity of Supply.

iii) Continuity of Supply: While there is a very large potential for exports of beef from the developing countries which have the ability to produce a viable beef cattle industry, it should also be noted that these developing nations almost all seem to be in the southern Hemisphere. This means that they are also subject to the possibility of prolonged periodic droughts,¹⁶ an aspect most relevant to the Sahel region. The vagaries of the weather not only prevent the fattening of the cattle but also lead to considerable herd depletion during drought years. There is another problem besides drought, and that is the endemic diseases which can seriously decimate the herds.

It is this potential for herd decimation through either disease or drought which can lead to substantial export reductions in any given year. Such fluctuations in supply would inevitably be reflected in the prices for beef (low supply means that prices would theoretically be pushed upwards) which the importing nations would have to pay. These fluctuations can have a ripple effect throughout the economies of the importing countries, a factor to be avoided at almost any cost. Hence, it is here suggested that 'continuity of supply', even at above

average prices, is more important to the developed nations than an erratic supply at possibly lower prices in some years.

RECENT DEVELOPMENTS IN BEEF TRADE STRATEGY

Part of the increase in World beef prices mentioned in an earlier section of this chapter may be attributed to higher production costs in the exporting countries. But this higher production cost may also be interpreted as a reflection of a different trading strategy.

Most beef sold on the World markets used to be in the form of half or quarter carcasses with the butchering taking place in the importing country. However, in recent years, butchering into joints, or steaks, has increasingly been undertaken by the exporting country. Two reasons may be said to account for this change; the United Kingdom imposed a ban on 'bone-in' beef from countries where 'foot-and-mouth' disease is endemic (a consequence of a belief that the disease can be transmitted in bone marrow or offal); and the demands of Supermarkets for pre-packaged meat, or restaurants for pre-packaged steaks.¹⁷

A further reason for the shift in the butchering process from importer to exporter may also be attributed to the system of grading meat into a consumer requirement and a manufacturing

standard (for soups, stews, and quick-frozen foods). This last factor is important because it means that an avenue is open for beef from the developing countries. Through this trade route it can mean that imports (exports in cooked or frozen form are free of disease) will not be competing with the higher quality domestic beef produced for the direct consumer market. A start has already been made in this direction with Kenya beef going to the markets of the United Kingdom and some western European nations.^{18.}

THE FUTURE FOR BEEF

Table #5-1, illustrated that by 1980 there could be a substantial beef shortage. While production is expected to increase by 29.5% between 1970 and 1980, demand will increase by 34.4% if supplies can be increased. Though this Table indicates a potential shortage of 1.6 million tons, it is based entirely on the existing production systems and the present trading patterns at constant prices.

Since beef production expansion in the developed nations is rather limited, the importers will have to lean more and more towards the developing nations for their beef needs. Thus, the developing countries, and in particular the Sahel, will have to improve both the quality and the quantity of the beef from the cattle industry. It should also be realized that the importing nations expect to pay higher prices by 1980, partly on account of

the short supply, and partly as a result of the higher production costs.

Having examined the World beef situation with the accompanying barriers to imports from the developing nations, it is now possible to check the problems facing beef cattle development in the Sahel region.

PROBLEMS FACING CATTLE DEVELOPMENT IN THE SAHEL

The cattle herds of the Sahel represent very large capital assets in the respective countries, but judging by the off-take rate which is possibly as low as 7%¹⁹, this capital is not being used effectively. From the standpoint of rapidly increasing the beef productivity, primary effort could be directed towards increasing the off-take rate as a first step.

In regions where the cattle populations are low it is biologically impossible to build up herds rapidly in the face of high domestic demand for beef. However, where large numbers of cattle exist which are poorly utilized, such as in the Sahel, the potential for rapid reversal most assuredly exists. Unfortunately, the main trouble with the supply problem from the Sahel is the relationship between the existing animal husbandry practices and the land ownership. Closely related to this is the traditional attitude of the nomad towards the cattle. This aspect really

stems from the fact that, in the absence of a monetary economy, cattle have been the main form in which wealth could be accumulated.

When the productive potential of the Sahel is viewed as a whole, particularly in light of the drought problems mentioned in chapters III and IV, it is clear that the present failure of beef cattle production relates to the fact that the nutritional requirements for cattle are not being met on a regular basis. Thus, this is another point which must be resolved in order to develop a strategy, since success will depend upon attaining the correct relationship between feed resources and the stock numbers. However, since the major portion of the diet for beef cattle is derived from the consumption of range herbage and there is a direct relationship between the ratio of feed and the number of cattle, there must also be a relationship between the land area and the cattle. Given this latter ratio concerning land ownership and cattle, then it could also be that land ownership occupies a central position in the search for a beef cattle development strategy or Plan.

Under a system of communal land ownership, or tribal grazing rights, when a given area of land is stocked to its maximum capacity the addition of one more head of beef will reduce the output of the herd as a whole, although for the owner of

the extra animal there will be short-term gains. However, over the long-term the additional numbers, as is common with the nomads in times of good rainfall, are severely detrimental both from the viewpoint of soil erosion and from the lower productivity and accompanying increased cattle mortality. However, by contrast the Plan of chapter VIII may have to consider the possibility of private ownership, or a system of special land tenure such that the numbers of beef cattle can be directly related to the land. This idea may reduce overstocking by providing a greater incentive to invest in land than in increasing the size of the herds.

Since health was mentioned earlier in this chapter as being one of the principal barriers to trade with the European markets, a solution to the problem of the endemic diseases is therefore, another essential factor for a Sahel beef industry. Such a resolution being really a pre-requisite for the sound development of beef cattle. However, there is little doubt that, in general, this type of control can best be undertaken by the individual Governments of the region, but much co-operation will be needed from the cattle and other livestock owners.

Despite the mention of several problems which must be solved before a successful beef industry can be developed, probably the most important would be those concerning markets and

infrastructure. The problem in marketing is really two-fold; firstly, to change the traditional system of marketing, which, although very effective in that it can deliver a live animal from producer to a consumer some 1,000 to 1,500km away, is often more costly than a more developed marketing system.^{20.} Secondly, it will be necessary to standardise the different systems the individual Governments have of levying taxes, tariffs and other licence fees.^{21.}

Coupled with the distance problem mentioned above with reference to the traditional markets, there is another problem which must be considered. Markets must be thought of on a regional basis since it is impossible for a single country to obtain full benefit of the traditional system of exporting 'on-the-hoof'. A regional system is necessary because of the long land borders, frequently crossed by the traditional nomad, allowing easy opportunity for smuggling, thereby short-circuiting any initial efforts at market improvements by an individual nation.

SUMMARY

In this chapter an attempt has been made to clarify the World market for beef cattle and also to view the main barriers to free trade which exist between the developed and the developing nations. These barriers of 'health', 'economics' and 'supply con-

tinuity' were considered as a general application to all the developing nations since they were not specifically formulated against the formation of a beef industry in the Sahel. These barriers were shown to be protective measures for the importing nations of the World. Thus, the strategy of chapter VIII will have to devise a way to meet the standards being set by the importing countries, if the beef shortage predicted for 1980 (see Table #5-1) is to be partially reduced by an expanding Sahel beef industry.

Recent developments in World beef trade strategy were also mentioned since the increased pre-export meat processing can have some added benefits for the Sahel economies in their efforts to develop backward and forward linkages from a beef industry.

Having briefly considered a few of the important aspects of the World situation with regard to beef, the problem facing beef cattle development in the Sahel nations was discussed. These problems were also noted as being of key importance for the strategy to be proposed in chapter VIII.

Despite the items considered in this chapter, such discussion still does not permit the immediate development of a beef Plan for the Sahel. Before that step may be taken, it is necessary, in the next chapter, to examine the fundamental requirements of a basic beef cattle industry such as the water needs, disease control measures, feed and grazing requirements, marketing and the infrastructure.

FOOTNOTES

1. Indicative World Plan for Agricultural Development to 1975 and 1985, published by the FAO, Rome, 1968. p.252.
2. World Animal Review, No. 4, 1972 published by the FAO, Rome, p.1.
3. Ibid., p.1.
4. FAO Trade Yearbook, Vol. 26, 1972 and the United Nations Yearbook Of International Trade Statistics 1970-1971

1971 World Trade Total	\$348,000 million
1971 Meat and Livestock	\$6,860 million
5. Price increases of 52% for live animals and 41% for processed meat. Information developed on Table #5-2 from FAO Trade Yearbook, Vol. 26, 1972.
6. Developed from FAO Trade Yearbook, Vol. 26, 1972. World Trade in thousands U.S. \$ (1972).

Live animals	\$2,220,757	(23.6%)
Fresh, chilled or frozen	5,071,451	(58.5%)
Dried and canned	1,547,062	(17.9%)
Total	\$8,641,270	
7. 'Abattoirs' in this paper refers only to the slaughterhouse facilities, these being in no way connected with the meat processing plants.
8. FAO Trade Yearbook, Vol. 26, 1972 - Sahel Meat Trade 1972

Live animals	\$63,499,000	(93.0%)
Fresh, chilled or frozen	4,450,000	(6.5%)
Dried and canned	219,000	(0.5%)
Total	\$68,168,000	
9. FAO Trade Yearbook, Vol. 26, 1972 - World Imports 1972

World	\$9,476,485,000,000
Western Europe	6,253,613,000,000
10. FAO Trade Yearbook, Vol. 26, 1972 - World Exports 1972

World	\$8,641,270,000,000
Western Europe	4,262,978,000,000 (49.5%)
Developing nations	1,575,245,000,000 (18.2%)
11. The trade volume of meat between Europe and the developing nations must be very small due to the import barriers imposed by the European countries. With the present regulations very few countries can meet the requirements. Unfortunately, no data is available showing the origins of European meat imports.

12. FAO Yearbook, Vol. 26, 1972

World meat exports 1972	\$8,641,270 million
Pork, poultry, mutton, lamb, 1972	2,817,625 million
13. The definition of 'developing nations' as applied to this paper uses the FAO definition which excludes Argentina which produces 12% of the World's beef supply. The definition is listed in the FAO Trade Yearbook, Vol. 26, 1972. p.407.
14. The GATT has long held, as one of its primary objectives, the removal of all trade barriers, and while each bargaining session brings this objective closer to fruition, complete free-trade is still a long way away.
15. More mention will be made later in this paper concerning the Sahel Inter-State Committee.
16. Even the beef producing countries of South America have been subjected to periodic droughts but their cattle have not been too affected because the droughts appear to have been isolated to relatively small areas. This is very unlike the droughts of the Sahel, since the Sahel has no major geographical features to assist in changing the weather patterns.
17. The Ponderosa Restaurant chain in Ottawa is a classic example of the ordering of pre-packaged steaks. This chain of restaurants orders the pre-cut steak from a ranch in Australia, where the beef steer is raised to meet the desired quality.
18. Kenya meat is being exported in canned form from the Kenya Canning Company. It is the pre-cooking which ensures sterile, disease-free exports which in turn satisfy the health requirements of the importing nations. The Kenya facilities were also subject to inspection by the importing countries prior to the issuance of the necessary licence.
19. Indicative World Plan, op. cit. p. 253.
20. J. Dirck Stryker, Livestock Production and Distribution in the Mali Economy. Report for A.I.D. August, 1973. p.44.
21. Frank D. Abercrombie, "A Sectoral Approach to the Cattle Industry in West Africa, in, Development Digest, Vol.XIII, No.2, April 1975. p.73.

"...A maximum of fourteen different taxes have been levied against the movement of animals overland to coastal markets. Such taxes may include: buyers'

license, market tax, municipal tax, sanitary inspection fee, charge for certificate of origin, and fee for export permit. In addition, there is an export tax, and import tax, and, in some cases, a transit tax. At the abattoir a market tax is levied, an abattoir tax, a sanitary inspection charge, and perhaps another official tax. As a result, a large share of costs to marketers are for taxes, 45% if sold in Abidjan (from Mali), and 35% if sold in Igo (from Mali) or 53% if sold in Iome."

CHAPTER SIX

THE BASIC REQUIREMENTS FOR A BEEF
CATTLE INDUSTRY

Introduction

Water requirements

Disease control

Feed and Grazing

Education and Manpower

Marketing and infrastructure

Summary and Conclusion

CHAPTER SIX

THE BASIC REQUIREMENTS FOR A BEEF

CATTLE INDUSTRY

INTRODUCTION

The earlier chapter have made an attempt to provide a clear understanding of the Sahel economies and also the important beef cattle. Additionally, the current economic plight relating to the drought was discussed with the root-causes being pinpointed. In this chapter, the fundamental elements needed for the successful development of a beef cattle industry will be examined. Table #5-3, chapter V, showed that the Sahel would seem to have the basis of a substantial cattle population, at least according to the FAO estimates. Thus, the elements which must be considered for the viable future development of beef production are set forth as follows:-

- water requirements
- disease control
- feed and grazing needs
- education and manpower
- marketing and infrastructure

While this chapter will go into some detail about the above requirements, there will be no attempt made to outline a beef industry development strategy at this stage. However, since the points listed for examination are also relevant to other sectors economies, some suggestions will be made as the the approaches these

sectors might take, or at least, ideas which should be considered during their planning. Such suggestions point the way towards 'sector and regional integration' as mentioned in chapters III and IV.

WATER REQUIREMENTS

How much water is required per head of livestock on a daily basis?

How is this water obtained in order to annually sustain the daily requirements of the entire Sahel livestock population?

Though the answers to the daily needs are important, filling the water needs of the total animal population on a permanent basis calls for a major water resource policy. Such a policy is outside the scope of this paper since the hydraulic resources must be able to provide for all sectors of the economies. Nevertheless, a few suggestions will be made which might be considered by the water resource planners when they endeavor to supply the requirement of the beef cattle industry.

During the times of drought, such as the past few years, it might be said that the cattle die from hunger as much as from thirst since they are unable to digest the food without adequate water. In many areas of the World there is often enough moisture

in the grasses of the pastureland, but during the dry season in the Sahel, the grasses dry, leading to the abandonment of any pastureland which does not have an abundant water supply. Hence, grazing areas which do have an adequate water supply become rapidly trodden down and over-grazed.

The practice of abandoning grazing areas without water and moving to pasturelands with water, is the normal pattern of the nomads in the Sahel.¹ Indeed, it is the system of transhumance which has permitted the development of a beef industry as it presently exists in the region. With the southerly migration in search of water and the northerly expansion of the agriculture,² two questions arise which are even more germane to this paper than the two questions posed at the start of the section.

Should the beef industry be retained as a viable sector of the economies of the Sahel countries, despite the ever decreasing pasture areas?

In the light of chapter V, where the importance of beef to the Sahel was shown, the answer must be, yes.

However, this answer, perforce, begs the question:

How can the beef industry be retained as an important part of the Sahel economies?

The answer to this second question can be simply stated; it can be accomplished by a policy of sound range management.

Unfortunately, the phrase can mean a hundred different things to a hundred different people. However, in this paper it is suggested that once a pattern of water supply has been developed whereby there is equilibrium between the water resources and the nutrient value of the pastures, this balance must be maintained by continuous management of both resources.

The water needs of livestock can now be set forth along with a few suggestions as to how the 'balance' can be arrived at and maintained:

Table #6-1: AVERAGE WATER CONSUMPTION DURING THE DRY SEASON

<u>Animal Species</u>	<u>Daily intake in litres</u>	<u>Frequency of drinking</u>
Sheep	4-5	Once every two days
Goats	4-5	Once a day
Asses and donkeys	10-15	Once a day
Horses	20-30	Once or twice a day
Bovines	30-40	Once a day or once every two days
Camels	60-80	Once in four or five days

Source: "Water for Livestock in semi-arid zones" by J-P Baudelaire in World Animal Review, No. 3, 1972, published by the FAO.

Thus far in this chapter, four questions have arisen, but answers have only been provided to three of them. The unanswered question is,

How is this water to be obtained to annually sustain the daily requirements of the entire Sahel livestock population?

Earlier, it was mentioned that this paper would not be concerned with the development of a water resource policy. However, before a concrete programme for the recovery and future development of a beef industry can be produced, certain things must be undertaken by the water resource planners.

The first task is clearly the compilation of an inventory of all surface and ground water available³. At the same time, in conjunction with agriculturalists, a map must be produced showing the land capabilities for each area, ie., its value to cash crop or rangeland. From these two tasks, a third factor can be developed, namely the siting of water points to fulfill one or more of the following needs:

- for livestock along the transhumance routes
- for livestock in temporary grazing areas
- for livestock in permanent pasturelands
- for agriculture through irrigation
- to meet the requirements of the sedentary population
- to satisfy the needs of industry, both present and future

It is now possible to spell out in more detail exactly what is required by way of water point development as relevant to

the beef industry.

While the normal needs of livestock were presented (see Table #6-1), common sense will dictate that more water will be required when cattle must exert themselves crossing rough terrain instead of flat pasturelands. Further, the daily requirements will vary according to the moisture content of the cattle feed additions over and above the normal dried-up forage.

Previously, in chapter III, it was shown that the semi-arid Sahel area had a very limited rainfall of between 100mm and 600mm annually (see Map #2). Under these conditions surface water is both scarce and irregular and hence, only the sturdy drought resistant animals of the Sahel can endure the hardships imposed by this condition. Even with the right adaptation of cattle, which is clearly the case with the special Sahel breed of Zebu cattle, water must be managed to provide sufficient supply according to the season and local conditions. Thus, water must be controlled at least from a quantity standpoint.

However, under a sound water management programme, the control really commences before the water resource is brought into use. Prior to establishing a water point, a chemical analysis must be made to ensure that the total salinity is within the tolerable limits⁴ and that it contains no toxic salts such as nitrates,

fluorides and molybdenum. The bacteriological quality of the water must also be tested.

For the beef cattle industry two main types of water points must be considered; the permanent and the temporary site. Both must be controlled and tested, hence no attempt has been made at differentiation thus far in this section. However, from this juncture on, they must be considered separately because they serve different livestock needs in addition to having vastly differing cost factors.

Temporary water points are not, for the most part, high cost. These are often normal excavations or natural depressions which collect and store surface run-off during the rainy season, but they evaporate during the dry season or long droughts. Thus, they can be made deeper at minimal cost in order to reduce the evaporation rate (digging deeper reduces the surface area exposed to evaporation). These temporary water points serve two vital functions; firstly, their location permits the cattle to graze larger areas during the dry season; secondly, they are interspersed between the permanent watering points at short distances from each other, particularly along the main stock routes.

Permanent water points however, are the key ingredient for a stable, healthy beef cattle industry. These must be capable

of distributing water at all times and in almost unlimited quantities. Whereas during, at least the latter part of the dry season, the temporary water sites will be dried up, the permanent locations must be reliable and function even during periods of drought. It is the location and spacing of these permanent water points which must be very carefully planned by the water resource development specialist, because, the entire success of a viable beef cattle industry is dependent upon their siting and reliability.

Concerning the location and spacing, it should be mentioned that though the number and distance between them will depend to a large degree on the resources of the region in relation to the extent of the pasture, if at all possible they should not involve more than several hours cattle trekking distance (10-15 km for beef cattle)⁵. This means up to 30 km distance between permanent points.

It was suggested that these permanent sites were really the key to the beef industry. This is also where the high investment costs occur because the sites must be able to serve the needs of a large number of stock. Such locations not only require labour for initial construction, but they also need a permanent building and water storage system, in addition to a reliable source of power to pump water up from the well. The cost of pump power

can vary considerably according to whether one uses manual labour, animal traction, wind power, thermal power or diesel power. However, whatever power is used, there must also be a Warden Service to be responsible for repairs, operation and maintenance.

Having spoken at some length about water points as they concern the beef industry, it should be mentioned that there are other water needs which are important to the beef cattle development strategy. Here it is important to remember that beef cattle is not a sector on its own, but that it is really part of the agricultural sector.

In the tabulation of water requirements was listed 'for agriculture by irrigation'. While this is most vital for export cash crop production such as cotton lint, cotton seed and ground-nuts, or alternately, for the domestically needed millet or sorghum, it may also be considered crucial for the irrigation of fodder crops, which are a necessary item for standard quality beef cattle feeding.

This development of irrigation for agriculture also permits the creation of large scale industries derived from agriculture and livestock. But such industries in turn require a large, constant water supply for both power and transportation. Thus, large rivers can become important agro-industry sites.

In this section, though it has been primarily concerned with the water requirements of the beef cattle industry, it has

deemed necessary to suggest the primary approach needed for development of a total water resource programme. This has been done because, while water is important to livestock, it is also vital to every other sector of the Sahel economies. Without the proper coordinated development of hydraulic resources, the Sahel would remain in a permanent state of emergency: No water, means not only the death of people and their animals, but in addition, no agricultural production, no industrial development, no exports and no money to pay for the much needed imports.

While this section discussed briefly the location, spacing and even alluded to the cost of water points, mention must be made of the problem of "water point sanitation". Many livestock diseases are spread by the cattle themselves through their pollution of what water resources there are at the moment. Thus, the next section will examine the requirements of 'disease control' as they are relevant to beef development.

DISEASE CONTROL

In chapter V, it was shown that livestock production in the developing economies, especially in beef cattle, had a high potential for earning foreign exchange. Unfortunately, the exploitation of this potential has been seriously impeded in the Sahel countries by their inability to enter the very profitable

overseas markets due to health restrictions imposed by the importing countries.^{6.}

The FAO, in Rome, has long advocated that members of both the FAO and the Office International des Epizooties (OIE) concentrate on the development of "disease-free zones". Only with such zones will any of the developing nations be able to surmount the health barriers imposed by the potential markets.

In order to establish disease-free zones, as have been set up in Kenya and Tanzania,^{7.} the countries of the Sahel require a substantial veterinary organisation. Such an organisation must develop a high degree of control over all animal diseases in the Sahel, a very difficult task when dealing with the nomadic herds. This control and this organisation becomes, of course, another high cost investment since, not only must enough people be trained so that there are adequate staff; but they must also have sufficient laboratory facilities to carry out their important work of testing, research and immunisation of all animals. In addition, they must be staffed sufficiently to be able to maintain a survey of the wild animal disease situation.

What measures can be taken to develop and maintain disease-free zones?

The above question will be answered briefly at this point.

However, in chapter VIII, more detail will be provided on the establishment of such zones, since they form an important element in the strategy for beef given in this paper.

Primarily, with a disease-free zone, the concern is with a vast area⁸ so that enough livestock can be produced to provide a continuous supply for the export markets and to help ensure the economic viability of any abattoir operation. Such an area should be screened off by either a fence or natural barriers to prevent the free movement, in or out, of livestock from the non-controlled area.

Secondly, there must be a comprehensive system of vaccination of stock to immunize against the various major diseases such as foot-and-mouth disease, rinderpest and contagious bovine pleuropneumonia.

Thirdly, if the nomadic herdsmen are to be expected to conform with disease control regulations, there must be some incentive provided for them. Such incentive can take the form of a share in the financial rewards of involvement in the profitable export markets.

Fourthly, besides the control of all animal movement, both wild and domestic, in the disease-free zones, there must be a satisfactory control of people movement as well. This control of people movement can have serious implications for the nomadic

way of life, a point which will be considered later in chapter VIII. However, this people movement control really also goes on to the question of education which this chapter will consider in a later section.

All the points mentioned above, concerning the development of one or more disease-free zones, hinge on the competence of the veterinary system, since without their organisation and knowledge no disease control would be possible. Hence, the livestock mortality rate would increase unabated, destroying the entire beef industry.

The veterinary organisation is also fundamental for the abattoirs concerned with export production. These abattoirs would have to be constructed and staffed in a manner that would satisfy the meat hygiene requirements of the potential importing nations.

These disease-free zones can only prove successful and beneficial provided that there are adequate supplies of feed and grazing for the livestock which are under control. This point will be examined in the next section. However, disease-free areas with an adequate supply are only part of the solution. These zones, plus the abattoirs, must be well controlled and properly staffed by trained people. To this end, the nomadic herdsmen must fully understand and be in favour of what is being attempted,

thereby setting-up yet another point related to a later section of this chapter, that of "Education and Manpower".

FEED AND GRAZING

Primarily, as was shown in an earlier chapter, the live-stock industry as such, evolved over many years. With this evolution the nomadic herdsmen also developed ways of keeping their herds in balance according to the available feed supplies. To ensure this 'balance' the nomads utilized two important methods:

1. If pasture were being overgrazed
 - (a) many animals would die bringing about a 'balance'
 - (b) some animals would be loans to another herdsman, or sedentary farmer, thus part of the herd would be transferred to another grazing area.
2. In times of abundant rains, the vegetation for grazing would be plentiful causing herds to grow fat and healthier, thus multiplying more rapidly. Under the circumstances the herdsmen would be able to increase his wealth, and more stocks would arrive at the markets having survived the long trek.

With these traditional methods of the herdsmen, the cattle herds were brought into 'balance' with the available food supplies. But yet, if the nomadic herdsman were asked the following question:

How many head of livestock can the available pasture-lands support?

the herdsman certainly would not be able to provide a very scientific answer, despite his having been able to maintain a 'balance' during

normal times,⁹ and for many years. Most assuredly the nomadic method worked well for the initial development of the beef industry. However, in terms of a modern development plan in which the cattle segment plays a vital and consistent role, a more precise method of balancing animals to pasturelands must be devised.

Unfortunately, there is very little data available for the Sahel region as to how many head of cattle can be grazed on the available acreage. Thus, such information must be developed as soon as possible by the new Government research centers in the area. Nevertheless, in the interim, it is still possible to create a strategy for recovery and development of the beef industry. This step can be undertaken, since the herds have been decimated¹⁰ by the prolonged drought which has caused virtually the total destruction of the beef industry. However, during the interval in which the industry is in the recovery stage, and before it moves into the future stage of modernisation with consistency of production, much research must be undertaken.

Such research must be oriented to the questions of types of vegetation and land use. A land ~~survey~~ must be developed covering vegetation, state of land use and/or deterioration, the grazing capacity and the nutrient value of the grazing areas. This agricultural research should be combined with a substantial study

of climatology and meteorology. After which the combined study results should be made available to the water resource planners.

Though water was mentioned as the primary factor in a beef cattle industry, the second pre-requisite must clearly be a knowledge of the fauna, flora and the fodder crop varieties. Of the research suggested in this and the previous paragraphs, some work has already been undertaken in regards to certain specific areas by a number of different agencies: notably Institut d' Elevage et de Médecine vétérinaire (IEMVT) in Mali and Niger; Kew Herbarium for Sudan and Northern Nigeria; United Nations Educational, Scientific and Cultural organisation (UNESCO) for Africa in total. These plus some other agencies such the FAO, office de la Recherche Scientifique Outre-mer (ORSTOM), Institut Fondamental d' Afrique Noire (IFAN) and the Paris Museum of Natural History would be ideally suited to continue this research so that the information would be available as early as possible.

While this section seems generally to have been concerned with the number of head of cattle which can be supported by the pasturelands of the Sahel, the most important question really concerns the possibility of improving the existing stock breeds. No evidence has been found about research on cattle breeds in the Sahel. This may mean that there is an underlying assumption

that the present zebu cattle are best suited for the semi-arid Sahel climate. However, chapter VII, will discuss cattle breeds more fully.

In November 1968, at a joint meeting of the FAO and the World Health Organisation (WHO), the decision was made to direct attention to the problems of productivity and cattle breeding in hot climates. Subsequently, a study was made into the relationship between cattle breeds in Asia, Africa and Europe. These first efforts of the FAO and WHO were printed in "Codex Alimentarius", which was an attempt to establish guidelines for the suitability of cattle breeds for the various levels of management (intensive, semi-intensive, extensive and nomadic) under varying conditions of climate and terrain.

In this section concerning "feeding and grazing", while time was spent on the question of available pastures, and the point of breeding was mentioned, no considerations have been made about feed additives or diet supplements. While these feed additives such as urea, huiet, molasses and NPN factors can be most helpful for the growth and health of cattle, they may not be considered to be a fundamental requirement for a beef cattle industry. Thus, they will be considered more fully in chapter VII of this paper.

EDUCATION AND MANPOWER

How many people are required and what education must they be given if a modern beef cattle industry is to be developed?

While this question, or one similar, is possibly the most often asked question in the developing countries, there is no clear answer. However, it is generally conceded that it will be many years before the developing countries have enough trained manpower to provide entirely for their own growth.

If an attempt is made to answer this question with regard to the Sahel countries it will prove impossible. While it is known that there are many links in the beef industry production chain, it is still not possible to state how many people are required even in this one industry. Clearly the first link of the beef chain would consist of the nomadic herdsmen. But what education do they need? They must at least have some understanding of water control and pasture regulations.¹¹ The next link must be the sedentary agricultural people in the fodder crop production. They also must receive some education and training, since their knowledge and farming ability can do much to increase the yield per acre of fodder crops. These sedentary farmers must also become even more important as a link in the future, because fodder growth and storage can do much to prevent more losses from drought in years to come. Other links which may be considered part of the

beef chain are the abattoir personnel, followed by the people involved in all phases of transportation, marketing, water management and disease control. Obviously the demands of the nomadic herdsmen upon the formal education system are not too high. But when considering the abattoir people, the veterinary system must also be viewed, since it is this system which is involved in all the subsequent movements and the treatment of cattle.

How many people are needed in the veterinary system and what costs will be incurred in their training?

In the previous section, it was mentioned that the FAO and WHO were in the process of developing a listing of stock breeds in the "Codex Alimentarius", which would permit consideration of different cattle breeds possibly more suited to a certain region. Since no data is available concerning the personnel requirements of the various economic sectors, the FAO is developing a tabulation similar to the "Codex Alimentarius" but this time concerning people, the "Manpower Profile"¹². This is to be a listing by service, and by sectors of the economies, which will show the numbers and training of personnel actually employed. Such a table will be based upon the experiences of many different countries in the World. On completion it could prove to be a most useful tool for planners and developers, when they begin to consider the complex situation concerning manpower numbers and the training levels needed.

So far in this section the interest has been resting upon the sectoral manpower and educational requirements. But the present shortage of trained people should not be taken as an implication that nothing has been done in the past. All six countries of the Sahel had a system whereby there was a full slate of education institutes. Unfortunately, the educational development mainly provided trained people for salaried employment in the modern sector, the preference being for the Public sector.¹³ It is, of course, true that the modern sector represented only a minute proportion of the national activities and thus there was a fairly high unemployment for school-leavers (meaning drop-outs and graduates). This employment aspect may also be attributed to the fact that the school system seemed to be expanding more rapidly than the economy (see Table #6-2) and the rate at which new jobs were being created.

It would seem that the basic educational establishments were being treated as an end in themselves, not actually tied to the needs of economic growth. However, over the past ten years, UNESCO has provided assistance to the Sahel zone through the UNDP, and the International Bank for Reconstruction and Development (IBRD) and the United Nations International Childrens Education Fund (UNICEF) projects,¹⁴ with the following main objectives in view:

1. To help States in the modernisation of formal education systems; new types of teachers to meet local needs (Niger); redefinition of education needs (Senegal); establishment of rural education centres (Upper Volta).

Table #6-2: NUMBERS ENROLLED IN, AND GROWTH RATE OF, THE EDUCATIONAL INSTITUTIONS

Country	Primary		Schools		Average annual growth rate (%)	Secondary & Technical		Average Annual Growth Rate (%)	Growth Rate of Per Cap. GDP
	1960	1970	1960	1970		1960	1970		
Mali	64,801	203,703			12.14	4,636	8,444	6.18	3.0%
Niger	26,609	88,594			12.78	1,420	5,274	14.02	0.3%
Mauritania	11,279	31,500			10.82	554	3,186(68)	24.44	4.6%
Senegal	128,755	264,000			7.44	12,422	55,212(69)	18.03	-1.4%
Upper Volta	56,598	105,706			6.45	2,955	10,724	13.76	-1.4%
Chad	74,167	157,794			7.84	1,901	9,911(69)	20.14	-1.8%

Source: Developed from data available in tables presented in Education published by the United Nations, New York, ST/SSO/14, 9/January/1974.

2. To help States to develop non-formal education systems; functional literacy (Mali); educational radio (Senegal).

The new systems of education must be organised so as to enable them to break free of the constraints gradually imposed by the traditional institutional methods.

What has been mentioned so far, would indicate that the FAO "Manpower Profile" could help considerably in the determination of the Sahel manpower requirements, both generally and in the beef cattle industry. In addition, it has been shown that, for a few years the educational system has been in the process of undergoing a change to ensure the functionality of education. Thus, the needs of manpower will be more closely satisfied in the future, particularly the developing beef cattle industry's needs.

MARKETING AND INFRASTRUCTURE

This section should commence by an examination of the various products of the Sahel and their respective regional markets. But since the Sahel countries produce basically the same items, there is little trade generated among themselves, particularly in beef. Most of the agricultural and livestock production is consumed locally and in the larger urban centres which are therefore fairly close to the areas of production and hence require little in the way of a transportation infrastructure. Of the six Sahel countries,

only Mauritania imports any quantity of food supplies, and this she can well afford to do because of the foreign exchange earnings from the ore mines.

There are growing markets in the coastal countries for cattle from the Sahel, Ivory Coast being the biggest importer of Sahel cattle.¹⁵ Once again this type of localised market had little need for a transportation infrastructure since the cattle are exported 'on-the-hoof'.¹⁶ Under these existing traditional methods of scattered cattle production there would seem to be no need for any increase in the already scant transportation sector. Unfortunately, with the system of exporting 'on-the-hoof' there is a considerable weight loss by cattle and an accompanying deterioration of their health. This whole facet could be improved, given that these same cattle were exported by road or rail transport. In fact, it is very probable that the additional cost of transport could be more than paid for by the increased sale price derived from a higher quality export product.¹⁷ Basically this export 'on-the-hoof' means that the Sahel countries are missing the full economic benefits of several links in the development chain of a beef industry.

One of these links would be the abattoir industry, which could be more productive and important to the economies if they were permitted to process the additional exports. This abattoir

could mean a greater value of exported meat because it is processed, and also a greater weight factor due to the reduced trekking distance. Such a move would necessitate the development of transportation facilities for processed meat. However, if the export markets were limited to the adjacent countries, even for processed meat, the transportation needs would either be by water, rail or road. In this case, it would prove to be a very expensive transportation method because, though the main infrastructure could be used by other exports and imports, the additional cost of refrigerated transport vehicles and cold storage facilities would be a cost only against the processed meat operation. However, if the quality of the beef exports could be improved, then the Sahel countries could well aim at the high profit markets of Europe, as suggested in chapter IV. If these markets became open to Sahel meat, then the most economic transportation system could well be the 'expensive' air freight. Although air-freight costs are higher than road, rail, or even ocean shipping, time-savings on 'capital in the pipeline' may more than offset the difference in costs. Air transportation has already been proved more economical for the fruit and vegetables flying from East Africa to the European markets. Air freight is already being used for certain shipments of meat and other high value products over relatively short distances,^{18.} but with giant air transport planes having greatly increased capacities and much lower costs, the present physical barriers

to trade could be broken down. Presently Kinsha imports quite a lot of meat from Chad via air.¹⁹ It should be noted that air transport further reduces the refrigeration problems inherent to land and sea transport. The International Civil Aviation Organisation (ICAO) will be undertaking a study of this transportation mode to assess its practicability.²⁰

Of course, though air transport could prove to be the most satisfactory for the beef industry, this may not be the case for other products. Road transport presently is dominant throughout the Sahel region, but an expanded existing long-distance railway system could be more economical than the existing road services in terms of ton-km carried.²¹ Rail transport would also be beneficial to the livestock industry for the movement of meat, particularly live animals to the coastal countries of west Africa.

The other form of transportation presently being considered is that of the large river systems. However, while the potential for river navigation is limited due to seasonal and unreliable flows, the Canadian International Development Agency (CIDA) is deeply involved in developing a viable water transport system using the Niger River.

SUMMARY AND CONCLUSION

This chapter spelled out the basic requirements for a

modern beef industry covering such items as:

- water
- disease control
- feed and grazing
- education and manpower
- marketing and infrastructure

Each of the above have been explored in some detail and some proposals have been made as to what steps can be taken for research and development. Such suggestions have been made for the consideration mainly of the individual sector planners, because the beef industry must be developed as part of a totally integrated economic structure.

However, having set forth the needs of the beef cattle, the position is still not clear to propose a strategy for beef cattle recovery and development. Hence the next chapter examines some of the recent research that has been undertaken in other countries which could prove helpful to the Sahel.

FOOTNOTES

1. This point was more fully explained in chapter IV, "The Traditional Nomadic Movement".
2. Again chapter IV carried a more complete description, "Agricultural Expansion".
3. The inventory of surface water available has been systematically conducted in all the countries of the region: meteorological surveys were done by ASECNA and other hydrological studies by ORSTOM. With respect to ground water, after the creation of the Hydraulic Service for West Africa in 1956, when a programme of ground water reconnaissance and an inventory was started. This work is still continuing today under a French Bilateral Assistance Programme. In addition, several specific organisations have been created for the development of large river basins:
 - (i) Organisation pour la mise en valeur du fleuve Senegal
 - (ii) The Niger Committee
 - (iii) Commission mixte Tchad-Cameroun
 These organisations have been in existence since the mid-sixties. Although their activities have been rather limited and largely of a study and advisory nature, they have been useful for the collection and exchange of information among the member States.
4. Five grams dry residue per litre.
5. J-P Baudelaire, "Water for Livestock in Semi-Arid Zones" in World Animal Review, No. 3 1972, published by the FAO.
6. These health restrictions were more fully explained in chapter V, under the heading, "Health Barriers".
7. The examples of disease-free zones in Kenya and Tanzania will be covered in more detail in chapter VII.
8. In the case of the Kenyan experience these areas can cover up to 40,000 km².
9. 'During normal times' has been used to separate the cyclical climate with the periodic droughts from the abnormally prolonged drought which recently occurred, and which has not occurred for sixty years (see chapter IV).

10. Cattle loss estimates vary from "...a high of 55% reported by AID to a low of 22% estimated by the French Foreign Office". A statement by J. Caldwell, an Australian Professor of Demography with a vast knowledge of the Sahel region. His personal estimate placed the loss of cattle at 18%. (Seminar held at Carleton University on 5/March/1975).
11. This is in particular reference to the sanitation rules which must be forthcoming on water-point control and information concerning the grassburning. This latter subject will be detailed more fully in chapter VII.
12. The reference to the Manpower Profile was taken from the East Africa Livestock Survey, published by the FAO, Rome, 1967. The profile does not appear to have been completed thus far.
13. Education, published by the United Nations, ST/SSO/14/R.1., p.4 January, 1974.
14. Ibid., p.5.
15. 135,000 head of cattle in 1972 according to the FAO Trade Yearbook, Vol. 26, 1972.
16. "On-the-hoof" is generally considered purely for the sale of live cattle. However, in the case of the Sahel countries, besides being live cattle, they actually trek to the importing countries and thus are exported literally 'on-the-hoof'. Chapter V, made mention of this type of export as being hard to control.
17. More on air-freight later in this section.
18. "Indicative World Plan for Agricultural Development to 1975 and 1985", FAO, IWP/68/RS.3, Vol. 1, Rome, 1968. p.116.
19. Ibid., p.113.
20. Transport, published by the United Nations, ST/SSO/13/R.1 5/April/1974, p.16.
21. Ibid., p.22.

CHAPTER SEVEN

SOME RESEARCH UNDERTAKEN WHICH COULD HAVE VALUABLE APPLICATION IN THE SAHEL

Introduction

Pasture improvements on traditional grazing

- a. Soils
- b. Grass burning
- c. Pasture for extensive grazing
 - (i) Townsville Lucerne
 - (ii) Stocking rates of pasture

Introduction of modernisation technology

- a. Fertilisers
- b. Cattle feed
 - (i) Fodder crops - maize, sorghum, millet
 - (ii) Feed supplements - groundnut, cottonseed, molasses, urea

Cattle disease

- a. Trypanosomiasis
- b. Contagious bovine pleuropneumonia
- c. Rinderpest
- d. Foot-and-mouth

Cattle Breeds

- a. N'Dama
- b. West African Shorthorns
- c. Maure
- d. Azaouak
- e. Sokoto
- f. Fulani
- g. Kuris

Summary

CHAPTER SEVEN

SOME RESEARCH UNDERTAKEN WHICH COULD HAVE VALUABLE APPLICATION IN THE SAHEL

INTRODUCTION

Though the aim of this paper is to produce a strategy for the development of a viable beef industry in the Sahel, any research which may help in this regard must be considered. Accordingly, much written material has been examined in the areas of soils, pastures, fertilizers, cattle feed and feed supplements, cattle diseases and cattle breeds. This research has been carried out in places as far apart as Australia and Argentina, not to mention the many points in between. From the volumes of documentation available it would seem that almost every developed country in the World has at least one livestock research facility, plus a regular publication for the dissemination of information. The above is not intended to imply that the developing nations do not have similar facilities, in fact, many of them do. This aspect is especially true of East Africa, Botswana and South Africa, all of whom have carried out some research which could be most helpful to the Sahel countries. It should, however, be noted that though there is a lot of published material, the largest percentage is designed primarily to solve the problems, or improve the situation, in

economies that are enjoying seemingly successful livestock industries. Nevertheless, some of this advanced experimental research could still prove useful in the Sahel. In fact, in chapter VIII, some research results will actually be incorporated as part of the suggested beef industry development strategy.

In this chapter, an attempt has been made to sift the bulk of the research documentation so that the results of relevant experimentation may be considered. It should also be noted that a large amount of the data which could aid the Sahel has been developed in Australia. While there is a vast amount of research being undertaken in Canada, the United States of America and many other of the more advanced nations, the work produced at the Kimberley Research Station (KRS) in Western Australia is perhaps the most helpful. This is mainly due to the fact that the climate and vegetation of the KRS at Kununurra bears many similarities to those of the Sahel. A brief description of the Kimberley region will substantiate the statement pertaining to similarity¹:

"The Kimberley region of north-western Australia (see Map #5) comprises approximately 80,000 square miles of country lying between latitude 14° S and 20° S.... The terrain is broken hilly country, covered with either Spinifex spp. or Sorghum australiense, surrounding large plains of heavy clay soils on alluvia or basic rock. Trees are scattered and consist mainly of Acacia, Bauhinia, and species of Eucalyptus... 2.

Rainfall is low, averaging 686mm per annum at Kununurra for the period 1950-1960 (see Map #5 for monthly distribution):

Map #5:

AUSTRALIAN RESEARCH STATIONS Average Annual Rainfall: 1950-1960Kununurra

Source: Australian Journal of Experimental Agriculture and Animal Husbandry, Vol. #7, 1967. p.533.

...Effective rainfall is low due to the high evaporation rates and the rapid run-off of rain water, particularly where penetration is poor, as in the overgrazed areas."

Temperatures are not as high as the Sahel though, since Kununurra's temperatures only exceed 100°F for two months of the year.

Though a brief statement of KRS, Kununurra was not necessarily germane at this point, it has been included because so much of the experimentation from the Australian research facility will be quoted in this chapter as being very useful in the Sahel. No attempt is made to provide descriptions of any other regions since the added information would not be relevant to the research results listed in the following pages.

The data presented in this chapter will be categorised under several main headings which, in turn, reflect some of the major elements of any beef cattle industry:

- (i) Pasture Improvements on Traditional Grazing
 - Soils - including grass burning
 - Pastures for extensive grazing - including Townsville Lucerne and stock rates
- (ii) Introduction of Modernisation Technology
 - Fertilisers
 - Cattle feeds - Fodder crops and feed supplements
- (iii) Cattle Diseases
- (iv) Cattle Breeds

PASTURE IMPROVEMENTS ON TRADITIONAL GRAZING

In the arid region of the Sahel the problem which the

nomadic herdsmen really face, and thus, the Governments of the Sahel nations, is how to prevent land degradation which in essence becomes a matter of the adjustment of stock numbers to the natural feeding resources. Clearly, from what has been mentioned in chapter VI, increasing the grazing pressures beyond the limits set by the dry season reduces forage and fodder resources and leads to depletion. It is unfortunate that little is known about the possibilities of periodic re-sowing, but the low carrying capacity places an obvious limitation upon the capital investment for pasture improvement. Thus, returns on investment must, perforce, be low in the short run and hence, any investments of a re-pasturing nature would have to be Government funds, or external aid. Nevertheless, despite the low return on investments, pasture production and improvement must be the main support of any beef cattle industry. Already major developments have taken place in pasture improvement in the humid zones³ (over 1524 mm rainfall annually), namely South-East Asia, Central America and the West Indies, but the arid zone research has been largely neglected.

When animals go hungry for long periods, as during drought, they lose weight and maturity is delayed for years, resulting in slaughtering of cattle at anything up to 7 years of age. Under these poor nutritional conditions there is often a break in the breeding cycle so that the calving percentages are unduly low and calving intervals too long, making it difficult to maintain herd numbers

and at the same time provide cattle for slaughter.⁴ While breeding and control of disease are important, under such conditions, first attention must be given to the problem of adequate nutrition throughout the life of the cattle. To this end, it is important to examine the whole problem of fodder resources, since the pastures will only provide the basic needs of the cattle during the dry season. Therefore, supplementary feed will be required at other times of the year (see the strategy of chapter VIII). Though the question of supplementary feed production is really outside the scope of this paper, and the strategy will make a case for supplementary feed, the actual development of such a resource truly becomes part of the agricultural development strategy as it relates to the sedentary farmer.

It is the Agricultural Development Strategy which will have to provide information on the management of the pastureland and its fertiliser treatment, the techniques of plant introduction, and the source of supply of seeds (legumes and grasses) for incorporation into the existing swards with, or without pre-cultivation. The strategy for the sedentary farmer will also have to provide information on fodder conservation and the harvesting and storage of conserved feeds, plus how far irrigation is possible having regard to capital costs as well as the water resources.

d. Soils: What then of the soils which are the basis of any improved pastures?

In general, it can be said that the main fact is that

the pasturelands of the Sahel are nitrogen-deficient which results in low-protein herbage.⁵ This is particularly noticeable in areas where it has been the practice to fire the grass every dry season.⁶ J.H. Topps,⁷ states:

"...proved beyond a doubt that nitrogen (N) is the chief deficiency in the herbage for many months of the year. low N content coupled with the fibrous and coarse indigestible nature of the grazing causes a retardation of the fermentation and digestive processes in the gut with a consequent lowering of the proportion of food digested. Intake is also reduced ..."leading to weight loss"...which if prolonged may be associated with a high incidence of infertility in the breeding females".

Nitrogen is an element which must be present if high yield dry-matter and protein yields are to be obtained from pastures on the existing Sahel soils.

- b. Grass Burning:⁸ Pastoral tribes of the Sahel have long used burning as a means of securing successional grazing for their herds; cattle will eat, and flourish, on the young leaves of most grasses, even those species whose mature leaves are unpalatable and useless for food. As the grasses grow older the leaves become unpalatable, thus the burning clears the way for new young shoots.

Burning is perhaps one of the most common tools in the management of uncultivated nomadic pastures, but its value for the successful recovery and continued development of a beef cattle industry is definitely subject to question. The effects of 'burning' includes the fact that those parts of vegetation

which are above ground are not returned to the soil to form valuable humus, but merely provides ash. Though this ash settles and will be washed into the soil, some of the nutrients, particularly sulphur⁹, are lost in the burning.

However, the most important effect of burning is the loss of the fresh organic matter which would decompose to provide humus. It is this loss which contributes to the generally very low organic content of the Sahel soils,¹⁰ implying that 'burning' is bad.

M.J.T. Norman, prior to describing his own experimentation,¹¹ reviewed the research findings of O. West who suggested,¹²

"...the withholding of fire generally results in the suppression of new growth by accumulated dead material and in an eventual fall in pasture production. The frequency of burning required to maintain a productive native pasture is broadly dependent on rainfall; more frequent burns are needed in the higher rainfall regions where pasture production is higher".

Norman's own experimentation covered the period from 1958 to 1968, with varying periods of 'burn' frequency. His results indicate a regular 'burning' treatment is valid every five years if there was little or no grazing; but every second year at the beginning of the wet season, when pastureland has little protection from grazing. This two-year cycle was proved to produce both the highest dry matter yield (lbs/acre) but the highest percentage of nitrogen. There was one other interesting result of Norman's research which could prove useful to the strategy

of chapter VIII. There was no change in the relative proportion of the three major pasture species; perennial grass remained dominant with the bi-ennial¹³. burn. But, this was not a result based on his experiments concerning an annual burn and the burn every five years. In these cases there was a tremendous increase in the annual pasture species in relation to the perennial species.¹⁴

Of the soil resource in general it should be mentioned that a knowledge of the soils is a basic requirement for the planning of agricultural development and irrigation projects. To this end, the FAO and IFAN have combined their efforts to develop a comprehensive soil map of West Africa,¹⁵ which includes all the Sahel countries. The map,¹⁶ when available, will become a useful instrument of education, research and soil resource evaluation.

Logically, the use of fertilisers could be considered under the sub-heading of "soils" but this would draw this section into a full discussion of soil chemistry and the accompanying chemical benefits of fertilisers. Thus, to avoid such soil chemistry data which, though interesting, is not immediately helpful to the beef cattle development strategy, fertilisers will be considered only as they relate to increasing yields of fodder crops in a later section of this chapter under the heading of, "Introduction of Modernisation of Technology".

- c. Pastures for Extensive Grazing: Thus far, little work has been carried out on the actual pasture analysis of the Sahel region. Controlled breeding, weaning or supplementation are not practiced and therefore cattle conditions may be deemed to be similar to those which existed for the early settlers in Australia's Northern Territory.¹⁷ During the wet season there was a flush of nutrition forage, followed by a long dry season when growth ceased and the pastures decreased in quality as the season progressed. In the Sahel, the dependence of cattle on the pastures is complete, and thus changes in pasture quality, i.e. protein content, are quickly reflected in changes in cattle body weights. During the wet season, there are weight gains due to the improved grazing on the lush pastures; in the early months of the dry season, the cattle exhibit a zero weight change with the main weight losses occurring during the latter months of the dry season, when pastures are at very low levels of crude protein and phosphorus.¹⁸

While Robinson and Sageman analysed the nutritive value of some pasture species during the late dry season and confirmed the gradual loss of phosphorus, protein and calcium, they failed to explain why this change took place. However, during the course of their observations they did note something else of importance,¹⁹

"...that perennial pasture species, by virtue of their higher nutritive value during the late dry season, are superior to annual species (for cattle grazing)..."

This higher nutritive value of perennial pastures is important because it ties in with the 'bi-annual burn' and the 'five year burn' (these being the burn frequencies with which the perennial grasses remained dominant over the annual grasses), and thus, both factors have important strategy implications. It should also be noted that with the perennial grasses the 'voluntary intake of dry matter' was higher, and the 'dry matter digestibility' percentage was also higher than the annual species.^{20.}

- (1) Townsville Lucerne (*stylosanthes humilis* HBK):^{21.} Having regard to the sharp contrast in the Sahel between the wet and dry season, herbage which retains its nutrient value into the dry period is of particular value. To this end, the merits of legumes^{22.} such as Townsville Lucerne must be considered. To provide good grazing outside the period of active growth (the wet season) is very difficult under the conditions of the Sahel climate, so it could be possible that the grazing animals will require some form of supplementary feeding. Under the normal methods of supplementary feeding, which will be considered later in this chapter under, "Cattle Feed Supplements", there are important economic questions involved and a number of technical problems which must be considered. However, in the Sahel, standing Townsville Lucerne may be feasible as a

dry season protein supplement when sown into the traditional native pastures in a 'complementary grazing system.'

In 1964, M.J.T. Norman and G.A. Stewart,^{23.} set up an experiment to measure the liveweight gains of steer on varying combinations of native pastures and Townsville Lucerne. The experiment was conducted for a period of three years, with the following results during the dry season testing:^{24.}

"...good gains (by steer) on Townsville Lucerne alone, lesser gains on Townsville for four days each week (plus three days on native pastures), slight losses on Townsville for two days (plus five days on native pastures), and heavy losses on native pastures alone."

In a later experiment published in 1972,^{25.} the yearly weight gain of steer on Townsville Lucerne was:

"...over five times that obtained on the native pastures and at about ten times the stocking rate."

Clearly, Townsville Lucerne has considerable potential as a dry season feed supplement, but it must be sown in a manner such that it will be available for the dry season grazing period. While this pasture legume is self-seeding, the aspect of the initial sowing poses an important question in that, under normal circumstances, cultivation of legumes, like any agricultural crop, could be very expensive, particularly

when the area to be sown is a vast region for extensive grazing. Fortunately, some experimentation has been undertaken to answer the questions of "When?" and "How?" to sow Townsville Lucerne. H.P. Miller,^{26.} carried out experiments to evaluate three sowing tests on native pastures that had not been cultivated and neither had the trees been cleared. It is obvious that any lengthy soil preparation in the grazing region of the Sahel would be very time consuming and costly; therefore, Miller's results could have important benefits for the Sahel.

Miller tested three seeding rates under three different pasture conditions:

- (a) Heavy grazing in the previous wet season
- (b) Late dry season 'burning'
- (c) Early wet season 'burning'

He showed that good stands of Townsville Lucerne could be established in uncleared perennial pastures without cultivation,^{27.} and that it is possible to cover a large area in a short time by aircraft seeding.^{28.}

Miller further showed that, under favourable weather conditions, Townsville Lucerne would

"...germinate rapidly and seedlings were observed at the open cotyledon stage 24 hours after sowing."

It is the aspect of 'favourable weather conditions' which would seem important for the results Miller obtained, since

rainfall is most crucial within 24 hours of the sowing. Thus, his results call for accurate forecasting of the cyclonic spells which would provide the much needed rain.^{29.}

For possible later reference concerning fodder crop production, one other result of Miller's experimentation is useful to note: The dry-matter yield was an average of 5,870 lbs. per acre on unprepared land, but similar research on Townsville Lucerne in 1956-1957 yielded only 5,950 lbs. per acre on cleared cultivated pastures.^{30.}

- (11) Stocking Rates (carrying capacity) of Pastures: Stocking rates may be considered as a third method of pasture improvement, though it is unfortunately the one to which a precise answer cannot be given for the Sahel. Phillips,^{31.} discussed the carrying capacity of the natural pasturage in different tropical regions and suggested various cattle stocking rates. These rates ranged from a high of 1 acre per mature animal in forest regions, to a low of 40-100 acres or more per beast in sub-desert areas. While the later figure of 40-100 acres per animal (16-40 hectares per animal) is not necessarily helpful, it may be considered as a starting point as far as beef strategy development is concerned, for the Sahel.

Carrying capacities have been the source of considerable research in most countries of the World, but the results of

this type of research cannot be directly applied to the Sahel. This may be confirmed by the following,^{32.}

"The carrying capacity of spear-grass pasture at the main spear-grass experiment centre (Australia) has been raised from 1 beast to 9 acres to 1 beast to 2 acres, and a liveweight increase raised from a mean of 22 lbs to 217 lbs per acre per annum through the use of the legume Townsville lucerne and the appropriate nutrients."

While the above information would seem an added plus for the use of Townsville Lucerne, this does not guarantee the same results would be obtained in the Sahel. Dry matter yields per acre may vary according to the climatic data of the areas involved. Also, with regard to cattle, different strains of cattle have different feed requirements and corresponding 'feed to weight-gain' conversion factors. In fact, the 'feed to weight-gain' factor varies considerably on a given type of pasture, since the protein yield varies between the wet and the dry season feeding.^{33.}

Really, the stocking rate becomes very much a question of the economic justification for a given expenditure of money on costly pasture improvements. The following extract is an example of the 'economic justification' question;^{34.}

"In semi-arid pastoral areas, 25 acres of land may be required to carry a cattle beast which may take 6 years to reach market condition and eventually sell for 25 pounds. By introducing a bush-control measure requiring an expenditure of 30 shillings per acre and which requires repeating every 6 years, a better quality animal fetching 35 pounds may be marketed after only 3.5 years from 15 acres of improved land. Thus,

the gross return would have been increased from 3.3 shillings to 13.3 shillings per acre per annum at a cost of only 5 shillings per acre per annum."

There are, however, many other avenues for expenditure which can have a direct bearing on the carrying capacity of a given pasture. These may include such items as a pipe system for water, the application of fertilisers³⁵ to increase the carrying capacity per acre by increasing the liveweight production, the transplanting and planting of grass or legumes, fencing and irrigation.

In summation of the stocking rate question, it can best be assessed by separate calculations for each area of the Sahel which may be under consideration for beef cattle production. This is clearly so, since the economic circumstances will vary greatly from one country to another, and it is these circumstances which will affect the cost of inputs and the subsequent value of outputs. Thus, the accruing returns on investment will depend on the system of management practiced, the type of cattle utilising the unimproved pastures, the prevailing prices for the final product as well as on the biological efficiency of the production system.

Having examined briefly some of the important facts, or experiments, concerned with "Pasture Improvement" which can have useful implications for the beef strategy of chapter VIII, the next section

explores, in some detail, the possible value of fertilisers, feed supplements and fodder crop production.

While the above list may, at first glance, appear to be all part of the "Pasture Improvement on Traditional Grazing", this is not truly the case. This section was concerned solely with factors and experiments which were directly related to the traditional extensive grazing systems. However, the next section, "Introduction of Modernisation Technology" deals with those experiments which can be important to beef cattle development through not using the more traditional extensive grazing system. Instead, the facts which will be examined relate more closely to a modern system of feed-lot operations which are intended to produce beef cattle of a higher quality, a consistency of the higher quality, and the all important continuity of supply.

INTRODUCTION OF MODERNISATION TECHNOLOGY

Because of the periodic fluctuations in the nutrient quality and quantity on traditional extensive grazing, rates of growth are adversely affected, reproduction efficiency is diminished, and because of nutrient debilitation cattle succumb to other stress factors more easily. Therefore, research on rangeland grasses and their utilisation is the starting point for nutrition research in the Sahel. Today, through practically no supplementation of range cattle feed occurs among the nomadic herds, considerable work is needed on the use of

agricultural fertilisers, cultivated forage and cattle feed supplements. This section will detail the research undertaken on these areas where the results could be used in the Sahel.

- a. Fertilisers: Modern agricultural systems have placed great stock in the success of fertilisers since nitrogen (N) is the main element of growth. Almost the entire Sahel has an outstanding soil-nutrient deficiency in N,³⁶ a fact very noticeable during the severe dry season due to the practice of burning the grasses every dry season. The consequence of this burning is that all the N in the top growth of the grass is returned to the air, with only the mineral ash being returned to the soil.

Smith's experiments in 1961 and 1964,³⁷

"...found that when 40 lbs of N was applied three times during the growing season each lb of N fertiliser increased the dry-matter production by 23 lbs and the crude protein by 3 lbs.....they grazed their pastures with dairy heifers, and the response per lb of N applied was.....2.5 to 3 lbs liveweight gain in the heifers."

West's 1959 experiment³⁸ obtained liveweight gains of steers of 90 lbs per acre over a 150 day grazing season on natural pastures, and 150 lbs if 80 lbs of N fertiliser were given, but 440 lbs if this amount of N were given on improved pastures.

The main point about N fertilisers was that the protein content of the dry season growth was raised so that when growth ceased, the standing dry fodder had a higher protein content. This aspect was illustrated by the research of Vicente-Chander and Figarella³⁹ on Guinea Grass in Puerto Rico.

Their research also showed that N fertiliser applications above 100 lbs per acre did not increase the dry matter yield, and that although there was an increased protein yield, there were clearly decreasing returns to scale as the application of N was increased.^{40.}

Phosphate fertilisers (P) would seem to be almost as important as the N fertilisers just mentioned, but the phosphate responses are not so clear-cut as N. This is because P fertilisers are rendered insoluble when they enter the soils. Thus, as P fertilisers are spread over the soil surface they become concentrated in the top few inches of the soil and can only be taken up by plants when the surface soil is moist, therefore being only beneficial to wet season growth.^{41.}

Norman's experimentation^{42.} showed that while cattle responded favourably to a P supplement in the wet season (confirmation of the insolubility of P), but that P supplement in the dry season does not prevent heavy losses in weight. His later research results published in 1965,^{43.} indicated that while N is an overriding deficiency in the dry season, P is also a limiting factor.

All research reports which were examined gave positive results for the tests carried out using P fertiliser, thereby leaving little doubt that both N and P fertilisers must form an important part of the chapter VIII beef strategy. However, while some indications have been given concerning the quantities of N which

must be used, it is therefore necessary at this point, to cite some of the experimentation which could provide similar information for the use of P fertiliser. To this end, the work of Winks et al⁴⁴ should be stated along with that of Evans and Bryan.⁴⁵ The research of Blunt and Fisher⁴⁶ is also important, but it will not be quoted since they were using irrigated land in the Ord River valley of Western Australia. However, their work could have important benefits for the Sahel region when irrigation is more extensively developed.

Evans and Bryan showed that annual applications of 250kg.Ha superphosphate (9.6%P) significantly increased animal production above applications of 125kg.Ha, but that there was no significant effect of increases in the level of applied potassium (KCL) beyond 63kg.Ha. (KCL is the third key fertiliser element, but in all experiments studied it was combined with either N or P fertilisers). The greatest liveweight gains per hectare were obtained with a stocking rate of 2.47 beast/ha (1 animal per acre) also producing a corresponding result of a greater dressed carcass weight. However, the results of Evans and Bryan showed that top grades of carcass meat was obtainable from a stocking rate of as high as 1.23 beast per hectare, with the same fertiliser treatment earlier mentioned of 250kg.Ha, and 63kg.Ha KCL.

The research of Evans and Bryan has been included to provide the fertiliser rates, but it must be mentioned that the stocking rates were tested in the Queensland area of Australia, which has

a much higher rainfall than the Sahel. Thus, the work of Winks et al is now considered. Their work commenced using the optimal fertiliser application rate of 250kg.Ha the first year (1965), followed by 125kg.Ha for the remaining years (1966 through 1968). The importance of their work stems from the fact that the stocking rates were more applicable to the Sahel. The area of their testing being the dry area of Northern Queensland with a mean annual rainfall of 799mm (the mean during the four years of the experimentation was only 661mm, very much closer to that of the Sahel). The pasture tested was Townsville Lucerne (a legume of potential importance to the Sahel beef cattle as was suggested in the previous section). The normal stocking rate of the dry Northern Queensland area ranges from 0.16 to 0.06 steers per hectare, but their studies showed a substantial increase was possible through the use of fertiliser. A stocking rate of 0.41 beasts per ha was proved to be a safe stocking level for steers in all years, including the drought year of 1969, when only 325mm of rainfall was recorded.

This section has clearly shown that certain fertilisers at given application rates can, most assuredly, have a beneficial effect on both the stocking rates and the quality of the resulting beef carcasses. It may appear that since these results obviously pertain to a system of extensive grazing. However, supplementary feeding in feedlots using fodder is very responsive to fertilisers, although this

factor really becomes a pure question of the economics. The following example, from tests in Botswana,⁴⁷ will provide some indication of the basic economic calculations:

Test acre with fertiliser

<u>Costs</u>	100 lbs nitrogen fertiliser/acre	= R. 1.93
	100 lbs phosphate fertiliser/acre	= R. 1.55
		<u>3.48</u>

Revenue Yield of sorghum 7.1 bags*/acre @ R.3.5 = R.24.65

* bag = 200 lbs.

Net Return - Revenue less Costs

R. 24.65 - 3.48 = R. 21.17

Test acre without fertiliser

Revenue Yield of sorghum 4.6 bags/acre @ R. 3.5 = R. 16.10

Net Revenue increase through fertiliser use

Net Revenue with fertiliser - Net Revenue without fertiliser

21.17 - 16.10

= R 5.07 (31% increase in Net Rev.)^a

While the use of fertilisers must be an economic question, much information has been mentioned here which will be incorporated into the strategy. If the use of fertiliser becomes part of a Government Plan, then the economics of fertiliser useage must also be balanced with the development of fodder crops, as part of an Agricultural Development Policy. It may eventually transpire that the returns for the final beef product can only justify development of fodder crop production without the use of fertilisers. Hence, the next section deals with the question of fodder crops.

b. Cattle Feeds:

"The whole technology of fodder conservation will demand study in relation to the requirements of the animal. There is only limited experience in the tropics upon which to draw and it will not be wise to rely wholly on work done outside." 48.

While information will be required by the Sahel region beef cattle producers on the management of pasturelands, fertility treatments and the techniques of plant cultivation, information will also be required on fodder conservation, the grazing methods to achieve this and on the harvesting and storage of conserved feeds. To reduce, or eliminate cattle weight loss during the non-growing season it is necessary to increase the amount of feed eaten. This is where fodder crops and feed supplements can play an important role in the development strategy.

The practical difficulties of making hay or silage must be overcome, but it is unfortunately in this regard that a firm method cannot be proposed in this paper. Nonetheless, some of the research on fodder crops to be cited in this section will indicate some of the potential.

The simplistic calculation shown under "Fertilisers" gave some indication of the value of fertiliser use for fodder crop production, but it did not provide the whole story. Though fertilisers can substantially increase crop yields during the growing season (wet season); management, soil factors and rainfall actually set many limits on cattle stocking rates. The main limitation to the number of animals per unit is really determined

by the bottle-neck of drought unless fodder is consumed for dry season feed.

The FAO, in 1970, published the "Better Farming Series" wherein volume #12 set forth an easy method for the preparation and storage of silage and hay. It would seem that this FAO recommendation has also proved successful in some native villages of Mali.⁴⁹ Temanson, a Peace Corps volunteer, operated a successful self-help project with the aim of 140 pit-silos being completed by September 1974. His project was ideal for the Sahel because no expensive equipment or special technology was needed.

An important plus for the beef cattle industry is that this type of self-help silo programme is not directed at the nomads of the Sahel. Instead, it is aimed at the sedentary farmers who would be responsible for the important fodder crop production link of the beef industry.

There are undoubtedly other methods for the preparation and storage of fodder being used in other parts of the World, particularly in East Africa, which could be useful to the Sahel. However, the FAO system is cost free, a key factor when such a large proportion of development finance must come from external sources.

What of the crops that may be considered for fodder and which could be produced in the Sahel?

Such a list for consideration must seriously consider Townsville Lucerne, both for grazing and silage; maize,^{50.} which exceeds all other crops in the average yields of dry matter and of digestible nutrients per acre;^{51.} sorghum,^{52.} which makes good palatable silage if ensiled when the seeds are hard and ripe.^{53.} While Lucerne legumes, maize and sorghum appear to have been the most researched, and therefore the most widely used as dry season fodder, this is possibly because, at present, they may be considered the most readily available. However, there are several other crops which have proven successful elsewhere, particularly in East Africa, but these other crops require slightly more sophisticated preparation than do the three already mentioned. Nevertheless, they will be listed here, with the suggestion being made in chapter VIII, that their development be given serious consideration, since they would seem vital to a continuous supply of improved and consistent quality beef. These crops are millet, groundnut oil meal and cottonseed meal, and they will be considered individually after maize and sorghum.

(1) Fodder Crops:

- (a) Maize: Maize is grown in five of the Sahel countries, the exception being Chad. It has generally been regarded as a product that would mainly be consumed by the Producers, or sold in the towns. High yield maize seeds are being developed (54) which in turn should reduce the per bushel cost. The lower cost, combined with increased yields and the higher meat prices, may justify the use of maize as a complementary feed for cattle.

- (b) Sorghum: As produced in Africa, has been cultivated for centuries in the Sahel region. Like maize, the FAO suggests that further research must be undertaken (55) particularly aimed at hybridizing.
- (c) Millet: Excellent results have been obtained in millet through the use of hybrids with which gains of 50-100% have evolved (56). However, millet research must be continued because of its potential, since it is able to survive in areas of less than 500mm annual rainfall, where sorghum virtually disappears. Millet is important also because, though it resembles maize, it has an appreciably higher protein value than maize (57).

(11) Feed Supplements:

- (a) Groundnut Oil Meal and Cake provides a feed supplement which is very high in protein and it also is well liked by cattle (58). The total digestible nutrients can vary considerably according to whether oil meal, or oil cake is used, and this in turn is a reflection of the extraction process.
- (b) Cottonseed Meal or Cake like groundnut or cake, has a varied total digestible nutrient percentage according to the extraction process used. Cottonseed extract has a very satisfactory protein level and is a good feed supplement for cattle. In addition, cottonseed is one of the richest feeds in phosphorus, containing in excess of 1% of the mineral (59).

The above listed cattle feed supplements are by no means the only fodder supplements, but they are of high protein value, having good cattle acceptability and are readily available throughout the Sahel region. However, there are two other supplements which have been proven to be very beneficial to cattle on feed-lots; molasses, which is not locally produced in the Sahel (except for in Senegal) and would therefore have to be imported at a cost; urea, which can be produced throughout the Sahel region.

- (c) Molasses is a by-product in the manufacture of sugar (60) from sugar-cane, or sugar-beet. It is well liked by cattle such that a small amount may be used to induce stock to eat poor quality sillage. However, for this purpose it is often mixed with urea.
- (d) Ureas is a simple organic compound with a high nitrogen content. It is widely used in Rhodesia and Kenya for the maintenance and fattening of beef cattle in feed-lot operations. This is particularly valuable because urea can supply up to 50% of the protein requirements (61).

Molasses, urea, maize sillage and cottonseed cake have proven successful when fed to cattle as a dietary supplement, both in Kenya at the Kenya Beef Industry Development Project⁶². and the big Cuban feed-lot⁶³. in Camaquey Province.

In the Cuban feed-lot of 10,000 head, there was a daily weight gain increase of over 105%, using a molasses based diet, when compared to the more traditional forage based diet. However, in any strategy using molasses, the work of Morrison⁶⁴. must be remembered when he suggested,

"...the maximum limit of molasses in the diet should be 10%, since at the higher levels...its feeding value could be expected to decline."

In the Kenya feed-lot experiment the cattle were on a ration composition of 52.8% maize grain, 33.4% maize sillage, 11.1% of 4% urea with molasses and 2.7% cottonseed cakes. The high energy feed gave increased yields of edible carcass meat between 30% and 50% after only 10 weeks in the feed-lot.

CATTLE DISEASE

In chapter V, 'health barriers' were shown as being a major hurdle which the Sahel countries must overcome if they are to successfully develop a beef cattle industry. Though these health barriers were considered in regards to beef being exported from the Sahel to Europe, control of the diseases makes good economic sense, since they impose heavy burdens on the industry. The diseases and parasites cause death, debilitation, condemnation, disruption of market movement, and generally add to the cost of production.

Because of their overwhelming importance, disease problems have been given priority attention in the past and can be considered as a major impediment to expanding beef production. Really, disease research and the subsequent disease control is an international goal, since all continents are affected to some degree by the same catastrophic infections such as trypanosomiasis, contagious bovine pleuropneumonia, rinderpest and foot-and-mouth disease.

Perhaps the most important organization specialising in these diseases for African livestock is the Inter-African Bureau for Epizootic Disease (IBED). This organization has been undertaking a systematic quarterly collection of reports from twenty Governments⁶⁵ south of the Sahara. Though the IBED has been collecting information

on eleven epizootic diseases,⁶⁶ it has been focusing special attention on the four most serious cattle diseases which have already been listed. These diseases are highly contagious and therefore, once into a country they are very hard to eradicate and control.⁶⁷

While the cattle diseases of the Sahel cannot be completely eradicated at the present time, most can be controlled by vaccination programmes, or modern management which necessitates the control of all animal movement (a hard task due to the variety of wild life). However, though the scientific advances for disease control may move at a fast pace, the same pace cannot be matched for the application of these advances. This slower pace of disease control application may well be due to the apathy of the cattle owners, who, for the most part, lack education or sufficient comprehension of modern livestock management. Also, there is the additional problem of cost to the herd owners, or the Governments, a point which is stated by Rouse:⁶⁸

"...scientific advances cannot rapidly be matched by practical application - one of the major tasks being to counteract apathy and financial stringency."

A brief listing of the main cattle diseases of the Sahel region follows at this point, with a short description of the control methods which are presently possible. Such a listing will provide important background information for the beef strategy of chapter VIII.

a. Trypanosomiasis: Though a major disease in Africa, only in equatorial Africa does it constitute a major obstacle to beef production. This is because the equatorial climate is highly conducive to the tse-tse fly breed which is the insect vector of trypanosomiasis. In the Sahel region it is primarily a camel affecting disease,⁶⁹ though it does occur in the southern areas of the Sahel countries where the rainfall is higher.

Some cattle breeds of the Sahel are resistant to the disease (see next section, "Cattle Breeds"), particularly the humpless cattle of West, although some other zebu breeds are highly susceptible, thus contracting the disease when being exported south on-the-hoof.

While presently there is no practical method of immunization,⁷⁰ detection and treatment may be considered both a curative and a prophylactic procedure. Many organizations are involved in trying to combat this disease in many parts of the World, including the new⁷¹ International Laboratory for Research on Animal Diseases (ILRAD) at Muguga, Kenya. However, while no immunisation is presently possible, the best method of eradication really should be improved cattle management combined with the improved breeding of trypanosomiasis-tolerant cattle.

b. Contagious Bovine Pleuropneumonia: Research on this disease has been going on for many years, but the results of research

and the application really stem from Joint Project #16,⁷² which was set up by the Inter-African Bureau for Animal Health (IBAH). Research has indicated the ability to control the disease as a result of early detection and subsequent immunisation through vaccination. Nevertheless, despite these efforts Chad, Mali and Mauritania still seem to have a high incidence, with Niger and Upper Volta reflecting moderate success against the disease through their quarantine programmes.

- c. Rinderpest: This is another highly contagious cattle disease. Though it has been reasonably well controlled in West Africa⁷³ since the establishment of Joint Project #15,⁷⁴ there is still a high incidence in Mauritania,⁷⁵ thus suggesting the progress of vaccination, quarantine and slaughter have been more successful in countries other than Mauritania. It should be noted that the programme of Senegal has been so successful that there has not been a reported case of rinderpest since 1968.⁷⁶ Clearly, therefore, rinderpest is well on the way to becoming a disease of the past so long as work continues for improved methods of detection and control, and the herd owners can be taught improved management methods.
- d. Foot-and-Mouth: This disease has been the scourge of Europe for many years and even today there are still periodic outbreaks.

Thus the 'health barriers' are designed very specifically to prevent the return of this disease to the European countries. While the disease is hard to eradicate completely it can be done through the implementation of vaccination,⁷⁷ quarantine regulations and the control of all animal movement. This 'movement' is particularly important at frontiers for countries like Chad, Mali and Niger who experience a considerable illegal export trade of cattle-on-the-hoof.

According to the FAO Disease Yearbook, with the exception of Senegal,⁷⁸ all countries of the Sahel still have foot-and-mouth even though most have already tried to implement some quarantine regulations with varying degrees of success.

Mention of these four diseases has been important because the outbreak of any one of them could, if undetected, destroy the beef industry of a large part of the Sahel. Even small outbreaks could be crucial to the 'continuity of supply' (see chapter V) and therefore the strategy will have to be very much concerned with the control and eradication of these diseases discussed and others, such as anthrax and ochinoconossis-hydralidous. Clearly, all the animal disease research facilities must represent a considerable resource in the future development of a beef cattle industry. Though it is expected that the Governments of the Sahel will continue to assume a large share of the costs involved for the control.

CATTLE BREEDS

In most of the developing countries certain breeds of types of cattle have evolved as a result of natural selection. Many of these animals possess extremely desirable characteristics such as disease resistance, heat tolerance and the ability to convey coarse feeds and fodder. However, the lack of systematic selection, the retention of all males and the indiscriminate breeding has given rise to many characteristics of questionable value. In recent years a tendency to import European or American stock into Africa has resulted in a dilution of the characteristics of the indigenous animal.

Unfortunately, very little work seems to have been carried out on the breeding of cattle in the Sahel for beef purposes. This is probably due to the fact that most cattle in the region are run by the nomadic tribes.

Prior to the independence of the Sahel countries, the French Colonial Administration established several Centres des Recherches Agronomiques in what was then called French West Africa. But, these Centres were developed primarily to assist the farmers by conducting research into improved agricultural production. However, the Centre des Recherches Agronomiques at Bambey, Senegal, became involved in some cattle cross-breeding though the work was geared towards the development of a satisfactory draft animal and dairy cow, not beef.

3

OF/DE

4

Despite this fact, the Bambey Research Station can still be helpful. It is at least already established for animal research and development, being organised with all the appropriate facilities for cattle. Secondly, while past cross-breeding has not been beef-oriented, the work using Djakoré⁷⁹ cows showed the Djakoré carried a fair measure of the trypanosomiasis-tolerance of the N'Dama (a popular breed of the wetter region south of the Sahel).

Since independence some exotic breeds have been introduced to Bambey, such as Red Sindhis and Sahiwals from Pakistan, and Guzerats from Brazil,⁸⁰ though once again these exotic breeds have been to aid the dairy industry and not beef. East Africa has been able to enjoy a reasonable degree of success with the importation of European breeds such as Herefords and Brahmins, but when these same breeds were taken to West Africa they were unable to tolerate the diseases or the heat. Thus, since the zebu cattle do have an ability to survive in the Sahel, possible cross-breeding of zebus could prove more helpful than the importation of exotics.

However, before zebu cross-breeding can be considered, some mention of the main types of cattle which exist in the region should be made. In the Sahel, the cattle must be called 'types' and not breeds because,⁸¹

"Tribal migration and nomadic movements are among the

factors which militated against the division of the cattle population...into clearly defined breeds" since much of the Sahel is occupied by "...cattle which are intermediate between one breed and another."

- a. N'Dama⁸². A popular beast in Senegal, Mali, Upper Volta and Niger because it is trypanosomiasis resistant and will produce excellent quality meat on relatively poor savannah grazing. The average weight at maturity is 350kg yielding 54-55% dressed weight on good cattle.
- b. West African Shorthorns⁸³. While not a native of the Sahel region, this animal can thrive in the region despite the longer dry season and the rather higher temperatures than their normal habitat, the coastal countries. The Shorthorn yields a good quality beef carcass of 55% dressed weight from an average slaughter weight of 200-300kg.
- c. Maure⁸⁴. The Maure is well known in both Mali and Mauritania. The Maure zebu are slaughtered for meat at about 4-5 years of age with a liveweight of about 350kg, and a dressed percentage of 45-50%.
- d. Azaouak⁸⁵. It is mainly a milk producer in Niger, being regarded as a meat producer of only average quality. Hence, it can be disregarded for the beef industry.
- e. Sokoto⁸⁶. This animal is owned mainly by the Fulani in Niger

and Upper Volta, being maintained north of the tse-tse fly area. While the Sokoto is primarily a dairy animal, research work on the Shika Stock Farm in Nigeria reported an average slaughter weight of 540kg per male and a dressed percentage of 50% at 5 to 6 years of age.

- f. Fulani (or Peul)⁸⁷. The Fulani is the pastoral tribe from which several cattle types take their name. The geographical area occupied by the Fulani cattle extends from west of the Senegal river to east of Lake Chad, including part of Niger and Mauritania.

- (i) The Nigeria Fulani is a good meat producer with 50% dressed weight from an average slaughter weight of 325kg.
- (ii) The Senegal Fulani is very much the same as the Nigeria Fulani though the poorer quality animals only yield 42-45% dressed weight.
- (iii) The Sudanese Fulani is primarily utilised for meat production, though the dressed percentage is about 46-47% of poor quality meat from an average liveweight of 325kg. However, the beast is fairly tolerant of tick-borne diseases and the occurrence of foot-and-mouth is very rare.

- g. Kuri⁸⁸. The Kuri has been reported to make excellent slaughter animals, responding well to natural pasture, and dressing out at 50% which is a meat yield of about 200kg on average. This type

is well adapted to the shore grasses of the Lake Chad area but they do not thrive so well in dry, sandy regions.

The aforementioned types of cattle are all indigenous to the Sahel, and thus they possess a heat-tolerance combined with an ability to forage successfully during the long dry season. Since work on cross-breeding in East Africa showed that crosses with the exotic breeds led to a loss of these indigenous abilities, the ideal would therefore, seem to point to the cross-breeding of zebu strains. While little work on zebu-crosses seems to have been carried out, a start has been made at Fianga, Chad. At the Fianga Experimental Station,⁸⁹ the N'Dama has been crossed with the West African Short-horn in the hopes of producing an improved well-acclimated type of beef animal. The result, thus far, has been a larger animal with better beef conformation than either parent type, but no more information is available at this time.

SUMMARY

While this chapter would seem very long and detailed, of necessity it had to be so. Despite its length, the chapter is really only a summary of the more important research that has been carried out in other parts of the World but which could prove beneficial to the Sahel.

In the latter part of this chapter cattle types were listed

but no research results were shown. The reason is that there is little cross-breeding research, thus far, which could be transferred to the Sahel region. Therefore, the breeds have been detailed with a view to incorporating this information into the strategy of the next chapter.

It should be pointed out that there has been other research undertaken which could help a Sahel beef cattle industry; however, the results selected for this chapter have been because they will be incorporated into the beef industry development scheme which can now be proposed.

FOOTNOTES

1. D.W. Robinson and R. Sageman, "The nutritive value of some pasture species in north-western Australia during the late dry season", in the Australian Journal of Experimental Agriculture and Animal Husbandry (Aus. J. of Exp. Ag. & A.H.) Vol. #7, 1967. p.533.
2. D.W. Robinson and R. Sageman, "The dominant species in the sandy soil in the north-eastern Kimberley area", Ibid., p.534
3. W. Davies and C.L. Skidmore, "Problems of Pasture Improvement" in Davies and Skidmore edition of Tropical Pastures, London, 1966. p.22.
4. Types and Breeds of African Cattle published by the FAO, Rome, 1957.

A study of the zebu cows listed suggested that they calve for the first time between 3.5 to 5 years of age; approximately double the time for the cattle of a developed economy. Calving intervals are double again, being normally about 18-24 months. Bulls are not used for service before 2 years of age, and often not before 3 years. Lactations vary considerable from a low of 4 to a maximum of 8.
5. P.M. Ahn, West African Soils, published by the Oxford University Press, 1970. p.154.
6. Ibid., p. 242.
7. J.H. Topps, "Urea or biuret supplements to low protein grazing in Africa", published in World Animal Review, Vol. 3, by the FAO, 1972. p.14.
8. M.J.T. Norman, "The Effect of Burning and Seasonal Rainfall on Native Pastures at Katherine, N.T.", in the Aus. J. of Exp. Ag. & A.H., Vol. #9, 1969. p.295.
9. Sulphur is an essential element which is particularly relevant to protein synthesis.
10. P.M. Ahn, op. cit., p.237
11. M.J.T. Norman, op. cit., p.295.
12. Ibid., p.296

13. Bi-ennial meaning every two years; not to be confused with bi-annual meaning twice annually.
14. M.J.T. Norman, op. cit., p.296.
15. The Evaluation of Soil Resources in West Africa - A Regional Seminar at Kumasi, Ghana, 14-19 Dec. 1970. Reported by FAO and UNDP.
16. This is not the first soil map of West Africa since IFAN, ORSTOM and CCTA (Commission of Technical Cooperation in Africa), have been actively producing soil surveys of limited areas for a long time. However, this new map promises to be the most comprehensive and useful for inter-regional development.
17. D.W. Robinson and R. Sageman, op.cit., p.533.
18. Ibid., p.535
19. Ibid., p. 538
20. Ibid., p.535
21. W. Davies and C.L. Skidmore, op. cit., p. 26.
22. Under "Soils" it was mentioned that N was an element in which tropical soils are particularly low and also lose rapidly; but it is an element which must be present if high dry-matter and high protein yields are to be obtained from pastures on such soils. Owing to the generally low economic level of the Sahel and the comparatively high cost of fertilisers, the principle supply of N by legumes becomes a matter of great importance, since N fixation by legumes is considerably higher than in grass.
23. M.J.T. Norman and G.A. Stewart, "Complementary grazing of native pastures and standing Townsville Lucerne in the dry season at Katherine, N.T.", in the Aus. J. of Exp. Ag. & A.H. Vol #7, 1967. p.225.
24. Ibid., p.227
25. R.N. Wesley-Smith, "Liveweight gains of shorthorn steers on native and improved pastures at Adelaide River, Northern Territories", in the Aus. J. of Exp. Ag. & A.H. Vol. #12, 1972. p.566.

26. H.P. Miller, "The effect of pre-treatment of native pasture and sowing rates on establishment of Townsville Lucerne on Tippera clay loam at Katherine, N.T.", in the Aus. J. or Exp. Ag. & A.H. Vol. #7, 1967. p.515.
27. Ibid., p.516.
28. Ibid., p.517
29. H.P. Miller, op. cit., p.571,

"...approximately 20mm of rain is reckoned sufficient to produce seedlings from an existing Townsville Lucerne style pasture, and follow-up rains are needed for further growth."
30. H.P. Miller, op. cit., p.517.
31. J. Phillips, The development of agriculture and forestry in the Tropics - Patterns, Problems and Promises, London, 1961. p.172.
32. J. Griffiths Davies and A.G. Eyles, "Communication of Results", in Davies and Skidmore, op. cit., p.153.
33. D.W. Robinson and R. Sageman, op. cit., p.5331
34. A.M. Morgan Rees, "The Economics of Tropical Grassland", in Davies and Skidmore, op. cit., p.168.
35. Ibid., p.170

"...applying varying levels of nitrogen and a basic level of potash, carrying capacity was increased by 0.5 beasts per acre for every three hundredweight of nitrogen fertilizer applied."
36. J.H. Topps, op. cit., p.14.
37. O. West, "Pasture improvement in the higher rainfall regions of Southern Rhodesia", in the Rhodesia Agriculture Journal, No. 53, 1956. p.439.
38. Ibid., p.439.
39. E.W. Russell, "Soils and Soil Fertility", in Davies and Skidmore, op. cit., p.42.

40. A.M. Morgan Rees, op. cit., p.170.
 "...work carried out by Motta (1961) in Jamaica on Pangola grass confirms the diminishing returns though he indicated the base level should be 3 cwt per acre of nitrogenous fertiliser but that carrying capacities were increased by 0.5 beast per acre."
41. E.W. Russell, op. cit., p.43.
42. M.J.T. Norman, "Dry season protein and energy supplements for beef cattle on native pastures at Katherine, N.T.", in the Aus. J. of Exp. Ag. & A.H. Vol. #3, 1963, p.280.
43. M.J.T. Norman, "Seasonal performance of beef cattle on native pastures at Katherine, N.T.", in the Aus. J. of Exp. Ag. & A.H. Vol. #5, 1965. p.227.
44. L. Links, F.C. Lamberth, K.W. Moir, and P.M. Pepper, "Effects of stocking rate and fertiliser on the performance of steers grazing Townsville style-based pasture in north Queensland", in the Aus. J. of Exp. Ag. & A.H. Vol. #14, 1974. p.146.
45. T.R. Evans and W.W. Bryan, "Liveweight change and beef production", in the Aus. J. of Exp. Ag. & A.H. Vol. #13, 1973. p.530.
46. C.G. Blunt and M.J. Fisher, "Production and utilisation of fodder and grain sorghum as forage for cattle in the Ord River valley, Western Australia", in the Aus. J. of Exp. Ag. & A.H. Vol. #13, 1973. p.234.
47. B.G. Level, "Agricultural Extension in Botswana", in Development Studies #7, 1970. p.57.
48. W. Davies and Skidmore, op. cit., p.24.
49. "Land, Livestock and Lady Bugs", in War on Hunger, Vol. #VIII, No. 8, published by the Agency for International Development (AID), Washington, 1974. p.14.
50. Maize is available in the Sahel.
51. J.H. Topps, Animal Feeds of the Federation, published by the University College of Rhodesia, 1961. p.38.
52. Sorghum is readily available in the Sahel and it could be produced in commercial quantities in the region, although the economics of 'comparative advantage' must be an important consideration.

53. J.H. Topps, Animal Feeds of the Federation, op. cit., p.40.
54. Indicative World Plan for Agricultural Development to 1975 and 1985, published by the FAO, Rome, 1968. p.170.
55. Ibid., p.161.
56. Ibid., p.161.
57. J.H. Topps, Animal Feeds of the Federation, op. cit., p.12.
58. Ibid., p.15.
59. Ibid., p.16.
60. Ibid., p.43.
61. Ibid., p.44
62. M.J. Creek, "The Kenya Feedlot Project", in World Animal Review, Vol. #3, 1972. p.23.
63. T.R. Preston, "Fattening beef cattle on molasses in the tropics", in World Animal Review, Vol. #1, 1972. p.24
64. Ibid., p.24
65. J.E. Rouse, World Cattle Vol. II, Oklahoma, 1972. p.283.
66. The IBED is not limited to cattle diseases but diseases affecting all animal life.
67. These diseases can exercise a virtual stranglehold on the cattle industry once into a country, as has been the case in both the United Kingdom and France in recent years.
68. J.E. Rouse, op. cit., p.283.
69. P. Finelle, "African Animal Trypanosomiasis", in World Animal Review Vol. #7, 1973. p.2.
70. Ibid., p.4.
71. The proposal for the ILRAD was submitted May 1972 by a team commissioned by the Rockefeller Foundation at the request of the African Livestock Sub-committee of the Consultative Group on International Agricultural Research.

72. A project established by IBAH in the early 1960s for the research, control and eradication of contagious bovine pleuropneumonia.
73. Thirteenth Annual Report, 1964, published by the Inter-African Bureau for Animal Health, p.9.
74. A project established by IBAH for the research, control and eradication of rinderpest.
75. Animal Health Yearbook, 1972, published by FAO-WHO-OIE, Rome, 1973.
76. Ibid.
77. Control by vaccination was first tried in Nigeria and Chad in 1963, but it should be noted that research on foot-and-mouth vaccines must be continued because the disease has several types of virus.
78. Senegal has had no reported case of foot-and-mouth since 1968.
79. J. Phillips, Agriculture and Ecology in Africa, published by Faber & Faber, London, 1959, p.768. and in Etude sur la situation actuelle de l'élevage dans les pays du Sahel et des mesures de sauvegarde à envisager, published by the Commission des Communautés Européennes, février 1974, p.219.

"The Djakoré is the result of generations of inter-breeding between the Gobra and the N'Dama under controlled conditions."

80. J. Phillips, op. cit., p.769.
81. Types and Breeds of Cattle, published by the FAO, Rome, 1958. p.6.
82. Ibid., p.118ff.
83. Ibid., p.130ff.
84. Ibid., p.54ff.
85. Ibid., p.48ff.
86. Ibid., p.81ff.
87. Ibid., p.86ff.
88. Ibid., p.139ff.
89. J. Phillips, op. cit., p.724.

THE BEEF CATTLE DEVELOPMENT

STRATEGYINTRODUCTION

The aims of the beef development strategy

- (a) Long-term aims
- (b) Intermediate aims

Ranch site selection

Development of grazing sections

- (a) Fencing
- (b) Grazing
- (c) Stocking-rate
- (d) Water
- (e) Forage production
- (f) Forage management
- (g) Fodder production

The Herd

- (a) Composition
- (b) Breeding
- (c) Calving
- (d) Mortality
- (e) Slaughter

The feedlot operation

- (a) Location
- (b) Construction
- (c) Stock capacity
- (d) Water
- (e) Feed types
- (f) Feed balance

The abattoir operation

- (a) Location
- (b) Operation
- (c) Markets
- (d) Benefits

Transportation modes

- (a) Road
- (b) Air
- (c) Other modes of transport

Disease control

Employment of Nomads

Long Term possibilities

- (a) Additional Ranches
- (b) Ranch expansion
- (c) Feed-lot addition

SUMMARY

CHAPTER EIGHT

THE BEEF CATTLE DEVELOPMENT

STRATEGY

INTRODUCTION

Different premises dictate different plans, and thus, at this point, it would be wise to set forth a brief list of the conditions which are believed to presently exist in the Sahel and which form the bases of the Plan described in this chapter.

1. The potential for the establishment of a successful beef cattle industry does exist in the region.
2. The traditional cattle knowledge of the nomads can be integrated into a modern food chain system.
3. The nomads can be introduced into a system of modern education.
4. The various nomadic bands can work together despite traditional hostilities.
5. The nomads and the individual Governments of the Sahel countries would welcome a beef development strategy.

THE AIMS OF THE BEEF DEVELOPMENT STRATEGY

Modern management techniques suggest the use of two types of aims; long-term aims and intermediate aims.

a. Long-term aims: The long-term aims or objectives are easily established since they frequently tend to be very broad in nature, often descriptive and even non-measurable. The long-term aims of the beef development plan of this chapter are listed below and it will be seen that they clearly substantiate the preceeding statement about being 'broad in nature'.

1. The ~~strategy~~ strategy must be multi-national so as to benefit all the countries of the Sahel, thus helping to ensure at least a partial balance of the benefits of beef industry development and an equitable distribution of the pre-development aid.
2. The strategy must aim at the development of a beef industry such that it will be self-sustaining within a period of 15-20 years. Hence, subsequent aid would not be required annually for the same project.
3. The strategy must aim at the employment of 250,000 of the present nomadic population by the twentieth year of the project.
4. The strategy must aim, by the twentieth year, to have developed a well integrated ~~scheme~~ scheme combining modern land and animal management techniques, thereby reducing the present dependance upon the vagaries of the weather.

- b. Intermediate aims: Though it is not unreasonable for the long-term objectives to be non-measurable, the same cannot be said for the intermediate aims. These latter objectives must be very specific and, therefore, quantifiable. Often these intermediate aims will be established so that an annual review can be made as a means of assessing the progress of the project towards the attainment of the long-term goals. Should these intermediate targets not be obtained at the required time, a good plan allows for a certain flexibility so that corrective measures can be taken, although sometimes a slight revision of the long-term aims may be acceptable.

The Plan presented in this chapter utilises a number of measurable intermediate targets though not such that annual review of progress can be made of the total project. This is mainly due to the nature of the project. For example, the progress being made on the construction of a hydro-electric plant can be accurately assessed annually. Unfortunately, this is not the case when dealing with livestock improvement, or a reduction in the calving interval for 18 months to 12 months. Hence, the intermediate aims of this Plan are set up on the basis of a five-year interval. For addition, the Plan has a flexibility such that if the intermediate targets are out by one, or even two years, it will not be a major disaster since the long-term objectives are of a very broad nature. This additional flexibility is probably one of the most important aspects of any development plan for a developing country since

the very success of such a scheme rests, for the most part, upon the speed of acceptance by the people of the necessary social change: To 'push' a scheme against the will of the people it is designed to help will inevitably doom the project to eventual failure.

For the Plan presented in this chapter there are really four categories where it is reasonable to establish intermediate targets. Certain categories can actually be assessed annually as will be apparent from the tables of chapter IX, "Ranch Operating Method and Finance". However, at this juncture it is enough to state the intermediate aims as they are applicable to the major time periods.

1. Beef Cattle Improvement:

a. Reduce the time to reach slaughter

weight maturity of cattle

from: 54 months at present

to : 42 months after 5 years

and : 24 months by the 10th year

b. Reduce the period of 1st calving

from: 42 months at present

to : 24 months by the 6th year

c. Reduce the calving interval

from: 18 months at present

to : 12 months by the 5th year

Under Beef Cattle Improvement an additional target could be to increase substantially the stock take-off rate which presently stands at possibly as low as 7%.¹ However, in order

to accomplish this latter goal, the intermediate targets listed above must be obtained to develop a viable beef industry which would permit an increased take-off rate. Therefore, these intermediate aims have been incorporated to yield the calculation for Table # 8-2.

Judging by the wealth of research that has been undertaken concerning cattle development, it is reasonable to suggest that all three intermediate targets can be met by improved health using better feeds and systems of disease control.

After health improvement measures, the Plan then only requires the addition of improved transportation and marketing to provide the profitability which will come with an increased take-off rate. However, all of this requires people and therefore employment targets must be considered.

2. Employment of the Indigenous People

- a. End of 5th year - all management positions to be filled by African.
- 900 nomadic families to be employed by each Ranch.
- b. End of 10th year - 2,100 nomadic families to be employed by each Ranch.
- c. End of 15th year - 4,500 nomadic families to be employed by each Ranch.
- d. End of 20th year - 7,000 nomadic families to be employed by each Ranch.

While the employment of nomadic families is listed as a target it really should be considered more as a guide as to what would be desire. Such employment targets are attainable provided the cattle breeding goals are obtained and also provided the nomads are still prepared to accept the necessary accompanying social change. For chapter IX, table # 9-1 can be seen the details per annum with regard to the Ranch employment of nomadic families.

Obviously, with the question of employment goes the important question of wages. Hence, the next category of intermediate objectives concerns income distribution to the workers.

3. Annual Income per Nomadic Family

a. Years	1 - 5	- \$200 per annum
	6 - 14	- \$400 per annum
	15 - 19	- \$600 per annum
	20 plus	- \$600 per annum plus a share of Ranch Profits

Since income targets are specified for the employess it is therefore important that there be profits from each Ranch operation to meet the anticipated operating costs. Thus,

4. Annual Profit or Loss Objectives per Ranch

1 st year	- a loss of \$1,202,870
5 th year	- a loss of \$1,379,077
10 th year	- a loss of \$1,673,795
15 th year	- a profit of \$687,755

Having, thus far, listed both the long-term goals and the intermediate targets a brief description of the basic strategy proposed would be in order, after which the specific Plan details will be set forth.

The basic strategy is the development of a system of large Ranches. At the outset, one Ranch would be established in each of the Sahel countries. This dispersal across all the countries is designed to ensure at least a partial national balance of the benefits of beef industry development and an equitable distribution of the pre-development aid. Each Ranch would consist of approximately 400,000 hectares (1,544 sq. miles) with a starting herd of 12,00 beef cattle. The first year of each Ranch operation will only benefit 400 families (2,400 people).^{2.} However, by the tenth year, 2,500 families (15,000 people) will be involved in the pasture areas. In addition, a further 200 families (1,200 people) would benefit from working in the Feed-lot, or the abattoir operation. (Both the feed-lot and the abattoir units would be part of the total Ranch complex being proposed in this chapter). Conceivably, by the twentieth year, 7,000 families (42,000 people) could be directly employed by an expanded Ranch operation in each country. There would also be many more thousands who could benefit indirectly through the economic linkage mechanisms (see Diagram #8-1: Economic Linkages).

RANCH SITE SELECTION

A Beef Cattle Planning Group (the Beef Cattle Group will be explained in chapter XI) in each country will have to

work with the respective National Governments in order to select the appropriate sites. The following criteria would be important in this regard:

- a. The area must be located in the existing pasture-land region.
- b. The area must be sparsely populated and not privately owned.
- c. Rainfall must be adequate to produce forage grass for livestock.
- d. Underground water must be sufficient to supply approximately 400 permanent wells.
- e. Land must be capable of producing year-round pastures.
- f. Site must have access to commercial routes. Or, the development of such routes must be feasible.

The site will be set out to approximate the layout shown on Map #6. Though the suggested layout may not always be practical, there are several benefits from such a design, not the least of which is controlled cattle movement to assist the disease control programme.

No costs are expected for land acquisition because the land can be deeded by the respective Governments.

DEVELOPMENT OF GRAZING SECTIONS

- a. Fencing: Each Ranch will be totally enclosed by a six-stranded barbed wire fence, thereby producing the basis of a disease Free Zone. This fence is intended, as far as possible,

Map #6:

IDEAL RANCH LAY-OUT

(2,470 sq.Km; 400,000 Ha.)

- A. Ranch Headquarters area: Headquarters Building, dispensary, Ranch shops, 44 houses (key personnel).
- B. Feed-Lot area (including 6 barns).
- C. Abattoir
- D. Community Area: 10 school houses, 16 homes (permanent staff), village for families of Ranch workers, irrigated land area for nomadic families now working on the Ranch.

NOTE: Area 'D' can be extended as the number of families employed increases.

Source: Developed by the author.

to prevent entry into the controlled Ranch area by the wild animals and other nomads with their livestock. It will be necessary to patrol the boundary fence for maintenance and to protect it against vandalism and trespassing.

Costs of fence construction are shown in Table #8-1.

- b. Grazing: Map #6, shows the Ranch site as being divided into five main grazing sections, each being approximately 75,000 hectares (185,250 acres). Each section will be grazed for a three months period using a system of rotation. This will ensure that each section is grazed in a particular season only once in a five year period.
- c. Stocking-Rate: The initial stocking-rate for the Ranches proposed herein will be approximately 27 hectares (65 acres) per animal per year. This somewhat conservative stock-rate allows for the tremendous soil deterioration which has occurred in recent years. However, by the tenth and twentieth years (see Table #8-2: Estimated Stock Numbers), the carrying capacity of the pastureland could conceivably be improved to the extent that the stocking-rate could reach 3.16 ha. (9 acres) ^{4.} per animal by the tenth year and even 1 ha. (2.47 acres) per animal by the twentieth year. Such a substantial improvement in pastureland can only be accomplished by the integrated development of water supplies, grazing control, forage and

Table #8-1: ESTIMATED COST OF FENCE CONSTRUCTION ⁽¹⁾

480 km of six-stranded barbed-wire (with concrete posts)

	Units	Price per Unit ⁽³⁾	No. of Units	Total Costs
Barbed Wire		\$		\$
	rolls	25.00	6,000	150,000
Wire stays	kilograms	0.0332	50,337	16,712
Cement posts (103,000 posts) ⁽²⁾	kilograms	0.05544	215,911	11,970
Reinforcing rods	metres	0.163	490,000	79,870
Concrete mixers	each	400.00	10	4,000
Fencing tools	set	2,000.00	4	8,000
Labour (Fence construction)	man-days	1.25	2,400	3,000
Labour (Post construction)	man-days	1.25	215	269
Trans-oceanic transportation	U.S. tons	65.00	520	33,800
Inter-African transportation	metric tonnes	190.00	470	89,300
				<u>396,921</u>

Annual Depreciation of 3% = \$11,907

Annual Maintenance costs = \$ 7,938

(1) This table is a modification of Schedule 3, in Ranching/Mixed Agriculture Program in Niger, Texas Tech University, 1974.

(2) 695 cubic metres of concrete

(3) Price per unit in U.S. Dollars.

Table #8-2:

ESTIMATED STOCK NUMBERS

YEAR

	Grazing Section	Feed-Lot Area		Slaughter Take-Off Percentage	TOTAL CATTLE ⁽¹⁾
		Pasture Area	Intensive Section		
1	11,000	1,000	-	-	12,000
2	13,500	5,000	1,000	-	16,000
3	16,816	12,500	-	-	26,000
4	21,866	17,500	-	-	36,000
5	30,816	22,000	2,500	5.5	45,500
6	36,166	31,000	5,000	8.3	60,500
7	47,833	46,000	11,000	14.8	74,500
8 (2)	57,660	45,500	11,000	12.8	86,500
9	75,166	55,500	12,500	11.6	108,000
10 (2)	94,750	48,887	11,500	8.1	141,000
11	119,000	59,666	19,250	10.5	180,250
12	149,750	75,166	26,750	11.6	230,000
13	124,533	94,800	33,750	11.4	296,750
14	145,186	120,566	43,750	11.4	384,000
15	210,350	157,900	58,750	11.9	496,750
16 (2)	291,683	235,300	108,000	17.0	609,750
20 (3)	200,000	200,000	200,000	33.0	600,000

(1) The total number of cattle cannot be computed by adding the cattle disposition figures since some cattle will be in both the grazing section and the feed-lot in the same year.

(2) Years in which the balance of the herd will be adjusted to improve the distribution between bulls and cows.

(3) Stock balancing will be done by the control of breeding. Hence, year twenty shows an equal distribution from breeding to slaughter.

Source: Developed by the author.

fodder cultivation.

- d. Water: It is anticipated that each animal will consume 50 litres of water per day (based on Table #6-1: Average water consumption during the dry season). The spacing of water-points, one well per 1,300 ha., will ensure that cattle do not have to walk more than 4 km to a source of water. This should reduce the weight loss which presently occurs when cattle may have to walk over 30 km to ^{5.} water.

Fifty-eight wells are suggested for each grazing section and these could also be supplemented by cachement basins at certain times of the year. It will be necessary to construct additional wells outside the Ranch boundaries in order to minimize trespass violations by nomadic livestock herders not initially involved in the scheme.

Each well must be properly constructed using concrete and installing drinking troughs to protect the water quality. The pump system used may initially be manual or animal traction, thereby reducing Ranch start-up costs. However, the fourth year will certainly require higher pumping capacities due to the increase in stock numbers and thus other pump systems, such as diesel or solar power, must be considered.

Around certain wells it will be important to develop a water storage system. Thus, there would be a reserve water supply available during a prolonged drought when the water

tables decline.

Well-maintenance crews will be a necessary part of the Ranch operation and thus an added cost. The estimated costs and pumping capacity requirement are set forth in Table #8-3.

- e. Forage Production: The aircraft seeding of Townsville Lucerne (*stylosanthes humilis* HBK), a pasture legume, is worthy of strong consideration since it requires no soil preparation and appears to do well under similar climatic conditions. Maize, millet and sorghum hybrids must also be considered.

Grass burning every two years is also recommended because this frequency was proved to produce the highest dry matter yield per acre.

The application of superphosphate fertilisers to the pastureland is the third important factor for forage development. While this may appear to be a high cost item, such an expenditure has proved to be justifiable in economic terms in other areas of the World. Presently, fertilisers for the Sahel must be imported. But, with the large volumes which should be used in the Sahel for all forms of agriculture, fertiliser production in one of the Sahel countries could prove economically viable. Each Ranch could use in excess of 100,000 metric tonnes per annum, using 250kg/ha. as

Table #8-3:

DATA FOR WELL REQUIREMENTS ⁽²⁾Livestock Water Requirement (maximum during first 16 years)

	<u>Grazing Area</u>	<u>Feed-lot</u>	<u>Total</u>
Litres per day per head	-	-	50
Litres per day all cattle	14,584,150	17,165,000	31,748,150
Litres per hour all cattle	607,673	715,166	1,322,839
Litres per minute all cattle	10,128	11,920	22,048
Litres required for 10 days supply	-	-	317,481,500

Well Requirements

Grazing section (5 x 58 per section)	290
Feed-lot section	20
Ranch Headquarters (Business Area)	20
Ranch Headquarters (Community Area plus irrigation)	20
Wells to be established for the nomads who are outside the Ranch boundaries	25
	<hr/> 375 wells <hr/>

Estimated cost for well development ⁽¹⁾

Well drilling and installation of a total water distribution system. \$12,500,000

Estimate of Annual maintenance costs @ \$100 per well = \$37,500

(1) The well development cost of \$12,500,000 may bear no relationship to the true well development costs. The figure presented here allows approximately \$30,000 per well, which is higher than would really be the case. However, this high figure is thought to offset the fact that no irrigation costs can be developed for this paper.

(2) A detailed water resource and cost study will have to be prepared for each Ranch at the time of site selection.

Source: Developed by the author.

suggested in the research of Evans and Bryan.

- f. Forage Management: Rotation grazing has been outlined as being for a maximum of three months in each section. However, overstocking and/or close grazing during the dry season must be monitored to assist the pattern of pasture improvement. An adequate stubble must be maintained during the dry season grazing since it is the stem base which is the essential storage place for carbohydrates. If forage appears to be insufficient to complete the full three month term per section, no premature grazing of the next section must be permitted. Instead, fodder crops will be brought in for supplementary feed as required.
- g. Fodder Supplements: One grazing section may be used each year for the production and harvesting of fodder products. Such production will be ensilaged and used as supplementary fodder to prevent overgrazing. Also a system of silos must be developed because ensilaged sorghum, millet and maize will be the feed base for the extensive feed-loy operation,; another important part of the total Ranch complex.

After the first few years of operation with an expanding herd, the Ranch crop cultivation will not be sufficient to supply the entire sillage requirements of the Ranch. Therefore, the Agricultural Plan must include a scheme for

fodder crop cultivation by the sedentary farmers. By this means, a trade linkage will be established between beef cattle and agriculture. The Ranch will be the catalyst since it will purchase supplementary fodder crops from the farmer.

THE HERD

- a. Composition: The initial herd will be costly since this strategy calls for the purchase of 12,000 head of cattle (the cost estimate is detailed in Table #8-4).

As far as is possible, the initial herd should consist of indigenous cattle because research indicates¹³ that exotic breeds have not fared too well in the harsh arid climates of semi-desert regions. Ideally, the start-up herd should consist almost exclusively of N'Dama and Fulani stock. However, in Chad, the Kuri cattle must be considered since they are the indigenous beasts of that country.

The N'Dama is popular in Senegal, Mali, Upper Volta and Niger because it is trypanosomiasis resistant and produces excellent meat on relatively poor savannah grazing. The average weight at maturity is 350kg. yielding a 54.55% dressed weight.¹⁴

The Fulani is a native of Senegal, Mauritania, Mali and Niger. Again it is fairly resistant to tick-borne diseases

Table #8-4:

START-UP HEPD

COMPOSITION AND COST ESTIMATE⁽¹⁾

(U.S. Dollars)

<u>ANIMALS</u>		<u>Price Per Unit</u>	<u>Number of Head</u>	<u>Total Cost</u>
Cows, purebred (3-4 years)	1st year	150	6,000	900,000
	2nd year	150	5,000	750,000
Bulls, purebred (3-4 years)	1st year	175	500	97,500
	2nd year	175	500	97,500
Goats and/or sheep	1st year	10	1,600	16,000
	2nd year	10	200	2,000
	3rd year	10	400	4,000
	4th year	10	400	4,000
	5th year	10	1,200	12,000
Chickens	1st year	1	4,000	4,000
	2nd year	1	500	500
	3rd year	1	1,000	1,000
	4th year		1,000	1,000
	5th year		3,000	3,000

Total Annual Costs Estimated for Animals

1st year	1,017,500
2nd year	850,000
3rd year	5,000
4th year	5,000
5th year	15,000

- (1) The estimated Price Per Unit only has been taken from, Ranching/Mixed Agricultural Program in Niger, published by Texas Tech. U. 1974.

with an acceptable dressed weight percentage of 42-51%,
^{15.}
 based on an average slaughter weight of 325kg.

The Kuri has been suggested for Chad since it is well adapted to the short grasses of the Lake Chad area. This
^{16.}
 breed dresses out at 50% on a slaughter weight of 550kg.

The initial herds would be composed of about 11,000 breeding cows of 3-4 years of age and 1,000 bulls of a similar age. With this foundation, cross-breeding of the types named could help establish a reliable beef cattle strain for the Sahel region.

- b. Breeding: Breeding would take place each year between August 1st and September 30th. Apart from this mating period, cows and bulls would be grazed separately to avoid indiscriminate mating. At a later stage, artificial insemination techniques
^{17.}
 will be used extensively to further develop the quality of the herds. The breeding date suggested will vary between the Ranches in each country according to the normal rainfall commencement time. The objective of a clearly defined mating period is to ensure the birth of calves in the early part of the wet season. The advantage is two-fold: First, the high nutritional requirements of the cow can more easily be satisfied and she will be in better condition when she calves; the calves thus being assured of a good start. Secondly, the cows will be in better condition during the next service period, thereby improving conception possibilities.

Conception, in this strategy, is accepted as being a very conservation 50% for the first two years with the start up herd. However, the conception rate could increase to 96% by the tenth year through the selection of good breeder cows and artificial insemination.

- c. Calving: Presently the age at first calving is of the order of 42 months, hence the start-up herd consisting of 3-4 year old cows. However, through improved nutrition, it is anticipated that this time to first calving can be reduced to 24 months by the sixth year, commencing with cows born in the fourth year.

The present calving interval ranges between 14 and 42 months, with an average of 18 months. It seems that this interval is not a reflection of any particular breed, so much as a reduced conception rate through poor health. Therefore, once again due to improved nutrition, the calving interval can probably be reduced to 12 months by the fifth year of the Ranch operation.

Both the reduced calving interval and the reduced first calving period are embodied in the calculations which were necessary to develop Table #8-2.

- d. Mortality: Calving mortality may be anticipated at 10% post-natal during the first two years of the Ranch, but it should decline to 2% by the eleventh year.

There is a pre-natal mortality rate which may be as high as 5% under traditional animal husbandry methods. However, it is felt that with good nutrition and stock management (see section on "Breeding") the pre-natal mortality will be minimized. These mortality percentages are also embodied in Table #8-2.

- e. Slaughter: Under the traditional nomadic system the bulls do not reach mature weight for slaughter until they are 4-5 years old. In fact, the average slaughter age is 54 months. Cows, of course, are not slaughtered until they are about 10-12 years of age and calf production has finished. However, by this age their meat quality is negligible.

With the Ranch operation, all cattle, prior to slaughter, will be sent to the feed-lot section (part of the total Ranch complex). The bulls, will, by the tenth year of the Ranch operation, be able to reach maturity in 24 months. They will have been weaned at six months and transferred to the Feed-lot section. However, for the final four months before slaughter they would be moved to the intensive Feed-lot area. In the case of the cows, they will be taken out of calf production at between 6-8 years of age. These cows will be slaughtered after 120 days in the intensive Feed-lot.

THE FEED-LOT OPERATION

- a. Location: The Feed-lot will be located in the central area of the Ranch (see Map #6), occupying an area of approximately 18,750 ha. (46,312 acres). It will be sub-divided into an intensive feed area and a pasture feed section; the latter part encompassing about 75% of the total Feed-lot area.
- b. Construction: Feed-lot pens will not be of permanent fencing as are the grazing sections. The pens will be of simple construction to permit modifications as stock numbers vary. In addition, shade will be provided over the water and feed troughs in the intensive feed section; such shade being made of thatched matting.^{24.}
- c. Stock Capacity: The required capacity of the Feed-lot will be 60,000 animals per annum in the intensive feed section with a further 158,000 per annum in the pasture section by the fifteenth year. However, these figures can be increased to 200,000 per Feed-lot section per annum by the twentieth year, since there will be space available for feed-lot expansion. Table #8-2 details the numbers of cattle per annum using the Feed-lot.

The pasture area of the Feed-lot will be entirely devoted to calves after they have been weaned at six months. All calves will spend 120 days in the pasture Feed-lot where

they will receive supplementary feed (ensillaged fodder crops). After the suggested 120 day period, the heifers will be integrated into the normal rotation grazing system of the main pasture sections with the main herd. However, the young bulls will remain for a further eight months after which they will be transferred to the intensive feed-lot for 120 days of fattening before slaughter.

By the twentieth year, the slaughter rate per Ranch could be up to 200,000 head per annum, all of which will require at least 90 days of intensive feeding.

- d. Water: For the Feed-lot operation, the capacity to meet a maximum daily need of 400,000 litres per hour (88,000 gals) must be developed. While this can be accomplished by 20 wells each pumping 20,000 litres per hour (4,400 gals/hr), it may not be the solution for each feed-lot operation in the Sahel. However, it can be stated that all pumping units in the Feed-Lot areas should be diesel powered because any pump failure could be catastrophic.

In order to develop a total Ranch start-up cost, well construction finances must be included. Thus, Feed-lot well costs are also included in Table #8-3.

- e. Feed Types: Cattle feed for the Feed-lot really should be sub-divided into two categories for the purposes of cost computation:

- (i) Fodder production
- (ii) Feed supplements

However, it is not possible to produce Feed-lot feed costs at this stage since there are too many variables and unknown costs. For this reason, such a calculation must be an entirely separate document taking into consideration the animal feed requirements at different cattle ages, different times of the year, feed prices, feed availability, transportation and storage.

- (i) Fodder Production: Fodder products would be partly available from the crop cultivation of one grazing section each year, giving a dry matter yield of 253,000 to 422,000 metric tonnes. Though this production would serve the Feed-lot needs of the first few years, at a later stage, it would be necessary to purchase fodder from the farmers.

Fodder products such as millet, maize and sorghum were mentioned earlier as being easily produced in the Sahel, possibly coupled with Townsville Lucerne. These crops could be ensilaged on the Ranch so that they would be readily available for both the Feed-lot and also, in times of shortage, the main grazing sections.

- (ii) Feed Supplements: Feed supplements are the key ingredients for the intensive Feed-lot section. It is these items which are costly since they are processed

feed products.

The two most important feed supplements are readily available in the Sahel; groundnut oil meal or cake, and cottonseed meal or cake. Both items have high protein value and good cattle acceptability. There are two other supplements which should be used in the Feed-lot operation: First, molasses, which is presently obtainable in Senegal. The second is urea, which can now be produced anywhere with the new simple production processes.

The increased requirement of all four feed supplements in the region of the Sahel could lead to the rationalised development of the necessary production facilities in one or other of the Sahel countries.

- f. Feed Balance: The cattle in the pasture section of the feed-lot would be fed ensilaged products, which would be supplemented with salt-licks and an adequate water supply. However, in the intensive feed-lot section, the suggested feed balance would be of the order of 67% high energy feed supplements combined with only 33% ensilaged roughage. This balance should produce a satisfactory weight gain and at a lower feed cost/kg gain than would a higher percentage of roughage.

THE ABATTOIR OPERATION

a. Location: There are few proper abattoirs in the entire
 28.
 region and what few there are fail to meet first class hygiene
 standards as required by many of the meat importing countries
 29.
 of the World. Thus, each Ranch would have an abattoir constructed nearby which would be operated as part of the total Ranch complex. In addition, this close proximity to the Ranch would reduce the tremendous weight loss which usually
 30.
 takes place under the traditional marketing process.

b. Operation: The abattoir would process all the marketable stock from the Ranch, a figure that could rise to 200,000 head per year eventually. This annual volume could yield approximately 34,000 metric tonnes of meat (an average carcass weight of 340kg dressing out at 50%).

Since the slaughter-house would be part of the Ranch operation there would be total disease control of the cattle from birth to market. In addition, the veterinary staff of the Ranch would be responsible for the sanitary operation of the abattoir and its initial construction. Subsequently, as the disease Free Zone is expanded beyond the Ranch confines, the other nomadic cattle could be fattened on the Feed-lot. Hence, the abattoir would be handling some additional slaughter and marketing.

c. Markets: Carcasses could be shipped by refrigerated truck,

or by air, to the markets of West and Central Africa, and even Europe. The markets of Europe would be open to the Sahel beef because the health requirements would have been met by controlled stock raising and the close veterinary supervision.

The FAO estimated that there would be a net meat short-^{31.} age in West Africa of approximately 318,000 metric tonnes by 1985. However, due to the increasing urbanisation and the expected meat consumption increase in Africa, the net shortage could go even higher.

Besides a meat shortage in Africa, there will also be a considerable meat shortage in Europe. In 1970, the European^{32.} shortage was estimated at 575,000 metric tonnes, though this could be well in excess of 1 million metric tonnes by 1980 and possibly 2 million metric tonnes by 1990.

Under the strategy of this paper, a single Ranch may be expected to produce 34,000 metric tonnes by 1990, with a total of over 200,000 metric tonnes being produced by the original six Ranches proposed. While this volume would account for only a small percentage of the European shortage, it could provide a substantial share of the anticipated West African meat shortage, besides being a better quality than had been exported from the Sahel in previous years. Exports would not be able to go entirely to Europe, despite the future needs of foreign exchange. Thus, exports would have to be

divided between both the European markets (which may be able to pay higher prices) and the markets of the other West African countries.

However, not all the Sahel beef would go for export. It must also be remembered that there is a domestic market need for meat which must be met. Part of this domestic requirement could, of course, be derived from an expansion of the Ranch programme to other areas, since the live cattle could be made available to reduce the initial start-up costs of subsequent operations. In addition, it was suggested that nomadic cattle could be fattened in the Feed-lot section, these being then sold in the domestic markets thereby satisfying the traditional requirement that meat be consumed only from the freshly killed stock.

- d. Benefits: Since the slaughtering and marketing operations will be totally controlled by the Ranch, another major benefit besides the sale of processed meat will be realised by the Ranch Management. This benefit will accrue through the local use and distribution of the cattle by-products such as hides, horns, bone meal, animal tallow and fertiliser. Thus, another important economic linkage can be developed from a successful beef industry in an area.

From the Ranch operation there would be no export of

cattle 'on-the-hoof'. In fact, ideally, all exports of live cattle from the Sahel countries would be eliminated, since it would be more expedient and profitable to export only carcass or processed meat. In addition, the elimination of live cattle exports could do much to reduce the spread of animal diseases.

TRANSPORTATION MODES

There are really only two transportation modes which can be considered, road and air. Both will undoubtedly have to be developed to serve the needs of each Ranch operation and the nomads in different regions.

- a. Road: Road development to the Ranch will be justified by the fact that it will be a supply link serving a community of at least 42,000 people. The road would be used to supply all the initial construction materials, plus food, medical and veterinary supplies. However, meat shipments, if by road, could only be transported by refrigerated vehicles. This latter fact could prove to be an expensive means of transporting meat over long distances due to the time taken on the existing road system, in addition to which, the return trips would often be with an empty vehicle.
- b. Air: The most economic transportation system for beef ship-

33.
ments could well be the 'expensive' air freight. Although air costs are higher than by road, rail, or even ocean shipping, the time-savings on 'capital in the pipeline' may more than offset the difference in costs. Air transportation has already been proved more economical for the fruit and vegetables flying from East Africa to the markets of Europe. Also, air freight is already being used for certain meat shipments from Chad over relatively short distances. The prospects for air transport could be further improved due to the advent of the giant aircraft which have greater capacities and a correspondingly lower cost per ton/mile.

34.
It should be noted that in addition, air transportation reduces the refrigeration problems inherent to land and sea shipments. The International Civil Aviation Organisation (ICAO) will presently be undertaking a study of the air transportation mode to assess its practicability.

35.
c. Other Modes of Transportation: River transportation, while it has some benefits for other sectors of the Sahel economies, would not prove too useful for meat shipments. Besides the special refrigeration needed on vessels for perishable goods storage, river navigation in the Sahel has not yet been developed to provide any degree of reliability.

Rail transportation is another alternative, but the

development of this mode of transport is still in its infancy. In addition to which, the Ranches would have to use trucks in order to take the meat to the railhead, a factor which would not help reduce the Ranch costs.

DISEASE CONTROL

Each Ranch will have a Veterinary unit as part of its operating staff. The primary function of this unit will, of course, be disease control and disease prevention in the cattle herd. This can be accomplished by a programme of vaccination of calves during the weaning period, thereby providing a considerable degree of protection against the major diseases. Controlled animal movement, by virtue of the fencing, will also do much to aid disease control.

The Veterinary unit will also be responsible for a continuous programme of water testing besides the checking of wild animal diseases and movements. In addition, the unit will be directly responsible for sanitation and the daily operation of the abattoir.

EMPLOYMENT OF NOMADS

36.

Though the IBRD Report called for a five year programme aimed at serving 200,000 to 250,000 families of the nomadic population,

the strategy presented herein clearly fails to reach that objective. Each Ranch will provide a livelihood for only about 7,000 families by the twentieth year. This figure translates into a total of 42,000 families in the Sahel; only 20% of the target set out in the IBRD Report. In addition, the 42,000 families involved will take place only after a twenty year period, considerably longer than the IBRD goal of five years.

Table #8-5, details the estimates of staff and wages which will be needed to operate the Ranch on an annual basis. However, the listing can only consider the direct employment generated by each Ranch. But there must be considerable employment generated indirectly from the establishment of beef cattle Ranches.

Initially, the nomadic herdsmen and their families will only be able to provide the manual labour needed on the Ranch, although they will assume more responsibility under the guidance of expert management personnel. However, through social development programmes, including education, it is expected that after a few years of work and job-training the nomads would be able to assume many of the supervisory responsibilities on the Ranch.

Clearly, the employment of nomads may be difficult from sociological point of view because of the need for education and also because of the various tribal traditions which exists. Thus,

Table #8-5: ESTIMATED ANNUAL PAYROLL
AND
STAFF REQUIREMENTS

<u>PERSONNEL</u>	(U.S. Dollars)	<u>YEARS</u>		
		<u>1-5</u>	<u>6-14</u>	<u>15-20</u>
Ranch Manager	45,000(a)	45,000(a)	25,000(a)	
Deputy Ranch Manager	40,000(a)	40,000(a)	20,000(b)	
Superintendants - Feed-lot	35,000(a)	15,000(c)	15,000(c)	
Abattoir	35,000(a)	15,000(c)	15,000(c)	
Marketing	35,000(a)	15,000(c)	15,000(c)	
Veterinary	35,000(a)	15,000(c)	15,000(c)	
Water	35,000(a)	15,000(c)	15,000(c)	
Grazing	35,000(a)	15,000(c)	15,000(c)	
Managers - Accountant/Business	35,000(a)	15,000(c)	15,000(c)	
Community	35,000(a)	15,000(c)	15,000(c)	
Transport/Warehouse	35,000(a)	15,000(c)	15,000(c)	
Supervisory Personnel (9 x 11,000)	90,000(c)	90,000(c)	90,000(c)	
Counterpart Trainees (11 x 10,000)	110,000(c)	-	-	
Superintendent & Management Assistant (11 x 10,000)	-	110,000(c)	110,000(c)	
Secretaries (2 x 15,000)	30,000(a)	-	-	
Secretaries (3 x 7,000)	-	21,000(d)	21,000(d)	
Clerks (4 x 3,000)	12,000(d)	12,000(d)	12,000(d)	
Mechanics (9 x 5,000)	45,000(d)	45,000(d)	45,000(d)	
Pilot	15,000(c)	15,000(c)	15,000(c)	
Labourers (400 x 200 1st year)	80,000(e)	-	-	
(900 x 200 5th year)	-	-	-	
Labourers (1,100 x 400 6th year)	-	440,000(e)	-	
(3,240 x 400 14th year)	-	-	-	
Labourers (4,500 x 600 15th year)	-	-	2,700,000(e)	
(7,000 x 600 20th year)	-	-	-	
		782,000	933,000	3,173,000
		to	to	to
		882,000	1,789,000	4,673,000

- (a) Personnel from aid donor countries
 (b) Indigenous people with high education and proven ability
 (c) Indigenous people with secondary school plus technical college
 (d) Indigenous people with secondary school
 (e) Indigenous people with primary education as soon as possible

Source: Developed by the author.

chapter X, will consider some the social implications of the Ranch beef strategy operating method which will be detailed in chapter IX.

LONG TERM POSSIBILITIES

The market potential after about twenty years, for all six Ranches, is only about 1,200,000 head per annum (approximately 10% of the herds existing in the Sahel in 1972). However, these Ranches will provide; firstly, a solid economic base for a nomad operated beef industry. Secondly, these six Ranches will be working economic models and not just show-places. Hopefully, other similar Ranches may then be established in other areas of the Sahel.

- a. Additional Ranches: Each Sahel country has more than enough permanent pastureland so that two or three similar Ranches can easily be established in other sections of the region. As was mentioned earlier, the start-up costs for other Ranch operations should not be as high as those incurred by the initial Ranches. The second series would be stocked from the initial models using proven developed cattle. Thus, the newer Ranch establishments could possibly become economically viable within a two year period because of the reduced period to first calving, the earlier slaughter-weight maturity, and the reduced calving interval.

- b. Ranch Expansion: The initial Ranch expansion has been explained under "The Herd", since the original fence boundaries are enough to allow considerable herd expansion. But, it is expected that other nomadic herdsmen will, after observation of the Ranch operation, be interested in the further development of disease free healthy stock. In addition, the easier and more profitable market system should provide an economic incentive to a people who are progressively feeling the pressures of a monetary economy.
- c. Feed-Lot Addition: Additional feed-lot operations could eventually be established in the more southern farm areas of the Sahel. These would be separate business enterprises set-up divorced from any Ranch. Such feed-lots may even be developed on a co-operative basis among the sedentary farmers. They would trade their grain products for cattle with some of the nomadic herdsmen because there would be many nomads still leading the traditional lifestyle.

The market for these additional feed-lot operations would probably be more oriented towards the domestic markets, due to the lack of disease control in such businesses. Nevertheless, they would still be able to benefit from some exports, albeit only short distance exports to neighbouring countries.

Chapter VIII commenced with a listing of the underlying premises upon which the beef development strategy of this paper was built. After which, the long-term aims were considered, though it was clarified that these final objectives were 'broad in nature' and thus subject to modification, at least with regard to the time parameter.

Of course, the final objectives were suggested as being inadequate by themselves for the development of any strategy, since all projects must have some form of interim progress measurement. Hence, intermediate aims were shown to be very important and accordingly were specified. After which, the Beef Cattle Development Strategy was set forth.

The Strategy may appear, at first glance, to be very categoric and therefore rigid. But, this is really not the case, since a degree of flexibility has been allowed concerning the time parameters of both the intermediate and long-term aims. This 'time' factor is the only flexibility that the writer chooses to consider at this stage. The Plan may be otherwise considered as rigid, in that, it is the viewpoint of the author based on the premises originally specified.

Having considered the Strategy, it now behooves the author to suggest the method of implementation. This is because, though there could be many ideas as to how a given strategy can be put into practice, when a individual develops a strategy, that person will have very specific thoughts on how his theory can be turned into a practical application if his final results are to be obtained. As a result of this, chapter IX suggests, what is for the author, a very logical method of strategy implementation.

FOOTNOTES

1. Indicative World Plan for Agricultural Development to 1975 and 1985, Vol.I. Published by the FAO, Rom, 1968. p.253.
2. Ranching/Mixed Agriculture Program in Niger, A study by Texas Tech University, Texas, June, 1974. p.10.
3. A conservative stocking rate when compared to the study results of P. Granier as reported in Ranching/Mixed Agriculture Program in Niger, Ibid, p.55. and even the work of J.Phillips, The Development of Agriculture and Forestry in the Tropics - Patterns, Problems and Promises, London, 1961. p.172. This latter work being cited in chapter VII.
4. J.Griffiths Davies and A.G.Eyles, "Communication of Results", in W. Davies and C.L.Skidmore edition of Tropical Pastures, London, 1966. p.153
5. J-P Baudelaire, "Water for Livestock in Semi-Arid Zones", in World Animal Review, No.3, 1972. Published by the FAO, Rome. Also cited in chapter VII.
6. H.P.Miller, "The effect of pre-treatment of native pasture and sowing rate on establishment of Townsville Lucerne on Tippera clay loam at Katherine, N.T." in Australian Journal of Experimental Agriculture and Animal Husbandry, Vol.#7, 1967, p.515. Also cited in chapter VII.
7. Indicative World Plan for Agricultural Development to 1975 and 1985, Vol.I. p.160ff. and also chapter VII.
8. M.J.T.Norman, "The effect of burning and seasonal rainfall on native pastures at Katherine, N.T." in the Aus. J. of Exp. Ag. and A.H., Vol.#9, 1969, p.295. and chapter VII.
9. Ranching/Mixed Agriculture, op.cit. p.M-2. indicates \$500 per ton.
10. B.G.Lever, "Agricultural Extension in Botswana", in Development Studies, #7, 1970. p.57.
11. T.R.Evans and W.W.Bryan, "Livestock change and beef production" in Aus. J. of Exp. Agric. and A.H. Vol. 13, 1973.p.530

12. Due to the rotation system of grazing suggested, only four sections will be grazed each year. Therefore, the fifth section will be available for the production of fodder crop for ensilage. Method of cultivation and the type of crops was suggested in chapter VII.
13. Studies cited in chapter VII, indicated that though exotic breeds have been successfully introduced into other parts of Africa, these same breeds, when introduced to West Africa, did not fair so well in the harsher climate. Hence, research presently being undertaken in the Sahel is primarily attempting to improve the indigenous zebu cattle.
14. Types and Breeds of African Cattle, published by the FAO, Rome, 1958. p.118ff. This information was mentioned in chapter VII, however, the detail has been listed again due to the importance to a fully understanding of the strategy and the subsequent profitability calculations.
15. Ibid., p.86ff.
16. Ibid., p.139ff.
17. Artificial insemination will be introduced gradually over a period of several years since this will be a new technique to the nomads. Introduction of this method will only move at the speed with which the nomadic herdsman are prepared to accept the method.
18. Types and breeds of African Cattle, op.cit.
19. K.L.Sjorberg and S.Persson, Cattle Production in Africa, Rural Development Study No.2. College of Agriculture, Sweden, March, 1974.
20. Ibid., p.41 ff.
21. Ibid., p. 41.
22. Ibid., p.57 ff.
23. Ibid., p.46.
24. Ranching/Mixed Agriculture Program in Niger, op.cit. p.46.
25. H.P. Miller, op.cit. p.517.

26. Salt-lick system are discussed extensively by G.I.Alexander in World Animal Review, No.4, 1972. p.11.
27. M.J. Creek, "The Kenya Feedlot Project," in World Animal Review, No.3. 1972.
28. Research indicates that there are only five real abattoirs in the entire Sahel region. However, this does not mean that very little slaughter takes place. On the contrary, a lot of animals are slaughtered each year, but by using the more traditional open 'slab'.
29. As was mentioned in chapter V, the countries of the EEC have established regulations for abattoir operations in overseas countries if these nations wish to export their meat products to the EEC.
30. This point was also mentioned in chapter V, wherein it was shown that up to a one-third weight loss may occur under the traditional system of marketing, since cattle may have to trek as much as 1,000 to 1,500km during the dry season. Also, qualified by J.Dirck Stryker, Livestock Production and Distribution in the Mali Economy. Report for AID, August, 1973, p.44
31. Indicative World Plan, op.cit. p.252.
32. Agricultural Commodity Projections 1970-1980, Vol.I. published by the FAO, Rome, 1971. p.136-7.
33. Transportation was examined in chapter VI, however, the value of air-freight was substantiated in the FAO publication, Indicative World Plan, op.cit. p.116
34. Ibid.
35. Transport, published by the United Nations, ST/SSO/13, April 1974.p.16
36. Proposal for a co-operative effort to rationalise the livestock industries of the Sahel. Published by IBRD following the August 1974 Sahel Conference, p.4.

CHAPTER NINE

RANCH OPERATING METHOD AND
FINANCING

Introduction

Ranch Operation

Ranch Ownership

Financial Matters

- (a) Capital
- (b) Annual Costs
- (c) Annual Revenues
- (d) Profit and Loss
- (e) Capital Investment Funding
- (f) Annual Operating Funds

Summary

CHAPTER NINE

RANCH OPERATING METHOD AND

FINANCING

INTRODUCTION

Experiences of history, and a number of development projects, have shown that the process of modernisation is slow and that old ideas die hard. Thus, the Ranch strategy of Chapter VIII cannot suddenly be introduced into the Sahel with the view of changing the nomadic life-style in the first five years. However, this change can be brought about by an approach of gradual nomadic involvement over a twenty-year period. In this way, the second generation of Ranch workers could possibly form a solid foundation for a modernised Ranch economy, thereby contributing in a substantial manner to the future development of the entire Sahel region.

This chapter will, therefore, spell out the method of implementing the Ranch strategy, with stress being laid on the gradual nomadic involvement. In addition, some estimates of cost/benefit will be considered so that the required development financial needs may be considered.

RANCH OPERATION

The Ranch would be built and stocked with cattle during the

course of the first two years. The first year would see the involvement of 400 nomadic families, with a further fifty families being brought on to the Ranch in the second year (see Table #9-1: Nomadic Families Involved Annually in the Ranch Operation). It should be noted that additional families will be integrated into the Ranch complex during the first twenty years up to a total of 7,000 families (a total of approximately 42,000 people forming the Ranch community). Map #6, indicates where these people will live on the Ranch, the Community Area being clearly shown. The Map also shows that there is no outer boundary fence for the Community Area, thus, allowing for an expansion of both the number of families and in the area to be irrigated for family use.

The nomadic families which commence during the first few years of Ranch operation will be families who have lost all their animals. Each family would then, upon arrival, receive the following gift:

- 9 cows
- 4 goats or sheep
- 1 donkey
- 10 chickens
- 2 hectares of land which will be irrigated

The goats, sheep and chickens would be maintained in the Community Area, However, the cows would be integrated with the Ranch herd and grazed in the enclosed Grazing Sections (also shown on Map #6). By this cattle integration, the cows owned by the nomads would receive the same feed, veterinary service and general care as the Ranch Herd.

Table #9-1: NOMADIC FAMILIES INVOLVED IN EACH RANCH OPERATION ANNUALLY

Year	Number of Families	Population of Ranch Community	No. of Head per Family ⁽¹⁾	Number of Cattle cared for per Family	Annual Payroll Total per Family (U.S. Dollars)
1	400	2,400	9	27	80,000
2	450	2,700	10	30	90,000
3	500	3,000	11	33	100,000
4	600	3,600	12	36	120,000
5	900	5,400	12	34	180,000
6	1,100	6,600	12	33	440,000
7	1,250	7,500	13	38	500,000
8	1,450	8,700	13	40	580,000
9	1,750	10,500	14	43	700,000
10	2,100	12,600	15	45	840,000
11	2,350	14,100	15	50	940,000
12	2,450	14,700	14	61	980,000
13	2,750	16,500	13	45	1,100,000
14	3,240	19,440	13	44	1,296,000
15	4,500	27,000	12	47	2,700,000
20	7,000	42,000	4	60	4,200,000

(1) It will be noted that the "No. of Head per Family" rises from the first year to the tenth year, after which the number begins to decline. The logic behind this change is explained in the text. However, the actual number of head owned per family is shown just as a guide since the nomads may not accept the concept of a Co-operative Ranch before the second generation of Ranch families.

Source: Developed by the author

While the nomadic families will receive stock and land, they will be expected to do labour work around the Ranch, in addition to tending the Ranch herd. Such labour work will be a permanent part of the Ranch operation and include such items as general construction, fence, well and pump installation, plus normal maintenance. These jobs will necessitate working under a Supervisor and require the use of motor transportation. For these additional labours, the workers would receive a salary of \$200 per annum during the first five years. This annual pay would increase to \$400 per family per annum, for years six to fourteen inclusive. After which there would be a further increase to \$600 in the fifteenth and subsequent years, combined with some form of co-operative profit sharing.

The families joining the Ranch could be from different tribes, some of which are traditionally hostile towards each other. For this reason, while they may be prepared to work side-by-side, they will probably choose to live in separate sections of the Community Area. Hence, the Community Manager will be well advised to work with, and through, the Head Man of each tribal grouping. It is hoped that by working together and eventually operating the Ranch as a team, the tribes will learn to co-exist in a peaceful manner. However, real tribal integration may not come about before the second, or even the third generation of Ranch families.

To further help the principle of co-existence and to aid the social development of the nomads, all families joining the Ranch must agree to attend the schools which will be established in each Community Area. An added reason behind this aspect of social development is the fact that, with the possible exception of the Ranch Manager, the sixth year should see the entire Ranch complex being operated by the indigenous Africans. However, the key personnel will not necessarily be of nomadic origin due to the high level of education required for some positions. Table #8-5 indicates the positions which will be occupied by the African during the three stages of Ranch development spanning the first twenty years. While the Table shows the salary for each position, it also shows the educational standards which will be required for each job. It is not expected that any of the original nomadic workers will have the required education by the sixth year. But, by the sixteenth year some can be expected in the Supervisor levels, with the second generation holding some technical positions at a later date.

RANCH OWNERSHIP

Though each nomadic family will receive a gift of cattle and land and an annual salary, still does not guarantee the success of the Ranch. Thus, a form of co-operative ownership is recommended

to provide an incentive to work and obtain at least the basic educational skills.

During the first ten years, it is expected that the nomadic families would be interested in continuing the traditional practice of increasing their herd size. Hopefully, with education and an understanding of the Ranch objectives, the important nomadic ownership of family cattle would probably die out and be replaced by the share system of the Ranch profits. Table #9-1, besides showing the number of families involved, also indicates the numbers of cattle which will be owned by each family. The first eleven years anticipates a gradual increase in the family stock ownership but, with the development of profit sharing, the later years show a decline in the numbers of family owned cattle. Such a decline should continue each year until such time as all cattle are Ranch owned. By that time, the Ranch complex will be a total Co-operative owned by the nomadic workers and their descendants.

The idea of a Co-operative is far from being new, having been tried with varying degrees of success in many countries of the World, particularly China and Israel. The countries where the co-operative system has been successful have, in general, been those countries where a reasonably high national education standard existed. However, there is no reason why such a system cannot be a workable proposition in the Sahel region. The main elements re-

required for success are time and patience. After all, though it may take twenty years to establish a complete Ranch Co-operative, such a move will do much to integrate the nomads into the mainstream of the national and regional economic life.

FINANCIAL MATTERS

- a. Capital: The Capital Investment required per Ranch would be slightly in excess of \$16 million during the first five years (see Table #9-2 and #9-3). However, all future Ranch investment needs will be satisfied by the Ranch profits.
- b. Annual Costs: An estimate of the Annual operating costs is given in Table #9-4. This Table indicates the anticipated major details, but the figures shown are only a guide. Accurate Annual Cost projections can only be given after the Ranch site selection has been made. It should also be mentioned that no two Ranch locations will have the same costs structure since each country will have different variables.

In the computation to develop the Annual Costs on Table #9-4, there has been a tendency towards over-stating the expenses. This has been done so that the final profit calculations will not appear to be too optimistic.

- c. Annual Revenues: The Annual Revenues for the Ranch will only be derived from the slaughtered animals. Obviously, after the

Table #9-2:

ESTIMATED REAL PROPERTY⁽¹⁾
CAPITAL REQUIREMENTS
 (U.S. Dollars)

	<u>TOTAL</u>
Housing for Ranch Manager and Specialists (11 x 20,000)	\$220,000
Housing for other key personnel (33 x 10,000)	330,000
Housing for other permanent staff (16 x 500)	8,000
Ranch Headquarters building	40,000
Dispensary	20,000
Abattoir	15,000
Schools (10 x 10,000)	100,000
Barns - 60ft x 100ft (6 x 30,000)	180,000
	<u>\$953,000</u>
Annual Depreciation of 10% = \$95,300 for 2nd year	
Annual maintenance cost 5% = \$47,650	
<hr/>	
Fencing (from Table #8-1)	\$396,921
Annual Depreciation of 3% = \$11,907 for 3rd year	
Annual maintenance cost 2% = \$ 7,938	
<hr/>	
Machinery and Equipment (includes trucks and an aircraft)	\$550,000
Annual Depreciation of 10% = \$25,000 2nd year	
= \$50,000 3rd year	
= \$52,500 4th year	
= \$55,000 5th year	
Annual maintenance cost 1% = \$ 5,500	

(1) While some of the above data was taken from the Texas Tech. University study on Niger, 1974, it provides only a guide. Each country of the Sahel will have different cost factors and therefore the true capital requirements will have to be calculated for each individual Ranch once the site selection has been made.

Source: Developed by the author.

Table #9-3:

CAPITAL INVESTMENT REQUIRED
(U.S. Dollars)

	YEARS				
	<u>1st</u>	<u>2nd</u>	<u>3rd</u>	<u>4th</u>	<u>5th</u>
Water development (from Table #8-3)	2,500,000	2,500,000	2,500,000	2,500,000	2,500,000
Machinery and Equipment (from Table #9-2)	250,000	250,000	25,000	25,000	-
Fencing (from Table #9-2)	396,921	-	-	-	-
Real Property (from Table #9-2)	755,000	-	-	-	-
Livestock (from Table #8-4)	1,017,500	850,000	5,000	5,000	15,000
<hr/>					
	4,919,421	3,600,000	2,527,000	2,527,000	2,515,000

Total Capital Requirement = \$16,088,421

Source: Developed by the author

Table #9-4: ESTIMATED ANNUAL OPERATING COSTS
(U.S. Dollars)

	<u>AVERAGE OF YEARS</u>		
	<u>1-5</u>	<u>6-14</u>	<u>15-20</u>
Payroll (from Tables #8-5 & #9-1)	816,000	1,312,544	3,450,000
Communication	10,00	15,000	15,000
Maintenance:-			
Wells \$37,500 (Table #8-3)			
Fencing \$ 7,938 (Table #9-2)			
Buildings \$47,650 (Table #9-2)			
Machinery <u>\$ 5,500 (Table #9-2)</u>	78,870	98,588	98,588
Supplies (1)	322,800	3,086,625	12,700,000
Depreciation (Table #9-2)	114,264	91,307	11,907
Miscellaneous (2)	200,000	300,000	400,000
	1,541,934		16,675,495
		3,086,625	

- (1) Supplies consisting of: Fuels and lubricants
 Fertilisers
 Seed
 Supplementary feed
 Machinery parts
 Medical and Veterinary supplies
 School supplies
 Miscellaneous items
- (2) Miscellaneous items: Additional salaries not in budget
 Administrative support (consultants etc.)
 Travel (National and International)
 Insurance
 Fringe Benefits
 Special courses for personnel

Source: Developed by the author

meat processing, different quality meat will command different prices. In addition, the sale of cattle by-products will produce revenues which cannot be presently assessed. However, since it is not possible to estimate any of the true revenue break-down, for illustrative purposes, a value of \$200 revenue per animal has been accepted. This dollar value would not seem unreasonable in view of the fact that the start-up herd was estimated at \$150 per head. Accordingly, using the \$200 per head figure, Table #9-5, reflects an attempt to calculate the estimated annual revenues thus generated from years one to twenty inclusive.

- d. Profit and Loss: Logically, the initial financing of a Beef Cattle Strategy by the Aid giving countries will be easier if the eventual aim of the beef industry is the development of a self-sustaining industry. Therefore, in order to be self-sustaining a project must generate a profit. To this end, the preceding two sections were concerned with the development of the Annual Costs and the Annual Revenues, thus permitting the production of a Profit Summary, as shown in Table #9-6.

While Table #9-6, may not be accurate in terms of the true dollar values, it at least illustrates that each Ranch can be making a profit by the thirteenth year of operation. As was mentioned earlier, the cost calculations tended towards excessive expenditure and the revenue erred towards a conservative figure. However, though allowances were made for

Table #9-5:

ESTIMATED ANNUAL REVENUE
FROM
LIVESTOCK SALES

<u>Year</u>	<u>Price Per Unit</u> ⁽¹⁾	<u>Number of Head</u> ⁽²⁾	<u>Total Revenues</u>
1	200	-	-
2	200	1,000	200,000
3	200	-	-
4	200	-	-
5	200	2,500	500,000
6	200	5,000	1,000,000
7	200	11,000	2,200,000
8	200	11,000	2,200,000
9	200	12,500	2,500,000
10	200	11,500	2,300,000
11	200	19,250	3,850,000
12	200	26,750	5,350,000
13	200	33,750	6,750,000
14	200	43,750	8,750,000
15	200	58,750	11,750,000
16	200	108,000	21,600,000
20	200	200,000	40,000,000

(1) \$200 per head seems a conservative figure for the sale price of cattle which have been fattened on the feed-lot. Particularly in view of the fact that weak undernourished cattle are being sold for \$150 (see price per head of start-up herd).

(2) The estimate of the cattle available for slaughter was taken from Table #8-2.

Source: Developed by the author.

Table #9-6:

PROFIT AND LOSS SURVEY

<u>Year</u>	<u>Capital Investment</u>	<u>Annual Cost</u>	<u>Annual Revenue</u>	<u>Net Profit/Loss</u>
	(Table #9-3)	(Calculated using Table #9-4)	(Table #9-5)	
1	4,919,421	1,202,870	-	-1,202,870
2	3,600,000	1,405,077	200,000	-1,205,077
3	2,527,000	1,560,077	-	-1,560,077
4	2,527,000	1,702,577	-	-1,702,577
5	2,515,000	1,879,077	500,000	-1,379,077
6	-	2,416,295	1,000,000	-1,416,295
7	-	2,686,295	2,200,000	-486,295
8	-	2,946,295	2,200,000	-746,295
9	-	3,388,795	2,500,000	-888,795
10	-	4,023,795	2,350,000	-1,673,795
11	-	4,592,245	3,850,000	-742,245
12	-	5,360,995	5,350,000	-10,995
13	-	6,469,745	6,750,000	-280,255
14	-	7,974,495	8,750,000	-775,505
15	-	11,062,245	11,750,000	-687,755
16	-	16,919,907	21,600,000	4,680,093
20	-	17,819,907	40,000,000	22,180,093 (1)

\$16,088,421 required capital investment

\$13,014,393 will be required to cover the operating loss which will occur during the first 12 years of Ranch business.

- (1) While the profit for the 20th year appears to be \$22 million this will not truly be the case. By that point in time, much of the capital will be required for expansion and the renewal of worn machinery. However, a \$5 to \$10 million profit would be expected annually before taxes and investments.

Source: Developed by the author.

changes in the depreciation, wages, and supply changes, neither the Annual Costs nor the Annual Revenues made any attempt to consider an inflation factor.

It should be noted that Table #9-6, lists the total Capital required separately from the amount of funding that will be needed to keep the Ranch solvent during the early years. This is because it is felt that the two different amounts of money can be handled in two different ways.

- e. Capital Investment Funding: The initial Capital Investment could be provided as an outright cash grant by one of the aid donor countries. Should a nation prefer to send aid in the form of personnel or equipment, then such gifts must conform exactly to the needs of the Plan for Beef Development. Any deviation from the strategy for beef would be the 'thin edge of the wedge' and therefore not acceptable. However, this aspect of negotiating the aid requirement will not be a factor borne by either the Ranch personnel or the individual National Governments. Obtaining the necessary Capital funding will be the responsibility of a new organisation which is proposed in Chapter XI of this paper.

- f. Annual Operating Funds: A total of \$13,014,393 is required to finance the Annual Ranch operation during the initial 12 years. However, this amount could be donated by one of the

aid agencies in the form of an 'interest free loan' repayable after a twenty-year period. Again, the negotiations for this operating capital would be handled by the new organisation of Chapter XI, since the bargaining would be on behalf of all six Ranches for the entire Regional Beef Industry.

The funds required are not necessarily the true amounts which will be needed by each Ranch. The Tables showing Costs, Revenues and also the Profit and Loss Summary have been developed for illustrative purposes. However, an attempt has been made to obtain as much accuracy as possible while trying to illustrate the direction such Ranch operations will take towards the aim of a 'self-sustaining beef industry' in the Sahel.

SUMMARY

This chapter provided a most important description of the Ranch Operating Method that should be employed to implement this Plan. While it is well understood that sometimes more than one approach may be used to implement a particular scheme, the system suggested in this chapter was developed to ensure a reasonable choice at meeting all the long-term and intermediate aims suggested in chapter VIII.

CHAPTER T E N

IMPLICATIONS FOR AGRICULTURAL

AND

SOCIAL DEVELOPMENT

Sector Integration

Agricultural Development

Social Development

CHAPTER TENIMPLICATION FOR AGRICULTURALANDSOCIAL DEVELOPMENTSECTOR INTEGRATION

The recovery and future development of the Sahel beef industry is impossible without a total Range Recovery Programme coupled with good Range Management. Both are closely linked to the Agricultural sector. After all, in order to modernise cattle raising and to make it an instrument of economic development, forage crops, dry and irrigated, must be developed. But, this latter development can only be started in the Agricultural sector by up-dating cultivation methods, crop species, crop rotation and turnover. These factors would be of benefit to other segments of agricultural production besides aiding the development of a beef industry. Clearly therefore, agriculture and animal husbandry are interrelated through Range Management.

A further need for sector integration is that between Range Management, including agriculture and animal husbandry, and the Water Resource sector (see Diagram #10-1: Development Needs of Sector Integration). There is a need for more and better distribution of water-supply points for the watering of cattle and for the irrigation in agriculture.¹ However, water problems have been

Diagram #10-1: DEVELOPMENT NEEDS OF SECTOR INTEGRATION

less acute for the cattle than for the agricultural needs of fodder crop production since the cattle die mainly from hunger (pastures were too dry for digestion). Thus, water-point establishment for irrigated fodder production is possibly more important for the immediate future. Also, it is possible that there are presently enough water-points available for cattle, particularly in view of the fact that the herds have been considerably reduced.

Sector integration can be more readily appreciated as a result of the practical application of the Beef Development Strategy set forth in chapters VIII and IX. Hence, it is now possible to consider some aspects of both Agricultural and Social Development.

AGRICULTURAL DEVELOPMENT

While there is already extensive agricultural development, mainly in the more southerly wet areas of the Sahel, increased non-livestock agricultural planning can most assuredly complement the Beef industry, in addition to providing economic benefits for the farmer.

Farmers must be encouraged to plant some of the new fodder crops (see chapter VII: Cattle Feeds) which are being developed, since these give high yields in semi-desert areas. In this context, the concern should be with the new hybrid varieties of the indigenous

crops such as maize, millet and sorghum. The harvested fodder could then be sold to provide additional income. In addition, part of the crop could be insillaged for dry-season feed to be used for the farmers own cattle; mainly draft and dairy animals at present. Such fodder crop production by the farmer could be in rotation with pastures on the arable soils of the agricultural areas, and also be in sufficient quantity to eventually support a year-round cattle feed-lot. Cattle operations established in the farming areas would be along the lines suggested in chapter VIII: Feed-lot Additions. However, the needs for agricultural production will be the size limiting factor for any southern area feed-lot operation, or Ranch.

There are many advantages to be gained by having feed-lots in the southern regions of the Sahel, such as closer proximity to fodder feed supplements and to the domestic market. However, large Ranch operations to support the feed-lot may not be too practical since Ranches need room for expansion. Also, cattle are not usually the most economic product to be produced using good farm land, since there are many other agricultural products that must be grown which can not be grown in the more northerly regions.

However, the establishment of some sedentary farm area feed-lots can be justified because that would form a usefal part of the existing regional economic structure, namely, that of trading

between the nomad and the farmer. The migratory herdsmen traditionally need food grain and other crops to sustain their families. These can only be supplied by the sedentary farmer in exchange for cattle from the nomadic herds.

The location of additional cattle enterprises as part of the farm system would also allow the more effective use of the arable lands associated with all the farm regions. By this means, the present non-tillable land could be made to yield a substantial income for the farmer, while at the same time, providing added employment in a region where people want to work but have few opportunities.

SOCIAL DEVELOPMENT

The success of any plan for development is very dependant upon the involvement and commitment of both the Governments and the people.² Therefore, the beef strategy suggested involves the nomadic peoples in a most direct manner. Hence, there must be a definite plan for social development which is closely linked to both the beef strategy and the agricultural plan. The reason for special social development is simply the fact that for any plan of "modernisation, the traditional lifestyle must undergo quite a substantial change.

This section will not set out any social development

plan, but it will list the principal features of the 'traditional' society which will be changed through involvement in a modernised beef cattle industry.

1. Livestock are individually owned and they can be sold, with limits, by individuals acting independently.

Under the Ranch concept of chapter VIII, all beef cattle will eventually be owned by the group of Ranch workers. This point was clearly indicated by Table #9-1, chapter IX.

2. In contrast to the individual ownership of cattle, the natural resources necessary for cattle are not individually owned. However, there is the opportunistic exploitation of water and grazing, in the short-term, by groups.

Under the Ranch concept, the exploitation of water and grazing resources will no longer be opportunistic. The strategy of this paper showed that all resources would be carefully planned for both the short and long-term use.

3. 'Boundaries' are least flexible with large groups of people, but all are subject to seasonal change and demand pressures.

Under the Ranch strategy boundaries would no longer be flexible. Fences would serve as permanent non-flexible boundaries but the need for a seasonal change of pasture will be planned through the system of rotational grazing. The question of demand pressures will be controlled through an increase in the take-off rate for slaughter.

4. Cattle are a multiple value item which cannot be equated in monetary terms. They represent power and prestige, which are pre-requisites for marriage and adulthood.

Under the Ranch strategy, through co-operative ownership and education, cattle would take on a very specific monetary value. In addition, it is expected that the cattle would eventually lose their social importance, though it may take more than one generation.

5. The cash incentive to market livestock is fairly low, but then so is consumer demand in Africa. (3) This is, in part, a reflection of the dominant position of cattle in the scheme of values.

Under the Ranch strategy, through education, the cash incentive to market cattle is expected to increase.

6. The herd structure of the traditional nomad cattle herd is at variance with that needed for commercial beef production:

- a) The value of cattle for social exchange purposes, encourages the keeping of old and weak animals.

Under the strategy proposed, the old and weak animals would be culled from the herd in keeping with good commercial herd development practices.

- b) Cattle are generally required to meet the needs of subsistence.

The strategy will change this fact. Cattle will no longer be sold or traded for subsistence purposes. Instead, the cattle will become the most important piece in an economic mosaic.

- c) A tradition herd will carry more mature males, than would be acceptable in a commercial herd.

The strategy stressed the separation of male animals before maturity. They would go directly to the feed-lot after being weaned so that they could be marketed as soon as possible at an acceptable slaughter weight.

- d) The nomadic pastoral economy consists of many animals, tended by, and supporting many people.

In the Ranch economy, such as in the more advanced countries, few people tend many cattle. The strategy suggested a continuation of 'many cattle being tended by many people', though the quality of the herds will be considerably improved.

7. There is a traditional hostility between many of the nomadic groups which, while sometimes practical in a hostile environment, could seriously jeopardize the development of Co-operative Ranches in the Sahel.

The strategy relies on the work and understanding of the Ranch Community Manager plus the success of the Ranch education program in order to eventually eliminate inter-group hostilities.

Clearly, for intensified animal protein production in the Sahel, whether the strategy of this paper is used, or some other plan, drastic changes in the way of life of the indigenous population is mandatory; particularly, a change from a situation whereby wealth is measured by stock numbers, to one gauged by monetary returns. Such a social transformation has only been undertaken in China, nowhere else in the World and could, therefore pose problems far more difficult to solve than those associated with the technical aspects of developing a successful beef industry.

However, the specific details of the social development needs will have to be documented separately by the sociologists, who would have to be active members of the Planning Organisation to be proposed in the next chapter.

FOOTNOTES

1. This need is substantiated by the Report submitted by the Permanent Inter-State Committee on Drought Control in the Sahel. Submitted 25/Jan/1974 to the Special Sahelian Office of the United Nations, New York.
2. The Masai of East Africa are a prime example of a case where the people were not committed to the process of modernisation.
3. Indicative World Plan for Agricultural Development to 1975 and 1985, Vol. I. Published by the FAO, Rome, 1968 p. 249 ff.

CHAPTER ELEVEN

PROPOSED NEW ORGANISATION

FOR

STRATEGY IMPLEMENTATION

CHAPTER ELEVEN

PROPOSED NEW ORGANISATION

FOR

STRATEGY IMPLEMENTATION

While external aid, both in money, personnel and material is vital for the recovery and development of a beef cattle industry, these ingredients of aid are not adequate by themselves to ensure success. In theory it may be an easy matter to provide huge amounts of aid, but without local commitment and involvement, any scheme would be doomed to failure before it could even begin. In the past, many development ideas have been started in a number of developing countries, but when aid flows ran dry, or were reduced the project died. This has even happened in the field of beef cattle development in Africa when the early Kenya experiment is considered. The first Kenya project for beef cattle ran for ten years, from 1953 to 1963, but instead of developing a viable and self-sustaining beef industry, at the end of the project period the entire scheme disintegrated. The Kenya project was aimed at the semi-nomadic pastoralists of the arid and semi-arid areas with the idea of developing a more rational use of rangeland through regulated grazing and stock control. The Kenya scheme may be considered to have been technically successful, but the ideas failed because they were not fully understood and supported by the Masai herdsmen, the very people the scheme was designed to help.

It may be possible to develop a beef industry in the Sahel without many of the nomadic herdsmen being involved. However, it must be remembered that all the economic development schemes must be for the benefit of the people in the respective countries. In addition, the external aid donor nations cannot be expected to continue pouring assistance into a country's programme of development if it is on project for which assistance would have to be continued 'ad infinitum'. Thus, any project must contain the aim of eventual self-sustainment. To this end, there must also be local population involvement and commitment. This latter point can best be brought about by having the support of the National Government. In essence therefore, it might be said that the key to any success must be Government agreement.

In the Sahel countries, this commitment will be hard to obtain if all six nations attempt to develop their own beef industry in isolation, without the co-operation of their neighbours. At this time a number of projects for livestock development are under consideration by both the Governments of the Sahel countries and the external financial agencies. However, the thrust and objectives of these projects vary considerably and are even contradictory in some instances (see discussion of chapter I).

In order to have a significant impact on the economies of the individual Sahel nations, chapter VIII, set forth the outline

of a total regional strategy for beef which would encompass all six Sahel countries. It should be noted that the beef strategy is just one of the sectors which can benefit from the total regional approach. To ensure the significant impact on the region and to ensure commitment and full cooperation of both the Governments and the people of the Sahel, including the coordination of the aid agencies, the following new Regional Organisation is seen as the first step:

"Organisation for Range Management of the
Sahelian Countries."

The new organisation must not be too large or cumbersome, despite the name. But, it must have the authority to act and make decisions on behalf of the individual Governments. Without such 'authority to act' it cannot be considered as being 'responsible' for anything, and thus, it would rapidly deteriorate into just another bureaucratic organisation.

The broad aims of the new organisation would be as follows:

1. To reclaim and/or develop all the pastureland available to the countries of the region.
2. To propose and implement a long-term regional strategy to develop and stabilise the livestock industries for the social and economic benefit of the nomads and the individual nations.
3. To provide a solidly based livestock industries organisation which will withstand the recurring drought.

It should be noted that the organisation name does not include the term 'livestock', but instead uses the more all-encompassing term of 'Range Management'. The reason is that while this paper has been concerned with beef cattle development, the beef industry is just one part of the livestock industry. Besides which, it was shown in chapter X, that beef cattle cannot be developed without the cooperation of some other sectors of the Sahel economies. Thus, at the supranational level, this proposed new organisation would consist of several committees, the Beef Cattle Committee being but one. (see diagram #11-1). The three Committees (Dairy cattle, Beef cattle and Other livestock) at the supranational level will permit regional co-ordination and rationalisation of the Support Group Services.

It will be noted that at the top level there is a "Finance and Administration Coordination Unit". It is envisaged that this unit will be responsible for the collection and disbursements of all forms of international aid which are related to all phases of Range Management. Disbursements would be made according to the project requirements of each Committee working with the Support Group.

Ideally, all the present plans for short-term livestock development should be brought to a halt. Then the entire

Diagram #11-1:
ORGANISATION FOR RANGE MANAGEMENT OF THE SAHEL COUNTRIES

region could be carefully planned and co-ordinated for all three livestock sectors. A period of two years should be adequate for the preparation, co-ordination and funding of a fully integrated development scheme. Such an integrated scheme must plan on the development of a self-sustaining beef industry within a period of about fifteen years (the strategy of chapter VIII shows that this would not seem an unreasonable target).

Once a self-sustaining beef industry has been established, in conjunction with a similar objective for the other Committees, this new organisation would be rendered obsolete and thus could be disbanded. However, at that point in time it could be replaced by a Regional Corporation. The Corporation would then assume total responsibility for the profitable commercial operation of a Regional Livestock Industry reporting only to a Committee of the National Governments.

It would seem clear enough that a supranational Beef Cattle Committee is the obvious way to ensure the cooperation of the aid donor agencies and the Governments of the aid receiving countries, such a Committee must also be active in the 'field', close to where the action is taking place. To this end, it is proposed that this Regional Organisation would have six National Offices, one in each of the Sahel countries. The National Offices would be composed of a number of Specialists working in a close-knit team organised as shown on diagram #11-2.

Diagram #11-2:

NATIONAL OFFICE ORGANISATION

- (1) Both the Dairy Projects section and the Other Livestock Projects Unit would have the same two-section breakdown as is shown for the Beef Projects Unit, and much the same staff org.
- (2) Specialists from the Support Services Section would work with the Projects Units as and when required.
- (3) There may be more than one Specialist for a particular phase of work depending upon the volume of research or analysis that must be undertaken. The main reason being that in the Planning Sections time will be of the essence.

The Planning Section of each unit would be responsible for the primary analysis of the specific conditions as they apply to the individual country. From their analysis, in consultation with the other National Offices, it would be possible to formulate a Regional Plan which would also list the feasibility calculations for the projects as they pertain to each country. Hopefully, such a Regional Plan could be completely developed in 18-24 months, hence, the earlier suggestion in this chapter that, "Ideally, all the present plans for short-term livestock development should be brought to a halt". At the end of 24 months, the new "Organisation for Range Management of the Sahel Countries" would be in a position to present a fully integrated Regional Livestock Plan for all six Nations. With the inclusion of realistic cost and benefit information, total agreement and commitment could be obtained from both the Governments and the aid donor agencies.

Once the Plan has been fully endorsed, the Implementation Sections of each National Office would be formed to assume complete responsibility for the Plan's successful implementation. The personnel for both the Planning Section and the Implementation Section should be Sahel nationals as far as is possible. Nonetheless, qualifications and ability must not be sacrificed to achieve this desirable increased African involvement in the Planning Section. However, it is very probable that the Implement-

ation Sections will have a higher percentage of well-trained Africans than would the Planning Sections. This would be a beneficial fact for the nations involved since these same people could readily be absorbed into the profit-making Regional Live-stock Corporation.

As was the case with the Strategy of chapter VIII, which was purely theoretical until some facts and figures were included in chapter IX. So with the new Regional Organisation for Range Management. Thus, Table #11-1, details the approximate operating costs of both the Organisation Headquarters (\$805,000 per annum for five years) and the six National Offices (\$937,000 per annum per country for two years). These costs must be considered as Planning costs and should not be charged to the development of the three livestock sectors so covered.

This cost of the new organisation is over \$15 million, which may appear to be high. However, this is not a high price to pay if the overall long-term benefits of such a body is considered. Funding for all livestock projects would be coordinated thereby reducing waste. The coordination and rationalisation of all research would be of great benefit, because qualified people for research and development within the continent of Africa are still a scarce commodity.

Table #11-1:

ESTIMATED ANNUAL COSTS
OF THE
REGIONAL RANGE MANAGEMENT
ORGANISATION

HEADQUARTERS

U.S. Dollars

Director	50,000
Assistant Director; 2 secretaries; 2 Aides	65,000
Beef Cattle Committee:	
Chief; 2 assistants; 2 secretaries	100,000
Dairy Cattle Committee: (as for Beef committee above)	100,000
Other Livestock Committee (as for Beef committee above)	100,000
Support Services Committee:	
Hydraulic Resource Team	60,000
Pasture and Feed Team	60,000
Veterinary Service Team	60,000
Social Service Team	60,000
Miscellaneous costs	50,000
	290,000
Office equipment, vehicles, travel and misc.	100,000
	<hr/> 805,000

NATIONAL OFFICES

Director	45,000
Chiefs: 4 x 35,000	140,000
Specialists: 16 x 30,000	480,000
Administration Section: Chief and Assistant	50,000
Secretaries and Miscellaneous personnel	72,000
Office equipment, vehicles, travel and misc.	150,000
	<hr/> 937,000

Source: Developed by the author

CHAPTER TWELVE

SUMMARY AND CONCLUSION

CHAPTER TWELVE

SUMMARY AND CONCLUSION

The Thesis presented herein, dealt with two ideas which were shown to be very closely related. First, the Multi-national Ranch system was proposed as a method for developing a substantial beef cattle industry, the benefits of which could accrue, in some degree, to all the countries of the Sahel. The second idea concerned the retention of some of the nomadic traditions, though it is hoped that their traditional value system (cattle as a sign of wealth) could gradually be changed.

Clearly, the easier of the two ideas to consider was that of the Ranch system as shown in chapter VIII. This aspect of the Plan really lies in the development of a technically feasible method which would enable cattle to improve according to the aims set down "The Aims of the Beef Cattle Development Strategy" (see chapter VIII). In the technical realm of the Plan a fully integrated Ranch operation was detailed to include the research suggested from chapter VII. The Ranch Plan included the full spectrum of the items which must be examined for the successful implementation of a self-sustaining beef cattle enterprise. Such items as:-

1. Ranch Site Selection
2. Development of grazing sections - fencing, grazing; stocking-rate, water, forage, production, forage management and fodder production.

3. The Herd - composition, breeding, calving, mortality and slaughter.
4. The Feedlot Operation - location, construction, stock capacity, water, feed types and feed balance.
5. The Abattoir Operation - location, operation, markets and benefits.
6. Transportation Modes - Road, air and other modes of transportation.
7. Disease control.
8. Employment of Nomads
9. Long-term possibilities - additional Ranches, Ranch expansion and feedlot additions.

In line with the details of the Plan, certain economic linkages were mentioned, and many financial aspects were calculated for the purposes of illustration. However, on this latter point, it should be emphasised that the tables of financial data were developed with as much accuracy as is possible short of being in the Sahel.

When dealing with the second idea, the 'nomadic traditions', while many of the nomadic attitudes were viewed as having to change (see chapter X), some vital traditional factors were to be retained.

- Primarily, of course, the idea of permitting the nomads to continue doing what they know best, 'caring for cattle'. However, another vital tradition was also retained, their value system and the 'ownership of cattle'. But, while the method of implementing the Plan of chapter VIII was stated in chapter IX, it will have been noted that it did include the gradual introduction of the nomadic workers to a different value system, that of money. In addition, while introducing

a monetary idea, considerable stress was placed upon the opportunity and the eventual benefits of some form of education. It was further intended in chapter IX, that the fact of an education and the working together could do much to reduce and eventually eliminate the traditional tribal hostilities. Only through education, monetary ideas and the disappearance of tribal hostilities will the question concerning the operation and the subsequent Ranch ownership be transformed to a co-operative system.

In summary it may be said that this document was divided into three clearly defined sections. The first part, consisting of chapters II through VI inclusive, dealt with the problems, both past and present, of the countries which compose the area known as the Sahel. The second part, consisting solely of chapter VII, was concerned with a review of the research literature which could prove helpful in the Sahel.

Having defined the problems and reviewed the research, it was then possible, in the third section, chapters VIII to XI inclusive, to present some aims and objectives for a Beef Cattle Development Plan. Once these aims were specified, an involved Plan for Beef Cattle Development was presented in chapter VIII, with chapter IX being concerned with the actual detailed steps for successful Plan implementation. However, while the development and

implementation of a Plan could be considered as being relatively straightforward, the implications of such a Plan could not. Thus, chapter X had to provide some clarification concerning the implications of the Plan as they pertained to agricultural and social development. Chapter X also showed that no Plan can be conceived entirely divorced from the other sectors of the economy. In other words, all segments of a country's economies must interrelate with each other. Therefore, chapter XI proposed a new organisation so that all the relevant economic sectors could be planned together, thereby ensuring the joint development of all sectors.

In conclusion, it should be mentioned that the Plan, herein presented, is not necessarily the best answer to the question of Beef Industry Development in the Sahel. It is a solution to the situation, as indeed were the studies reviewed in chapter I. However, this proposed Plan was based on a different concept to those reviewed. 'Management by Objectives' was the conceptual framework used to develop and set forth a system whereby a self-sustaining multi-national beef industry could be developed. This was not a Plan for a demonstration model of what might be achieved. This document presented a Plan for a large scale working example, with very specific inputs and expected results.

The expected results were seen as being the employment of 42,000 families (250,000 people) directly in the Ranches, with a minimum of 1.2 million head of beef cattle being slaughtered for market annually by the twentieth year.

Concerning the inputs, the total investment for the Ranch system covering the entire Sahel cattle region would be of the order of \$96.5 million. There would be a further amount of \$48 million in repayable loans. While these two amounts may seem high if one considers that only about 250,000 people can be shown to be obtaining a direct benefit. However, as was pointed out in chapter VIII, there are many Economic Linkages which would lead to many more thousands benefitting indirectly. Unfortunately, this latter group cannot be estimated as yet.

In addition, the establishment of a second generation of Ranches will not be nearly so costly as the first six, since the stock and expertise will be readily available from within the Nations of the Sahel. Besides which, the then established Ranches will probably be generating enough funds (see Table #9-2, chapter IX) to provide the necessary capital to finance a second generation of Ranches through the work and co-operation of the Inter-State Regional Livestock Corporation (see chapter XI).

To conclude, though all the aims and objectives of the Plan have been taken care of in the implementation method, it must

be stressed that 'time and patience' are really the main ingredients for success, and that at no time must these two factors be ignored. It is better to delay the co-operative move and permit the nomads to keep some private cattle, than to rush the profit-sharing idea. Failure to carefully consider the nomadic families at every point could leave each Ranch vacant with no workers,

'just another monument to another
Development Plan which did not
work as anticipated'.

BIBLIOGRAPHY

4

4

OF/DE

4

4

OF/DE

BIBLIOGRAPHY

BOOKS

- Ahn, P.A. West African Soils (3rd edition), Oxford University Press, London, 1970
- AID AID Economic Data Book for Africa, Washington
- Allan, W. The African Husbandman, Barnes and Noble Inc. New York, 1965.
- Brokensha, D. and Pearsall, M. The Anthropology of Development in Sub-Saharan Africa, University of Kentucky Press, Lexington, 1969.
- Davies, W. and Skidmore, C.L. Tropical Pastures, London, 1966
- Digby, M. Agricultural Co-Operation in the Commonwealth, Basil Blackwell, Oxford, 1970.
- Edwards, R.A., Animal Nutrition, Oliver and Boyd, Edinburgh, 1973.
- Greenbaugh, J.F.D.,
McDonald, P.
- FAO Agricultural Commodity Projection, 1970-1980, Rome, 1971
- FAO/WMO/
UNESCO A Study of the agroclimatology of the semi-arid area south of the Sahara in West Africa, an interagency project on agroclimatology, Rome, 1967.
- FAO Better Farming Series, Rome, 1970
- FAO Indicative World Plan for Agricultural Development to 1975 and 1985, Regional Study No. 3, Africa South of the Sahara, Vol. 1, Rome, 1968.
- FAO Types and Breeds of African Cattle, Rome, 1957.
- Forget, M.,
Galloy, P.,
Vincent, Y. Nomads et Paysans D'Afrique Noire Occidentale, University of Nancy, 1963.
- Gauthier, E.F. Sahara - The Great Desert, London, 1970
- Hopen, C.E. The Pastoral Family in Gwandu, Oxford University Press, London, 1970.

- Howells, W. Back of History (Revised 3rd Edition), Doubleday and Co. Inc., New York, 1963.
- ILO Labour Force Projections - Africa, Geneva, 1971
- IMF Surveys of African Economies, (3 volumes), Washington, 1968, 1969, 1970.
- Jain, S.C. Agricultural Development of African Nations, (2 volumes), Vora & Co. Publishers, Ltd., Bombay, 1965 & 1967.
- Jensen, R. and MacKay, D.C. Diseases of Feedlot Cattle, Leu & Febiger, Philadelphia, 1971
- Johnson, H.G. Economic Nationalism in Old and New States, University of Chicago, 1967.
- Kendren, W.G. The Climates of the Continents, Clarendon Press, Oxford, 1961.
- MacEachern, G.A. The Economics of Beef, Agricultural and Economic Research Council of Canada, Ottawa, 1973.
- Making, S.M. Agricultural Problems of Developing Countries in Africa, Oxford University Press, Lusaka, 1967.
- Marbut, C.F. and Shantz, H.L. The Vegetation and Soils of Africa, (1971 Reprint), AMS Press, N.Y. 1923.
- Mason, I.L. The Classification of West African Livestock, Commonwealth Agricultural Bureau, Slough, Bucks, 1951.
- McDonnell Improvement of Livestock Production in Warm Climates, W.H. Freeman and Co., San Francisco, 1972.
- McLoughlin, P.F.M. Agriculture in East and Central Africa - An Overview, Kenya Litho Ltd., Nairobi, 1970.
- Milford, R. and Minson, D.J. Tropical Pastures, Faber and Faber, London, 1966.
- Morris, R. and Sheets, H. Disaster in the Desert - Failures of International Relief in the West African Drought, Humanitarian Policy Studies, The Carnegie Endowment for International Peace, Washington, 1974.
- Mosher, A.T. Creating a Progressive Rural Structure, Agricultural Development Council Inc., New York, 1969.

- Payne, W.J.A. Cattle Production in the Tropics, Vol. 1 - Breeds and Breeding, Western Printing Services Ltd., Bristol, 1970.
- Persson, S. and Sjöberg, K.E. Cattle Production in Africa, College of Agriculture, Sweden, March 1974.
- Phillips, J. Agriculture and Ecology in Africa, Faber and Faber, London, 1959.
- Phillips, J. The Development of Agriculture and Forestry in the Tropics - Patterns, Problems and Promises, London, 1961
- Rouse, J.E. World Cattle, University of Oklahoma Press, 1970
- Sauer, C.O. Agricultural Origins and Dispersals, Bowman Memorial Lectures, American Geographic Society, 1952. also 2nd Edition by M.I.T. Press, Boston, 1969.
- Stenning, D.J. Savannah Nomads, Oxford University Press, London, 1964.
- Topps, J. Animal Feeds of the Federation, University College of Rhodesia, 1961
- Toynbee, A.J. A Study of History, Oxford University Press, London, 1947.
- Trewartha, G.L. The Earth's Problem Climates, University of Wisconsin Press, Madison, 1961
- Wilde, J.C. de Experience with Agricultural Development in Tropical Africa, Vol. 1, 1967. John Hopkins Press, Maryland
- WMO A Survey of Studies in Meteorology and Hydrology in The Sudano-Sahelian Zone of West Africa, Geneva, 1974.
- Yorgason, V.W. Canada's Livestock - Meat System, Agricultural and Economic Research Council of Canada, Ottawa, 1973.
-

REPORTS

- AFRICAIRE A Water Resource Development/Well Construction Program in the Sahel. Washington, June 1974.
- CILSS Report of the Permanent Inter-state Committee on Drought Control, Ouagadougou Conference, Sept. 1973. Report published Jan. 1974. (123 project proposals).
- ECOSOC Consideration of the Economic and Social Situation in the Sudano-Sahelian Region Stricken by Drought and Measures to be taken for the Benefit of that Region. Report of the Secretary-General to the 57th Session of ECOSOC, June 1974.
- ECOSOC The International Development Strategy: First overall Review and Appraisal of Issues and Policies. Preliminary Report of the Secretary-General to Committee for Development Planning, 9th Session, 2/13th April, 1973. Published March 1973.
- FAO East Africa Livestock, Rome, 1967
- FAO Evaluation of Soil Resources in West Africa, Report of Regional Seminar in Kumasi, Ghana, 14/19th Dec. 1970.
- FAO and WHO Meat Hygiene and Abattoir Management, Kenya, 1966.
- FAO Report of the 3rd FAO Meeting on Livestock Production in the Americas, Rome, 1955.
- FAO Report of the 6th Regional Conference for Africa, Algeria, 19 Sept. - 3 Oct. 1970.
Report of the 7th Regional Conference for Africa, Gabon, 14/30 Sept. 1972.
- F.E.D. Etude sur la situation actuelle de l'élevage dans les pays du Sahel et des mesures de sauvegarde à envisager. Rapport par Fonds Européen de Développement pour le Commission des Communautés Européennes. February, 1974.
- IBAH 13th Annual Report, 1964, of the Inter-African Bureau of Animal Health.
- IBRD Dynamic of Livestock Production in Sub-Saharan Africa, Sept. 1970. Report by J.F. Franson, R.H. Khouri and R. Milford.

IBRD World Beef Prospects, Report dated May 1974.

Lever, B.C. Agricultural Extension in Botswana, Development Studies #7, February 1970.

Rockefeller Foundation Conference on the Sahel, New York, August 1974

Rockefeller F. Working papers of the Conference on International Development Strategy for the Sahel, Bellagio, Italy, Oct. 1974. Published May 1975.

Rockefeller F. Proposal for an International Laboratory for Research on Animal Diseases, May 1972.

S.E.D.E.S. Projet de modernisation de l'élevage en zone Pastorale - République du Niger, Paris, July 1973.

Stryker, D. Livestock Production and Distribution in the Mali Economy, AID, August 1973

ST/SSO/1/Rev. 1 Towards a Strategy for Development in the Sahelian and Sudano-Sahelian Zones. October 1973

ST/SSO/7 Final Report on the Meeting of the Sudano-Sahelian Mid and Long-Term Programme. Report prepared for the Geneva Meeting 28/29 June 1973.

ST/SSO/9 Agriculture - Outline Analysis of the Agriculture Problem Area, Sudano-Sahelian Zone, November 1973.

ST/SSO/10 Livestock - Survey of the Range Recovery and Animal Production Sector in the Sudano-Sahelian Zone, November 1973.

ST/SSO/11 Water Management, November 1973

ST/SSO/12 Foreign Trade, November 1973

ST/SSO/13 Transportation, November 1973

ST/SSO/14/Rev. Education, January 1974

ST/SSO/15 Public Health, December 1973

ST/SSO/16 Industry, December 1973

ST/SSO/18 The Response of Pastoral Nomads to Drought in the Absence of Outside Intervention, Dec. 1973

ST/SSO/19 Meteorological and Hydrological Services, Jan. 1974

ST/SSO/20 Outline Analysis for Mining Sector, Feb. 1974

ST/SSO/21 Human Resource, Feb. 1974

ST/SSO/22 Energy, March 1974

ST/SSO/23 Social Institution, March 1974

ST/SSO/25 Tourism, April 1974

PAPERS

AERCC A Review of Agricultural Policy in Canada, Ottawa, 1966.

Brumby, P.J. International Financing for Livestock Development, 21/Sept./1972

Brumby, P.J. Some Economic Aspects of Tropical Pasture Improvement

FAO Prospects for Production, Marketing and Trade in Livestock and Livestock Production in East Africa to 1985.

IBRD Proposal for a Co-operative Effort to Rationalize the Livestock Industries of the Sahel. Presented at the Sahel Conference, New York, August 1974.

Mbilinyi Agricultural Research Problems in East Africa, University of Dar Es Salaam, Sept. 1972.

Pino, J.A. Discussion Paper on Livestock Production in Tropical Africa, for the Bellagio IV Conference, 1970.

Rockefeller F. Strategies for Agricultural Education in Developing Countries. Conference discussion paper Oct. 1974 reported in Dec. 1974.

- S.E.D.E.S. Supplying Middle-West Africa with Meat,
Paper presented to Société d'Etudes pour le
développement économique et social, Paris, 1969
- Sprague, H.D. A comprehensive system for recovery and re-
construction of agriculture in the six drought
stricken West African countries, 1974
- Schaefer, M. Conserving fodder and building-up fodder reserves,
Paper presented at the 2nd Meeting of the FAO
working paper on Mediterranean Pasture and Fodder
Development, 1953.
- SSO Consideration of the situation in the Sudano-
Sahelian Region stricken by drought and the
medium and long-term measures to be taken for
the benefit of that region, June 1974.
- SSO An approach to recovery and rehabilitation of
the Sudano-Sahelian Region, 1974.
- Texas Tech. U. Ranching/Mixed Agriculture Programme in Niger,
presented at the Sahel Conference, New York,
Aug. 1974 printed in Lubbeck, June 1974.
- UNDP Country & Intercountry Programming
-DP/GC/NER/R.1	Niger	1972-76	29/Nov/1973
DP/GC/CHD/R.1	Chad	1972-76	1/Dec/1971
DP/GC/MLI/R.1	Mali	1974-76	29/Oct/1973
DP/GC/UPV/R.1	Upper Volta	1972-76	30/Mar/1973
DP/GC/SEN/R.1	Senegal	1974-76	1/Sep/1973
- Environment Agency Cattle Feedlot and the Environment, presented
at the U.S. Environment Protection Agency,
Washington, April 1972

PERIODICALS - ANNUAL

- Legum, C. Africa Contemporary Record, London
- FAO Animal Health Yearbook, FAO/WHO/OIE, Rome
- FAO Commodity Review and Outlook, Rome.

EDIAFRIC	<u>Memento de l'economie Africaine</u> , Paris
FAO	<u>Production Yearbook</u> , Rome.
FAO	<u>Trade Yearbook</u> , Rome.
FAO	<u>Yearbook of International Trade Statistics</u> , Rome
IBRD	<u>World Bank Atlas</u> , Washington, D.C.
Jakane, L.K.	<u>West Africa Annual</u> , Lagos
UN	<u>Statistical Yearbook</u> , New York.
UN	<u>Survey of Economic Conditions in Africa</u> , New York.

PERIODICALS - TWICE ANNUALLY

	<u>African Social Research</u> , Zambia
FAO/ECA	<u>Agricultural Economic Bulletin for Africa</u> , Addis Ababa.

PERIODICALS - QUARTERLY

AID	<u>Development Digest</u> , Washington, D.C.
CJAS	<u>Canadian Journal of African Studies</u> , Montreal.
Rhodesian Dept. of Agric.	<u>Rhodesian Agriculture Journal</u> , Salisbury.
FAO	<u>World Animal Review</u> , Rome.
IBED	<u>Bulletin of Epizootic Diseases of Africa</u> .

AUSTRALIA

Australian Journal of Experimental Agriculture
and Animal Husbandry.

PERIODICALS - BI-MONTHLY AND WEEKLY

African Confidential (bi-monthly)

FAO -

CERES - Review on Development (bi-monthly)

Africa, Paris. (twice weekly)

THE DAILY PRESS AND PRESS RELEASES

Daily

Christian Science Monitor

Citizen

Globe and Mail

New York Times

Washington Post

Press Releases

Food and Agriculture Organisation

United Nations

World Food Programme

END

1003 17

FIN