

PREFACE

At the suggestion of Anne De Lattre, Secretariat of the Club Du Sahel, an international organization whose function is to improve economic relations between Sahelian countries, as well as with the international community, I devoted myself upon a study of the role of food production in the economic development of the Sahel. Food production is a topic of central importance to the region; many of the problems influence its performance and the performance of the sector that will ultimately determine the Sahel's future.

THE ROLE OF FOOD PRODUCTION
IN THE
ECONOMIC DEVELOPMENT
OF
WEST AFRICA'S SAHEL REGION

A Thesis by

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Submitted to the Department of Economics,
Washington and Lee University
in partial fulfillment of requirements for Departmental Honors
15th May 1988

Approved for the
Economics Department

Instead I have focused on the current state of food production, preferring to show why and where improvements are needed and not why and if they are adopted. It is hoped that a description of the state of food production, will convey a sense of the way interdependent problems confronting the Sahel must be approached for development.

I would like to thank John Gunn for his advice and a steady influence

PREFACE:

At the suggestion of Anne De Lattre, Secretariat of the Club Du Sahel, an international organization whose function is to improve communication and cooperation among Sahelian countries, as well as with the international community, I decided to embark upon a study of food production in the Sahel. Food production is a topic of central importance to the region; many diverse factors influence its effectiveness, and it is the performance of this sector that will ultimately determine the Sahel's future.

In presenting this subject, I have shied away from detailed discussion of complex growth models and empirical verification of different elasticities in the agricultural sector. I have also refrained from presenting a detailed exposition concerning theories of different types of economic growth. In this sense, it might be argued that the draft suffers from a dearth of "economic analysis". My only justifications are that the esoteric nature of the material and personal predilections of the author occasioned this outcome.

Instead I have focused on the current state of food production, preferring to show why and where improvements are needed, and not why and if they are adopted. It is hoped that a panoramic view of the state of food production, will convey a deeper sense of the many interdependent problems confronting the Sahel, and its prospects for development.

I would like to take this time to thank John Gunn for providing guidance, reassurance, and a steadying influence

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Summary:

The Sahel area of Africa remains one of the less developed areas of the world. In the past twenty years the region has experienced two severe droughts, which have left the region at the point of economic and ecological disaster. The reader might accurately conclude, that if the Sahel was left to its own devices, development would indeed not occur. Judged internally, there remains tremendous need for aid, but the amount of such aid is beyond the scope of this paper. Instead, the paper constitutes a case study in food production, undertaken in the context of an area facing serious economic and developmental problems. Periodic difficulties arising from the region's idiosyncratic climate will always be a menace to development; without a doubt, drought will return to the area sooner or later. Although the exact effect of drought upon the cultivation and production of crops remains unknown, its arrival in the Sahel in recent years has also brought famine. At this time, one of nature's most damaging pests, the locust, also confronts the area threatening to destroy much its staple food crop. World response to this latest threat has been brisk and effective, owing in large part to the region's visibility since its last famine. Nevertheless, the menace of natural disaster constantly hangs over the region, imposing constraint on all development plans.

Working within the context of an unforgiving climate as well

as other natural hindrances, development planners face an arduous task in returning the people of the Sahel to a minimally comfortable standard of living. As recently as the early 1960's the region was in fact self-sufficient, and the specter of famine was not nearly as great. Current examination of the region's water, land, mineral, and human resources, however, reveals a corresponding pattern: a continual underutilization of existing resources. The lack of exploitation is a result of both an inability to fully develop their potential resources, as well as from mismanagement of current resources. The Sahel still has yet to scratch much of its economic capacity.

In terms of output, the region's rainfed crops, which produce nearly 95% of its food, have been a disappointment. Unless improvements in output are shortly forthcoming, cereals imports will continue to increase, making any hopes for self-sufficiency and a satisfactory standard of living highly improbable. Irrigated agriculture holds the promise of mobilizing the water supply potential, and of enhancing food security in the Sahel. Yet because of high costs, difficulties of implementation, and maintenance and management requirements, most rural Sahelians still view irrigated agriculture as a "mixed bag" at best. As such, its potential still remains far from developed.

Livestock production is now in a state of crisis in the Sahel. In the past, livestock production has been effective in pastoral areas, but production has declined as a result of the

drought and resource degradation. Safeguarding and improving forage potential remain major concerns. As is the case with irrigated agriculture, maritime and inland fisheries could be an important source of food, but they have been poorly exploited. Much of the Sahel's productive ability, therefore, lingers as unused capacity.

An unforgiving climate helps explain much of the underutilization of the Sahel's other resources. As of yet, climatic forecasts for the region are still plagued with uncertainty, so that annual or seasonal predictions for Sahelian rainfall cannot be regarded with confidence. When considering the Sahelian environment climate must be treated as a variable, not a constant. Desertification prevails as a prime example "of conflict between the public interest in long-term resource use, and private short-term resource abuse."¹ If desertification is to be arrested, policy makers must focus more attention upon human behavior which is alterable.

Problems associated with implementing new farming methods and techniques in rural areas also limit development. The communal system of land tenure has been labeled by some, as the main reason farmers refuse to invest in the land, and instead allow it to deteriorate. But in fact, communal land holding laws suit parts of the Sahel better than individual ownership, and their overall effect upon farming output is multi-faceted.

The Sahel's dry sandy soil prevents many areas from implementing animal traction; instead, hoe cultivation is often a

more profitable alternative. Where its use is economically sound, however, farmers have indeed been receptive to the adoption of traction. Rural Sahelian farmers do maximize their own welfare; they adopt those techniques best suited for their own survival.

The Sahel's soil and climate also prevent ready multiplication of the green revolution from occurring in Africa. Although the green revolution has not been an unqualified success, much of the future improvements in food production in the Sahel need to arise from the use of better seeds. But because they are still risky to use, many Sahelians resist the more drought resistant varieties, preferring to use instead their old staples. Hopefully, much more determination and effort from Sahelians and the international community, should eventually overcome such temporary barriers, and shorten the time for gains in food production.

But poor performance in agriculture has not resulted only from unfavorable climatic conditions. At times, it has often been the Sahelians themselves, with the misguided help of donor agencies, that have stalled progress in agriculture. Maintaining a stranglehold over the productive sector, Sahelian governments have pursued inappropriate pricing and marketing policies of agricultural output. Numerous disincentives to the rural sector coupled with a strong urban bias, have limited the profitability of Sahelian agriculture. Low profits result in low output.

Trying to implement development from the top down, donors

have also recommended inappropriate policies for agriculture, which have worsened the situation. After the first drought, for example, many donors funded the digging of costly, mechanized wells aimed at improving water security. After a few years, not only were many wells allowed to remain in disrepair for lack of spare parts, but it also became evident that the wells inadvertently helped escalate the desertification process. By attracting large numbers of animals, the wells concentrated demand for water and food; this led to resource abuse, which spurred along desertification.

One must not forget, therefore, that the Sahel comprises a fragile ecosystem within an area of scarce resources. Much care and understanding, that is to say "good government", is needed if these sparse resources are to be properly exploited. But in the past few years good government has been one of the resources in shortest supply in the Sahel! The food problems of the Sahel have been partly the result of both the underutilization of potential resources, and the poor management of the resources that do exist, through misguided government action. Better use of resources will only result from better government. Greater consistency between development objectives and practices, and clearer dialogue between Sahelian countries and donors, will ultimately provide better government.

The challenge for the Sahelians and the international community, then, is to overcome the problems of food deficits, desertification, and population growth. A great deal of

expenditures of time, effort, and resources are needed before the Sahel can hope to achieve a minimally comfortable standard of living for its inhabitants. With continued perseverance and dedication this goal is attainable. The possible long-term benefits outweigh any present costs.

Excluding a possible war, the most serious obstacle to the existence of so many of the world's people as the present is hunger and starvation. Hunger is defined as a strong craving for food or a specific nutrient; a weakened condition brought about by a prolonged lack of food.² Malnutrition is one form of hunger and may result from either a lack of food, or from a physical condition that prevents proper digestion of food and nutrients, or from over-consumption of calories. Depending upon a person's body weight and level of activity, a daily intake of around 2000 calories could provide "adequate nutrition."

The most common manifestation of hunger is kwashiorkor, a condition whose central affliction is protein deficiency, sometimes complicated by deficiencies of specific nutrients. When malnutrition does exist, it can give rise to a variety of symptoms (protein-deficiency disease is characterized by edema, stunted growth, and a variety of other symptoms). The individual who suffers from kwashiorkor has a very low level of energy and is unable to perform any work. The individual who suffers from kwashiorkor has a very low level of energy and is unable to perform any work.

I. INTRODUCTION

Why is the food of the people so scarce?
...Where does the blame lie? I have been
unable to attain a proper balance between
important and unimportant affairs. Let
this matter be debated... Let all exhaust
their efforts and ponder deeply whether
there is some way to aid the people.
Edict of Emperor Wen on the primacy of
Agriculture (163 B.C.)

Excluding a nuclear war, at this time nothing endangers the existence of so many of the world's people as the continuance of hunger and starvation. Hunger is defined as a strong craving for food or a specific nutrient; a weakened condition brought about by a prolonged lack of food.² Malnutrition is one form of hunger and may result from either a lack of food, or from a physical condition that prevents proper digestion of food and nutrients, or from over-consumption of calories. Depending upon a person's body weight and level of activity, a daily intake of around 2200 calories could provide "adequate nutrition."

The most common manifestation of hunger is chronic undernutrition; a condition whose central affliction is food-energy insufficiency, sometimes complicated by deficiencies of specific nutrients. When malnutrition does exist, it can give rise to kwashiorkor (protein-deficiency disease marked by bloated bellies and glassy stares) and marasmus (shortage of both protein and calories). Over a long period of time, any individual who constantly consumes fewer calories and less protein than his body

needs suffers chronic undernourishment. Eventually this person, especially a child, is so weakened that his energy level, resistance to disease, and productivity all decline.

One of the multiple ills associated with hunger and chronic undernutrition is the staggering toll it extracts in human life. Each year hunger induces 13-18 million deaths, which amounts to 35,000 daily worldwide, or 24 people every minute. Children under five years of age account for 75% of these deaths. Any other known disaster pales in comparison to the devastation hunger causes. In the last two years hunger has caused more deaths "than World War I and World War II combined" and the number of people who die every two days of hunger and starvation "is equivalent to the number who were killed instantly by the Hiroshima bomb."³

Yet these figures often remain unreported and little noticed. For the most part the persistence of world hunger occupies the back-stage of the lives of citizen's of the advanced nations. Since hunger is a constant condition that slowly kills millions, day in and day out, a large section of mankind has become inured to its effects. Although one writer has termed this attitude "compassion fatigue," ignorance and indifference also play their part. Only when famine-a severe food shortage or period of extreme scarcity of food-strikes a region, is hunger's suffering newsworthy. Because it is out of the ordinary famine makes the "news". In such instances, human distress is so acute that it cannot be ignored; in such times, a usually indifferent

world will mobilize to ameliorate suffering.

THE SAHEL FAMINE

Certainly the images of the recent famine in Ethiopia and the world's relief efforts are unlikely to pale soon from remembrance. Another area of sub-Saharan Africa prone to famine is the Sahel zone of the Sahara desert. This region of West Africa experienced a dreadful famine from 1969-73, a famine which ranks as one of the greatest tragedies of the 20th century. Estimates of drought-related deaths during this time, range from a low of 66,000 to a high of 100,000 out of an approximate population of 19 million. But because of both insufficient data and the poor quality of available figures, no one can say for sure how many deaths occurred.

By disrupting the availability of food in a society of undernourished people, drought, flood, or war, can cause famine. In the case of the Sahel it was drought--or almost five years of little or no rainfall--that brought the famine. These years of sparse rainfall resulted in falling waterlevels throughout the Sahel, which in turn led to large-scale ecological disorder. The usually commanding Niger and Senegal rivers became little more than streams in various places. One paper reported that "the Senegal River was reduced to 65 percent of its normal level" and that the Black Volta and Chari rivers registered declines of around 55 percent.⁴ In other spots, wells completely dried up, depriving farmers of their sole source of water. By 1971, even giant lake Chad had withdrawn from its shore, until it was no

longer a single lake, but four ponds that encompassed only one-third of the lake's former area.

The Sahel's vegetable cover also receded. Because of its reduced depth, the Senegal river, which usually acted as a barrier to the desert, could no longer perform this function. As one Senegalese official said "the desert had crossed the river."⁵ But lack of rainfall was not the only cause of desertification. Overgrazing, swift deforestation, and the increased use of marginal lands all played their part. The desert expanded the furthest around the newly crowded urban centers; as these areas swelled with refugees the demand for fuelwood and charcoal increased, which in turn led to denuded woodlands. Without question, the drought's incursion fostered the spread of degraded land conditions.

The abnormal levels of rainfall not only changed the Sahel's landscape, but also upset agricultural production. Since there were no rains to overflow the Sahel's riverbanks, traditional flood-recession agriculture, which rendered to many farmers an indispensable source of food, was infeasible. In some parts of Senegal and Mali, irrigated crops could only be grown on a portion of their regular tracts. In 1973 Mali witnessed the loss of 40% of its staple food crops of millet and sorghum. Peanut production also declined. Burkina Faso experienced a 26 percent decline in yields; Chad, 57 percent; and Niger, 41 percent; while production in Mali, and Mauritania stagnated.⁶ Likewise, Senegal's groundnut crop, which accounted for 80% of

its export earnings, could only generate half the production yields of the mid-1960's.

The nomadic communities suffered even more heavily than the farming sector. The loss in cattle, from either lack of water or grazing, is estimated to have reached 3.5 million head or about 25% of the herds in the region. Over half of Mali's herds vanished during the drought. In 1973 Mauritania had 600,000 head left from a pre-drought total of 2.5 million. Niger "escaped" just partially scathed, losing only a quarter of its livestock resources. Because the herds served as the economic basis of nomadic society, their loss was all the more severe.

Needless to say, the Sahel's suffering did not remain unnoticed. The world did respond with relief efforts, albeit slowly and with much delay. At first, logistical problems between the donor and recipient countries delayed the assessment and procurement of aid. American relief was further delayed by the large Soviet grain purchases of 1973, which removed a large part of the grain crop. Not until 1973, nearly 5 years after the famine began, did the first shipments of emergency food aid trickle into the Sahel!

Although hundreds of thousands of tons of grain were eventually sent to the Sahel, much of it remained unused. When food arrived, the region's rudimentary infrastructure rendered transportation difficult. Not only were roads and rail transport often lacking, but storage facilities proved totally inadequate. To overcome the distribution impediment, airlifts were employed

to disburse food to the needy inhabitants, often in remote places.

But there were also marked inequities in the distribution of aid resulting from fraud and profiteering. Nomadic camps often received less than their fair share of food aid, either because they belonged to the wrong ethnic group, or because they were unwilling or unable to pay for the food. In Niger, many government officials, including the President's wife, made a fortune by hoarding grain until its price soared.⁸ Also sensing the opportunity to net profits in time of distress, merchants refused to sell millet at official prices and instead withheld their stocks from the market until prices climbed. Another act of greed occurred in Niamey, where forty vehicles supplied by relief agencies were instead employed as taxis.⁹

Despite all the inefficiencies and waste involved in its dispersal, the arrival of food aid averted even greater distress, and assisted in returning some social services and sense of infrastructure to the region. But as one could suppose, the delivery of food served mainly as a stopgap measure. Undoubtedly, food aid could do little to advance long-term development in the region. Since the area could at any time be struck with drought (the rains faltered once again in 1977), the need for better management of the Sahel's resources became obvious. Further economic development was required, therefore, before the region could hope to achieve any measure of food security.

Nearly fifteen years after its most devastating drought

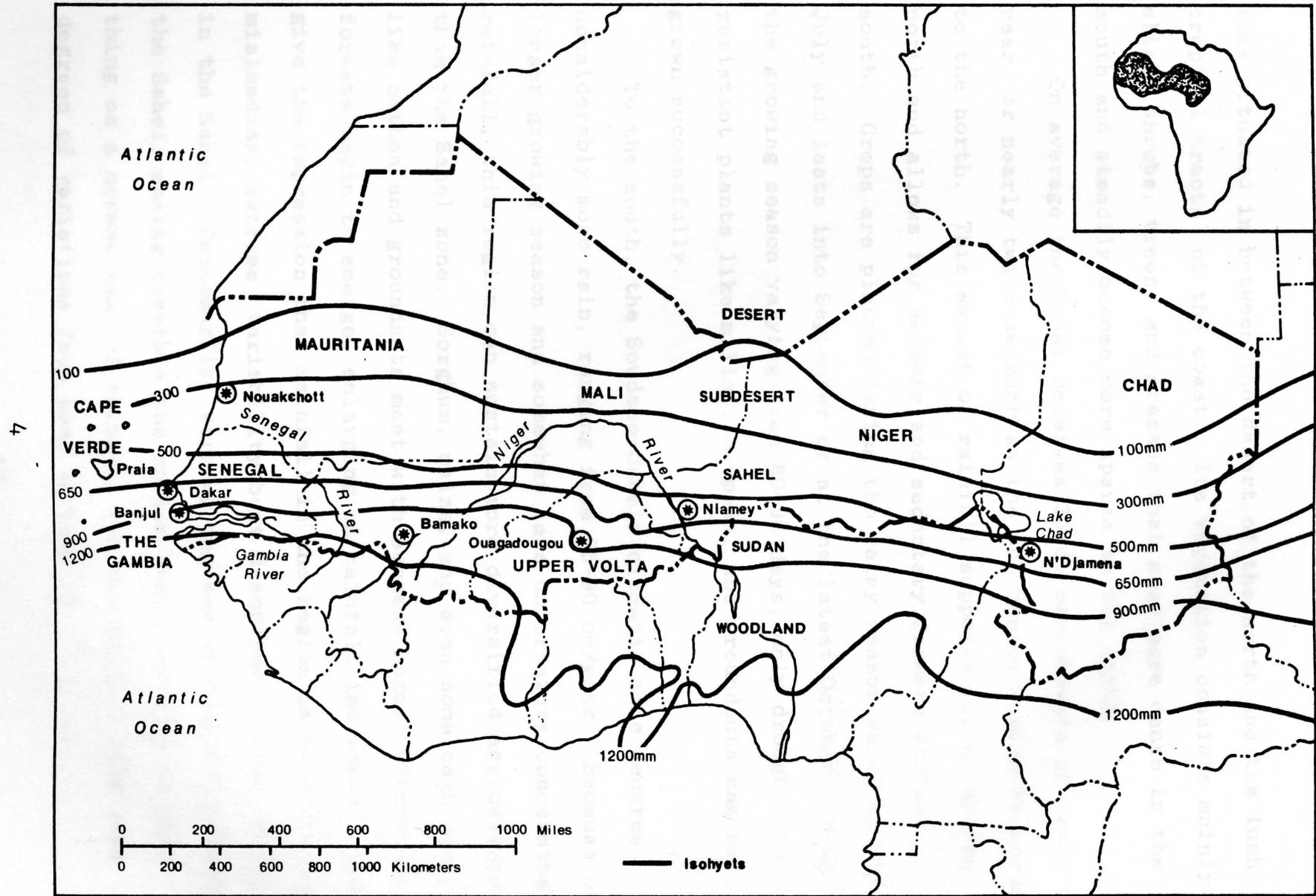
the Sahel still cannot feed itself. This paper will attempt to show why this is so, and how or if the area can secure its future, by examining in the context of the total economy the present state of food production. I will detail what efforts in the agricultural sector have been successful, which barriers have been overcome, and what constraints still remain for increasing crop production yields. In this study, attention will naturally be focussed on both the microeconomic level (the decision to farm, what inputs to use, etc.) and on the macroeconomic level (exchange rate policies, parastatal enterprise, government subsidies). Finally, because the region is one of the least developed in the world, and essentially dependent on a lot of aid to eventuate development, donor policies and strategies will be considered.

WHAT IS THE SAHEL?

For those unfamiliar with the term, there is no doubt the word "Sahel" has a foreign ring to it. Although scholars do not agree on a standard definition, the Sahel is accepted as meaning a "shore" or "border". By Sahel any coast belt may be indicated, but over time the Sahel has come to mean principally West Africa's sub-Saharan lands between the fertile area of the Sudan and the desert. This definition comes from the Arabic, which implies The Sahel had an oceanlike appearance to the caravan traders who crossed it.

This region, which is 200 to 500 kilometers wide stretches from north of the Senegal river, along the southern reaches of the Sahara desert, almost to the Red Sea. It is a transition

THE SAHELIAN COUNTRIES



zone situated in between the desert of the north and the lush tropical tracts of the coast. Its vegetation consists mainly of slight shrubs, trees, and grasses that grow more dense in the south and steadily become more sparse to the north.

On average the Sahel receives 30-65 centimeters of rain per year, or nearly twice as much as the sub-desert region it borders to the north. This amount of rainfall supports nomads in the north and allows for herders and sedentary farmers farther south. Crops are planted during the rainy season which starts in July and lasts into September or at the latest October. With the growing season varying from 60-90 days, only drought-resistant plants like millet, cowpeas, and groundnuts can be grown successfully.

To the south, the Soudano-Sahelo climatic zone secures considerably more rain, ranging from 65-90 cm/year. Because of a longer growing season and somewhat less uncertainty concerning rainfall, this region can sustain more diversified agriculture than the Sahel zone. Sorghum, maize, and even some cash crops like cotton and groundnuts meet with success here. Ultimately forests begin to emerge, enlarging as rainfall increases. But to give the impression that rainfall in the region is constant is misleading; extreme variability best describes rainfall patterns in the Sahel. Customarily, varying degrees of dryness confront the Sahel, making possible the notion that "there is no such thing as a normal year of rainfall for the Sahel," only less degrees of variations from year to year.¹⁰

Because of the extreme variability of Sahelian rainfall, the concept of an average rainfall has little value there.¹¹ At Gao, Mali, for example, there is a mean annual rainfall of 24 cm. But in only 4 years out of a 35 year period, was August rainfall within 10% of the August mean. Mean rainfall, therefore, has only limited use in indicating "the environmental conditions to which livelihoods, lifestyle and agriculture must adapt;" one must, therefore, be wary of not over-interpreting or "misreading" the available rainfall statistics.¹²

Besides the etymological, ecological, and climatic meanings which the word Sahel has come to convey, it has also taken on a new connotation. Since the Sahel zone crosses many nations commonly referred to as Sahelian, and these countries face similar circumstances, "the word Sahel has come to signify a geopolitical entity as much as a mere agro-climatic zone."¹³ Membership in this entity is contiguous with the member states of the Permanent Interstate Committee to Combat Drought in the Sahel (CILSS).^{*} Although other nations such as Nigeria, Sudan, and Ethiopia also face Sahelian conditions, because of the common sensitivity, outlook, and identity of the CILSS nations, I shall restrict my study to them.

^{*} The member nations are Burkina Faso, Cape Verde Islands, Chad, Gambia, Mali, Mauritania, Niger, and Senegal. Excluding Cape Verde Islands, the seven continental CILSS states cover 5.3 million square kilometers.

II. RESOURCE POTENTIAL OF THE SAHEL

Development consists primarily in employing existing resources in a different way, in doing new things with them, irrespective of whether those resources increase or not. Joseph Schumpeter, The Theory of Economic Development, 1961.

WATER

Does the Sahel possess sufficient resources for economic growth, or is the region just a hopeless cause from a development viewpoint? Although the Sahel does not receive ample rainfall to support a thriving and self-sufficient agriculture, the region boasts much untapped water under its surface.¹⁴ Exploit of this precious resource poses several problems. Although there is abundant underground water in the Sahel, it is not evenly distributed geographically.¹⁵ Furthermore, much of the reserves are only recharged slowly, other water strata prove difficult to tap, while certain layer's levels vary which can temporarily dry up wells. Sufficient water resources do exist for the needs of the next two decades. Before these reserves can be fully tapped however, more careful analyses of already existing data and improved methods of water management are needed.

It is estimated that the water resources of the Sahelian countries are sufficient to irrigate nearly 14 million hectares. At present, however, only 250,000 hectares, or about 4% of the Sahel's potential irrigable surface, is developed. The major river basins of Senegal, Niger, and Lake Chad, show much room for expansion. Many reports from international basin

authorities have already established the foundations for a "regional surface water system," which could prove instrumental in seeing experimental projects through to fruition.¹⁶ Although the high cost of pumping has limited the use of underground water for irrigated farming and cattle, this alternative cannot be ignored. In ^{the} future, the primary sources of irrigation water will have to be from efficient management of rainfall and from rivers and lakes. Nevertheless, these facts suggest irrigated agriculture could play a significant role in boosting food production in the future.

LAND

Of still greater importance is the fact that the Sahel has much unused tillable land. Whereas the Sahel encompasses nearly 540 million hectares, just 14 million hectares, or 2.6% of the total surface area is farmed. Specifically, the agriculture area under rainfed conditions is estimated to be around 60 million hectares, yet only 12 million hectares are cultivated, leaving considerable allowance for potential expansion, provided there is sufficient capital input, migration of people, etc. Potentially, much "new land" is located in Mali, Chad, Eastern Senegal, and Western Burkina Faso. For its current population, the Sahel has ample land to satisfy its farming needs.

One barrier to increased acreage tillage has been the considerable amount of marginal lands in the Sahel. Population pressures coupled with a harsh climate have created a swift progress of land deterioration and desertification. Deficiencies

in nitrogen and phosphate as well as other nutrients depress yields on many Sahelian lands. In fact "deficiencies in nitrogen, phosphorus, potassium, and acidification resulting from intensified continuous cropping limit food production."¹⁷ Only with the application of large amounts of costly fertilizer, can some tracts produce enough output to justify tilling. Fertilizer is, of course, one input that is difficult for low income farmers to secure. Some tracts remain unfarmed because they are located where diseases are prevalent. The fear of river blindness (onchocerciasis) and sleeping sickness act as strong deterrents to migration. Despite these hindrances, though, it is still thought that with the introduction and application of new technologies, improved seed varieties, better soil preparation, better utilization of pesticides and fertilizers, projections for substantial increases in food production are not unrealistic.

MINERAL PRODUCTION

Almost all of the mineral exploitation in the Sahel uses new capital-intensive procedures. Naturally its share of employment is considerably modest, as is the share of gross domestic product it generates. In 1975 mineral exploitation accounted for only 4% of GDP and this figure has stagnated over the last decade.¹⁸ In addition to collecting or saving foreign exchange, earnings from mines provide a somewhat stable source of revenue flows for Sahelian governments. For several years Mauritania has exported iron and copper, garnishing nearly 70% of its export earnings from these commodities. Also becoming

recently involved in mineral production are Senegal(phosphates) and Niger (uranium).

Undoubtably mineral production answers a critical financial need in the Sahel. With the proper management this sector could also aid in boosting agricultural production. As already noted, the low level of phosphate in the Sahel's soil constrains increases in crop output. Under natural conditions, "growth in the first part of the growing season is limited by phosphorous and in the second part by nitrogen."¹⁹ It is thought that if both phosphorous and nitrogen are supplied sufficiently, "production in the southern part of the Sahel can increase by as much as a factor of 5!"²⁰

As a general rule, above 30cm of rainfall the limiting factor for growth is the deficiency of nitrogen and phosphorous rather than water. Soil fertility, grazing, and runoff can all affect the 30cm cutoff line, but on the whole, this quantity represents the level of rainfall where aridity is not the chief constraint and lack of nutrients are. Lack of water, therefore, only limits production in the northern part of the Sahel, where animal husbandry predominates anyways.

Yet, Senegal and Togo now commercially mine phosphate. Fertilizer mixtures are made in Senegal from the raw materials while "beds of coprolitic (fossil) phosphate have been found in Mali and Niger suitable for crop production."²¹ Because of low fluorine content, the phosphate deposits can also be used as ingredients in mineral supplements for livestock. Recently

considerable deposits of phosphate rock were uncovered at the joining of Niger, Burkina Faso, and Benin. Although the element's high fluorine content might preclude its use as a feed supplement, the material is certainly suitable for crop fertilizer. With the availability of innovative, low cost techniques, the locating and further exploitation of pristine deposits as fertilizers and feed supplements becomes more feasible.

HUMAN RESOURCES

Partly because of Theodore Schultz's groundbreaking work in the 1960's, the role that human capital plays in increasing a worker's productivity and income has become better appreciated. Human capital is defined as "the increased productivity and correspondingly higher earnings of the human agent resulting from investments in education, health and nutrition, migration, and on-the-job training."²² Over the last twenty years development planners have emphasized more the central role that human capital formation plays a central role in the development effort of poor countries. By increasing labor productivity, encouraging greater physical investment, and reducing the dependency burden of the population, human capital formation helps to accelerate economic growth. Human resource development complements capital formation and aids technological progress.

Education is the most important source of human resource development. A competent education system provides the means of training motivated, skilled individuals, capable of staffing

social institutions and in the Sahel, education/training institutions are considerably inadequate in both size and structure. Approximately only one out of every four Sahelian children receives some rudimentary schooling, although figures show that the overall rate of primary school enrollment has increased since the 1960's.²³ The vast majority of those receiving schooling are the urban dwellers; the education system "is fundamentally open to those in the cities and especially the national capitals, but closed to those in rural areas."²⁴ Moreover, enrollment rates are drastically unequal between males and females, with access to primary education as a percentage of age favoring males to girls by margins of 34% to 6%.²⁵ Given these figures it is not surprising that the Sahel has an average illiteracy rate of over 90%.

The education system is also biased in what it teaches. After independence, Sahelian countries allocated an inordinate amount of resources to the training of personnel to fill leadership positions. As such, most countries now face surpluses in liberal arts graduates and shortages in more immediately productive fields such as agriculture, livestock, health, water resources management, etc. The University of Dakar in Senegal is seen as the paragon of liberal arts training in West Africa. Not until 1979, did the university set up a faculty for teaching agriculture to undergraduates. Trained scientists, administrators, and skilled manpower are still in short supply throughout the Sahel.

But the dismal performance in education has not been a result of lack of effort on the part of the Sahelians. On average, education consumes nearly "26 percent of annual national budgets and, of this amount, approximately 65 percent is devoted to primary education."²⁶ In terms of allocating their resource base, the Sahelians have made a large effort in the field of education. Improvements in education, though, are not only a question of spending more, but also of better use of already committed resources. But to view human resource development as an entirely separate sector is both inaccurate and misleading. Instead, overall gains in human capital can be seen as gains to a part of each production sector.

A review of the Sahel's resources shows potential for much development from native resources if they can be mobilized more effectively. The region contains sufficient natural resources and manpower to attain improved food security, and secure a decent standard of living for its inhabitants. Lack of natural resources, therefore, neither explains nor justifies the dismal poverty of most of the Sahel's population. In reality, the primary constraints to development have been socio-political in nature; "inadequate human organization and management" coupled with "limited financial resources" have left much of the Sahel's potential untapped.²⁷ Thus, for the Sahel to realize its full developmental capacity, more care must be taken in the formulation of policy, planning, and training, so as to eliminate such artificial limitations.

III. DIFFERENT MODELS OF GROWTH

Economic growth is often equated with economic development. Although similar in connotation the two terms do not in fact convey the same meaning. Economic growth, or more economic output resulting from either greater inputs, or from more efficient use of the same inputs, need not necessarily lead to economic development. As emphasized by the classic Herrick / Kindleberger book Economic Development, development goes beyond mere growth and encompasses changes in the composition of output as well as changes in the size of inputs to the production process. A program of economic development thus entails altering the composition of an economy's outputs and inputs.²⁸

Neoclassical theories of development

Originating in the classical economics of Adam Smith and David Ricardo, neoclassical theories of development stress the importance of price-oriented mechanisms, the tendency towards equilibrium, the role of technological innovation, and the law of diminishing marginal returns. Highlighting the role of the individual decision maker, the models maintain that such individuals will substitute at the margin among factors of production, provided they can choose among alternatives.

Implicit in this analysis is the understanding that the "elasticity of supply, the price elasticity of demand, and the elasticity of factor substitution" are all high.²⁹ No given producer or consumer is large enough to solely influence the market. Moreover, any activities such as public or private

monopolies, which prevent competition, are frowned upon. This approach is relevant when analyzing the behavior of the rural farmers of the Sahel. Since there is no reason to suggest that Sahelian farmers react any differently to prices than other farmers, much of my later economic analysis dealing with rural farmers, prices, and government activities, implicitly assimilates the neoclassical approach.

Structural disequilibrium theories

While neoclassical theories emphasize a tendency towards market equilibrium, structural disequilibrium thought maintains that in underdeveloped economies permanent disequilibria are the norm. Working within a shorter time horizon, these theorists see inelasticities throughout the economy. Thus there is a need to focus attention on the structure or composition of the economy, and not on the market mechanism. Aggregating the economy into different sectors, structuralists maintain that the agricultural sector responds differently to incentives than the industrial sector. Hence they favor sector specific plans for development aimed at overcoming market deficiencies.³⁰

But such sector specific project investments, guided agricultural targeting schemes, and import-substitution programs, have not met with much success in the Sahel. Rather there have been countless failures in the rural world. New roads have been built only to be engulfed with sand, wells have been abandoned, and costly power generators are left in disrepair. Although the recounting of past failures can help in the formulation of new

strategies, it is the prospect of future triumphs that is most important. When the next projects are implemented, therefore, there should be the presence of a healthy market mechanism to ensure their success. Past development failures are another reason I have embraced the neoclassical approach.

Radical development theories

Another alternative to the neoclassical approach, the radical or marxist, clamors for revolution as well as reform. Placing stock in the import of history on economic development, Marxists unify around the theme of international inequality and dependence of poor countries on the rich. According to Marxists, European imperialism in the 19th century helped create and maintain the present disparity in wealth.

Although it is true the Sahelian countries were French colonies for many years, France was never successful in extracting vast sources of wealth from them. There simply are no deposits of oil, coal, rubber, or natural gas in the Sahel. Other than the creation of immense groundnut plantations in Senegal, which achieved some minimal commercial success, France did not attempt to plunder the region of its wealth. Moreover, the recent creation of the CILSS and Club Du Sahel, represent shared attempts by the Sahelians and the international community to further development in the region. Such cooperation is not an instance of development imposed from abroad, but rather a concerted effort of mutual understanding. For these reasons I have not emphasized the Marxist approach in my work.

AGRICULTURAL DEVELOPMENT AS A GROWTH STRATEGY

Agriculture, no doubt, continues to maintain a symbolic as well as genuine importance in the world economy. At the most mundane level, agriculture produces the crops that sustain the populace with "the staff of life." There is no substitute for food; it must either be produced within a country or imported.³¹ But apart from its symbolic aspect, the agricultural sector performs an essential function for a country at an early stage of development, by providing more jobs than any other industry. In most of Africa, "four out of every five people work in agriculture," generating for most countries nearly 30 to 60 percent of their gross domestic product.³² In developed economies, however, agriculture typically employs only 10 percent or less of the workforce (only 2.6 percent in the United States).³³

In the less developed countries' (LDCs) economies, therefore, agriculture's sheer size draws notice. This size, usually around 70 percent of the population, gives agriculture an important role "in the provision of factor inputs, notably labor, to industry and to the other modern sectors."³⁴ Efficient agriculture contributes a "factor contribution" to economic growth by releasing the labor force, making possible other productions. Although increases in production in other sectors of the African economies have contributed and can continue to contribute to economic growth, as a world Bank report noted, "it is success or failure in agriculture that will determine success

or failure for economies as a whole."³⁵

That greater agriculture productivity and output can contribute to an economy's development, is a view that has been held since the days of David Ricardo. Besides releasing labor for other productions, developmental theorists have postulated that efficient agricultural production could: supply needed foodstuffs and raw materials to other expanding sectors, provide capital for growth through a surplus of savings and taxes, generate foreign exchange through exports or save foreign exchange through import substitution, and create a 'marketable surplus' of saleable goods that would raise the demand of the rural population for goods of other sectors.³⁶

Embracing both the supply and demand side, agriculture performs two roles in economic development. On the supply side agriculture is the primary source of food, the primary employment for labor, and an important foundation for both capital and foreign exchange. On the demand side the agriculture sector supplements urban and foreign sources of demand, provided that the distribution of income is not too unequal so that farmers have nothing left over after meeting their basic needs.³⁷ Greater agriculture output, therefore, is an urgent, even necessary policy to fuel economic growth.

SELF-SUFFICIENCY IN FOOD PRODUCTION?

Although efficient agriculture production spurs economic growth in LDCs, to what degree should a nation strive for food self-sufficiency? Because of both its motivation and of

limitations of scope to control the national economy, "economic development planning inevitably has a strong autarkic basis."³⁸ The desire to further development often promotes inward looking strategies as the best means of achieving this objective. Most African countries do in fact have inward-looking trade regimes, as tariffs, quotas, and subsidies are used to shelter import substitution sectors. But if natural resources are misused (over cultivation of land) or trade shunned (so as to avoid a foreign dependence) as a result of an internal approach, a nation could find itself little improved than before it began the development program. Resource degradation would lower yields and output, while the spurning of trade would at minimum, fail to allow for the possible exploitation of beneficial opportunities for specialization and production, thereby eliminating a possible alternate source of more efficient production. To realize maximum results, any development program must balance inward with outward policies.

Shortly after the ending of the drought in 1974, a number of development agencies arranged special studies to determine which growth strategies best suited the Sahel. Of most concern to the strategists were two issues. The best means of revitalizing the Sahel from the drought's aftermath, and of expediting long-term development. Viewing the Sahel as a entirety, the reports suggested development policies designed for the sub-region. One common note of agreement was that "the principal development objective in the Sahel should be better food security."³⁹

Food self-sufficiency would serve as an inspiration for cooperation and as a means of improving food security. Because of the traumatic experience of the drought, Sahelians determined not to remain as vulnerable to any future drought, especially in light of the world grain shortages of 1972-73. Food self-sufficiency would be achieved initially at the regional level; any attempts to achieve autarky in cereals was considered pointless. Everyone agreed that primary emphasis should be placed upon dry-land agriculture, with irrigated agriculture viewed as a valuable supplement and a way to enhance food production security.⁴⁰ As Table I shows, the Sahel is now less able to feed itself than during the famine of 1968-73.

TABLE I.
Sahel Food Self-Sufficiency Rates

Year	Percentage
1960	98
1973	65
1980	86
1984	55

Source: Drought And Aid In The Sahel. p. 35.

SECTORS OF THE SAHELIAN ECONOMY:

DRY-LAND AGRICULTURE

In terms of food production, acreage farmed, population employed, and exports, rainfed agriculture performs an invaluable function in the Sahel. With the exception of Mauritania, it is estimated that "at least 50% and probably more than 60% of the population is mainly occupied" in rainfed agriculture.⁴¹ In Mali, 92% of the cultivated area is sown to rainfed crops, while

in Burkina Faso and Niger 99.5% of the cultivated land is under rainfed crops. For the Sahel as a whole, rainfed agriculture covers more than 96% of the total cultivated area, or about 13.3 million hectares, and employs more people than irrigated farming, artisans, livestock, and industry and the government combined.

Given the proportion of land it covers and the population it employs, it is not surprising that rainfed agriculture produces most of the cereals in the Sahel. On the whole, rainfed cereal crops account for 95% of the cereals grown in the Sahel, with the ratio of cereals that are rainfed varying from a low of 85% in Mali, to as high as 98% in Burkina Faso and Niger.⁴² These crops include millet, sorghum, corn, rainfed rice, and fonio, and are the source of "two thirds of the calories consumed on average by Sahelians."⁴³ Besides being an excellent food, millet can be brewed into an alcoholic drink, its by-products can be used as animal feed, and medicinal purposes are practiced.

Fonio is a low-yielding variety of millet which was first grown as a "hunger crop."⁴⁴ Needing very little moisture, fonio's short growing season and its ability to thrive in soils too depleted for other crops, allows it to be harvested while waiting for the other more desirable crops to ripen. Comprising the lion's share of food intake in the Sahel are millet and sorghum, which not surprisingly account for 70% of all rainfed cereals. In fact, all Sahelian countries "have populations in which more than 40 percent of all food energy is derived from cereals."⁴⁵ Thus, rainfed cereals not only occupy a high

fraction of the acreage farmed, but form an important link in the food supply of the population. For the relative importance of different rainfed crops see Table II.

Table II.
Areas Under Different Types Of Crops (in hectares)

	Millet Sorghum	Rainfed Rice	Corn	Niebe	G'nuts	Cotton
GAMBIA	35,400	21,000	9,500	-	101,000	1,000
UPPER VOLTA	1,950,000	43,000	129,000	-	154,000	73,000
MALI	1,400,000	-	88,000	-	152,000	118,000
MAURITANIA	156,000	-	-	18,000	18,000	-
NIGER	3,840,000+	-	13,000	1095000+	184,000	3,000
SENEGAL	1,100,000	63,000	70,000	50,000	1050,000	30,000
CHAD	1,285,000	19,000	-	-	190,000	180,000
TOTAL	8,800,000	150,000	310,000	1160000	1850 000	400000

(+) Niebe is grown together with cereals so that the two figures should not be added as they are partly overlapping. In Niger, almost 70% of Niebe is grown with millet and sorghum.
Source: Development Of Rainfed Agriculture In The Sahel, p. 6.

Besides cereals, rainfed agriculture also consists of the export crops of groundnuts, cotton, and increasingly more so in Niger, the production of the foodcrop niebe. With increasing regularity groundnuts are also being used as a foodcrop. But only in Senegal and The Gambia is the production of export crops a serious undertaking. But even here output has decreased over time. Covering only 60% of the cultivated area in The Gambia and 40% in Senegal, groundnut production has declined in the face of deteriorating terms of trade. Because of volatility in

international prices and because of radical weather-related variations in production, groundnut exports have proven a highly unstable source of foreign exchange for Senegal.

In 1982, for example, "world prices for groundnuts were less than 60 percent of their 1979 level;" yields per hectare have also fluctuated as violently "ranging from a high of 1179 kilograms per hectare in 1975 to a low of 447 in 1978."⁴⁶ Although export crops only played a secondary role in their economies to begin with, the general trend away from export crops has continued in the other continental Sahelian countries. Table III. confirms the diminished role groundnuts have come to play in the Sahelian economy.

TABLE III.
Trend Of Groundnut Production

	(in thousand tons)						
	1961	1971	1975	1978	1979	1980	1981
THE GAMBIA	94	125	151	167	112	42	
UPPER VOLTA	50	66	90	70	75	53	77
MALI	110	152	205	166	179		
NIGER	152	256	42	74	90	126	96
SENEGAL	995	997	1 476	1 021	850	490	883
TOTAL	1 400	1 600	1 960	1 480	1 300		

Source: Development Of Rainfed Agriculture In The Sahel. p. 11.

Inadequacy of Good Data

This table shows that groundnut production reached a high in 1975 and has steadily declined since. When examining output figures for the Sahel, however, one must allow for the fact that data are hardly ever completely reliable. As regards cash crops, especially groundnuts, "the quantities marketed are reasonably well known but on-farm consumption or areas under crops are

shrouded by uncertainty."⁴⁷ The situation is similar with cotton. Reliable data on areas planted and production marketed are available, but figures on the inputs actually used by farmers are less certain.

Even more pronounced are the data uncertainties for cereal crops. In fact, almost all of the data on cereal crops are estimates! An extremely high margin of uncertainty surrounds the figures on acreage tilled, inputs used, amounts produced and both marketed, and actual prices. These uncertainties are a result of both information gaps within countries and of different Sahelian authorities using different agricultural statistics. In a given Sahel state, it is not unlikely to find the cereal production estimates for the same year, used by the Rural Development and Planning Departments, to differ by as much as 35!⁴⁸ Because national authorities use certain data, aid sources other data, and international organizations still others, no one really knows how much Sahelian farmers produce.

Rainfed Crops and Productivity

All rainfed crops remain extremely vulnerable to climatic conditions. Of the cereal types, rainfed rice remains the most sensitive to climatic factors, sometimes exhibiting a three-fold difference in production from one year to the next. Millet-sorghum yields can vary from as little as 300 kg/hectare in the drier Sahelian zone, upwards to 700 or 800 kg/hectare in the wetter Sudan zones. On average, the whole region produces 500 kg/hectare, this output has remained level for twenty years.

In Niger, average yields for millet-sorghum have actually declined from 525 kg/ha in 1960-67 to 425 kg/ha 1979-81. Similarly, Mali has experienced output declines in corn over the last 15 years.⁴⁹

Over the last two decades farmers' productivity has remained almost constant; production increases have resulted almost exclusively from greater numbers employed in agriculture. Over the last fifteen years, drought has certainly affected both yields and acreage cultivated by farmers. But its exact impact is yet to be analyzed and fully determined. Sufficient steps, however, have not been taken to minimize its force. For their own part, the "Sahelian farmers do not produce any of the short-cycle cereal varieties, which are less vulnerable to drought."⁵⁰ Besides shunning the more drought resistant cereal varieties, Sahelian farmers also spurn using selected seeds, pesticide and fertilizer use is still uncommon, and the use of animal traction is not very widespread. In Upper Volta, for example, "selected seeds are used in less than 1% of the cereal growing areas" and for millet grown in Niger this ratio is 3%.⁵¹ Although the other Sahelian states are further advanced in farming techniques, the overall trend has been away from mechanization.

IRRIGATED AGRICULTURE

Currently crops irrigated by use of underground water in the Sahel include sugar, wheat, rice, and cotton, but these crops made up only 4% of all crops cultivated in 1985. Although its current production is small, this sector's importance derives

from its potential for development, and also from the growing role its crops play in Sahelian diets. A joint report from the Société Centrale pour l'équipement du territoire--International (France) and the Société d'études pour le développement Economique et Social (France) estimated "that over 1.5 million hectares producing 10 million tons of cereals could be developed in 30 to 50 years."⁵² This estimate takes into account main rivers and those tributaries which appeared economically most feasible.

Since the rivers providing the needed waters for irrigation would draw their sources from outside the Sahel, irrigated agriculture's chief appeal is the hope that it could provide the Sahel "with a basis of agricultural production invulnerable to some extent from drought."⁵³ Other functions of irrigated agriculture include its use as a source of supply to meet consumer demand, compensation for dry-land crop deficiencies, and as a stable source of fodder for livestock. There is a very good possibility of rice and wheat displacing millet and sorghum as the principal staple foods in the near future. In particular, many urban Senegalese now find themselves dependent in fact slowly becoming fixtures in most Sahelian meals; there is upon imported rice for their diets. Leaving aside the cost differential, many people still find themselves unable to readily substitute millet for rice because of the difficulties in the preparation."⁵⁴ But before irrigated agriculture can achieve meaningful results, larger efforts in capital, training, and management from the Sahel states and donors are needed.

Notwithstanding eventual improvements in irrigation and agriculture, most Sahelian farmers will still have to live with the fact that their crops will fail because of lack of water. The harsh realities of the Sahel, therefore, lessen whatever innate interest the Sahelian farmers might have in the "water availability insurance" that irrigation might provide. Being proficient in the art of survival, the Sahelian farmer views new, unknown farming techniques as a questionable benefit. Irrigation, therefore, is seen "as a mixed bag at best" by Sahelian farmers, and its suitability presumably hinges on how well it can be combined with other survival methods.⁵⁵

LIVESTOCK

Like rainfed agriculture, the livestock sector also suffers from unreliable data. The performance of the livestock production sector has also coincided with that of staple foods. From 1960 until early 1970 favorable weather and improved animal health services, led to swift growth in livestock production in the Sahel.⁵⁶ The 1970 livestock populations were seen by most experts as the threshold level for the Sahel; any attempts to exceed this amount seriously endangered the region's fragile ecology.

The drought temporarily ended any concerns of overstocking. A third of the cattle in the Sahel and 10 to 15 per cent of the goats and sheep disappeared during the drought.⁵⁷ Although the reduction in livestock reduced pressures on the environment, it also produced new problems. Before the drought, livestock

provided food and income to the Sahel. On average, meat consumption in 1970 stood at 17.5 kilograms per head per annum, while annual exports from the Sahel of 150,000 tons of meat, mainly in the form of live animals, were common. But because the population continued to grow at a constant rate, the lowered livestock capacity resulted in an abrupt decline in individual meat consumption, which fell to 12.9 kg. in 1977.⁵⁸ Although net export earnings have not declined, they have remained relatively consistent, earning 21 billion CFA in 1968 (about \$100 million), and 23 billion CFA (about \$110 million) in 1977.

Animal Production

Animal production depends both on the feed supply and on the animals. First and foremost, however, animal feeding conditions determine the level of productivity. Because of a scarcity of forage crops in the Sahel, the main sources of animal feed are grazing land, fallow land vegetation, various agricultural by-products, and crop residues. Over exploitation of fodder resources, increases in the numbers of animals farmers maintain, and a reduction in fallow periods, have lead to the disappearance of perennial grasses and woodlands.

Also affecting animal production are the numbers and types of domestic species. As a result of the drought cattle numbers greatly declined, the goat population remained relatively constant, while sheep increased considerably. Mortality, growth, and reproduction of domestic animals all affect productivity; of these the overall health of the herd most influences mortality.

Table IV. provides the production figures for some of the Sahel's livestock.

TABLE IV.

The 1977 estimates for meat production are as follows:

Cattle	262,500 metric tons
Sheep and goats	137,500
Pigs	15,000
Other species	32,000

	447,000 metric tons*

Source: Elements For A Livestock Development Strategy In Sahel Countries. p. 5. Appendix A gives complete livestock statistics.

Representing 90% of meat production are herbivores; of this total 59% comes from cattle and 31% from sheep and goats.

In the Sahel pastoralists engage in the three types of livestock farming--nomadism, seminomadism, and sedentary animal husbandry. Seminomadism, which is also called transhumanance, is a system whereby twice a year the herdsmen and their herds migrate hundreds of kilometers in search of forage, leaving behind in the village the women, children, and elderly. This system is a very effective way to exploit the Sahel's rangelands, since migration assures that areas do not become overexploited.⁵⁹

Meeting Internal and external demand

Population and consumption trends show that total demand for meat and dairy products by the year 2000, could exceed 1977 productivity by three times.⁶⁰ If Sahelian pastoralists are going to be able to satisfy this excess demand, several changes are needed in current production methods. Several important

* Not included are an estimated 25,000 tons of camel meat.

ingredients have emerged as guides to development of this sector. Advances in productivity will result if pastoralists maintain an appropriate amount of livestock for existing forage resources, if they maximize those resources, and if they have access to better control of animal health and nutrition.

To achieve these measures, more properly equipped management personnel are required; substantial improvements in "land tenure, water use rights, and vegetative use rights" are also viewed as essential.⁶¹ One particularly promising approach is one that emphasizes integration of natural resource management; that is to say, better integration and cooperation among the herders, farmers, and government decisionmakers who make up the socioeconomic live-stock system.

But even the benefits from the integration of livestock and crop farming are restricted. It is argued that seminomads could supply young animals to the farmers in the south, which would be fattened on millet and sorghum. But since animals which have been raised on natural fodder often lose weight when they later eat millet and sorghum, resulting benefits are likely to be minimal. Still it is important to remember that grazing does not occur in a vacuum; the livestock sector's vitality affects both pastoralists and crop dependent farmers. Improvements in one sector will directly affect attempts at improvements in the other.

FISHERIES

This sector is probably the least understood and developed

in the Sahel. As such, the potential for development in marine and fresh-water fisheries remains very good. Already providing an important source of protein in the Sahelian diet, fish and fish products could conceivably supply an even larger share of the protein requirement of the Sahelian population. Reports estimate that maritime fisheries alone could possibly supply 2.7 million tons of fish per year, but because of poor exploitation the actual catch approaches only a fraction of that number.⁶² An inability to preserve the catch has been the chief constraint to growth in fishing. Almost one third of the "present freshwater catch is lost due to improper handling and spoilage."⁶³

The poor performance in the fishing sector has resulted in declines in average fish consumption. Most recently, inland fishing has fared worse than maritime fishing, with fresh-water fish consumption falling "from 5.2 kilograms per capita in 1973 to approximately 4.8 kilograms per capita in 1980."⁶⁴ A lack of flooding in certain years results in no flood-covered shallows where the fish can reproduce and feed. Besides deteriorating environmental conditions, overexploitation has also reduced the available catch. In the coastal countries of Senegal, Gambia, and Mauritania, however, annual fish consumption might be as high as 20 kilograms per capita. As these numbers show, in some cases fishing contributes as much as livestock to the Sahelian diet, despite the fact that nearly 60% of the Sahelian fish catch is exported.⁶⁵

Industrial or semi-industrial fleets shoulder the task of catching and exporting the fish, and thereby provide an economic service to the Sahelian economy by bringing in foreign exchange.⁶⁶ For the fishing sector to provide more benefits in nutrition and economic terms, progress in general fishing techniques must be forthcoming. Advancements in fish processing techniques, marketing techniques, as well as improvements in the education and training of fishery officers, are all required before this sector scratches its potential.⁶⁷ Table V. attempts to display changes in the value of fisheries production, in CFA Francs at constant prices.

Table V.

	1960	1970	1980
Burkina Faso.....	0.6	1	1.4
Mali.....	13	18	20
Mauritania.....	17.5	25	28.6
Niger.....	0.4	1.2	1.8
Senegal.....	25.6	42.5	75.4
TOTAL.....	57	88	127

(CFA Francs bn)

SOURCE: Retrospective View Of The Sahelian Economy. p. 17.

The causes of drought

Although high variability is a common characteristic of rainfall in dry regions, only when several abnormally dry years occur in succession does drought become severe.⁷⁰ Most of the region's inhabitants can readily endure one or two bad years, but if rainfall anomalies persist for more years than that, drought will occur.⁷¹ Many hypotheses based upon changing patterns of water air currents, sea-surface temperatures, and atmospheric

IV. CONSTRAINTS ON AGRICULTURAL PRODUCTIVITY

The distinction between factors that are "economic" and those that are "non-economic" is, indeed, a useless and nonsensical device from the point of view of logic, and should be replaced by a distinction between "relevant" and "irrelevant" factors, or "more relevant" and "less relevant."

Gunnar Myrdal, Economic Theory and Under-Developed Regions, 1957.

THE DESERTIFICATION PROCESS

In much of the Sahel the process of desertification is now at work. A process of "sustained decline of the biological productivity of arid and semi-arid land," desertification's end result is ecological degradation. Desertification, in short, produces a desert or depleted soil that is irrecoverable.⁶⁸ Almost any discussion of desertification centers on the question of whether drought and increasing aridity primarily cause the desert's expansion, or whether resource abuse by the area population is the main culprit. Needless to say this debate is far from settled; yet, the desertification problem remains quite severe.

The causes of drought?

Although high variability is a common characteristic of rainfall in dry regions, only when several abnormally dry years occur in succession does drought become severe.⁶⁹ Most of the region's inhabitants can readily endure one or two bad years, but if rainfall anomalies persist for more years than that, drought will occur.⁷⁰ Many hypotheses based upon changing patterns of upper air currents, sea-surface temperatures, and atmospheric

moisture have been proposed to explain drought in the Sahel, but none have met with general acceptance. Because most studies have focused on a single factor rather than integrating the combined effects, there still remains, "no conclusive answer to the question of why a drought occurs in the Sahel."⁷¹

A more important question is what causes drought in the Sahel to persist and escalate once it has commenced. Again many hypotheses have been put forth. Nearly all focus on a feedback mechanism-whereby changes of "the earth's surface induced by drought or desertification may interact with the atmosphere to reduce rainfall and/or intensify and prolong drought."⁷² It is thought that changes of the earth's surface albedo, soil moisture, and vegetated cover prevent a rain cycle from occurring, since the needed solar energy is not retained in the earth but instead immediately reflected back into space. Thus the continuation of drought may be caused by "biogeophysical feedback mechanisms involving long-term changes in the heat balance of the Sahel."⁷³ Drought and desertification, then, appear to provide the circumstances for mutually perpetuating one another's existence.

Resource abuse

Drought, or a "period of dryness especially protracted over a series of years," is a constant menace for the rural dwellers of West Africa's Sahelian and Sudanian zones. But drought alone has not produced the type of resource degradation now found in these zones. Other factors such as high population growth,

increased use of marginal lands, more extensive farming of existing lands, and concentrated demand for fuelwood are all at work.⁷⁴ Desertification can therefore be seen as a "product of climate and human activity and in the Sahel it has been accelerated alarmingly by both."⁷⁵

Table VI. furnishes numbers for sustainable population levels in the Sahel. It is a World Bank estimate based upon 1980 data, which correlates those areas experiencing greatest resource strain.

TABLE VI.
Sustainable and Actual Population Densities

Zone	Sustainable Population			Actual	Sustainable	Actual
	Crops	Livestock	Sum	Rural Population	Population Fuelwood	Total Population
----- (No./km ²) -----						
Saharan	-	0.3	0.3	0.3	-	0.3
Sah-Saharan	-	0.3	0.3	2	-	2
Sahelian	5	2	7	7	1	7
Sah-Sudanian	10	5	15	20	10	23
Sudanian	15	7	22	17	20	21
Sudano-Guin	25	10	35	9	20	10

Although imperfect data make such precise classifications of zones "iffy" and mask differences within the zones, these figures do show many things.

Source: Desertification in the Sahelian Zones of West Africa. p. 13.

One can easily see that in all zones, the carrying capacity of the natural forest cover is being grossly over-exploited. The actual population already exceeds the sustainable population in five out of the six zones. Densities for fuelwood, crops, and

livestock, all vastly exceed sustainable levels in the Sahelo-Sudanian zone; this zone now finds itself highly susceptible to the desertification process.⁷⁶ According to World Bank figures, this zone can support "a human density of 15 inh./km², and where the present average density per square kilometer is 20, with... great unevenness of spatial distribution."⁷⁷ The fact that this zone supports more than 11 million rural dwellers, or a little more than 40% of the rural Sahelian dwellers, illustrates the growing danger of resource abuse now facing the Sahel.

Nine out of ten rural Sahelians use fuelwood. Such large demands have led to the disappearance of many woodlands. When fuelwood runs low, dung, usually used as a fertilizer, is burned, which further impoverishes the soil. Pricing policies have also supported the desertification problem. Neither stumpage fees, wood harvesting fees, nor transport permits have kept pace with increases in the market price for fuelwood and buildings in the last twenty years. As a result of overcutting and poor pricing policies, the Sahel "has lost more than half of its forest since 1950," so that most Sahel countries now find themselves cutting into their capital stock of trees, as they consume far more than the total fuelwood output of the natural forest.⁷⁸

The Population and Urbanization Problems

Population density in the Sahel is highly concentrated. In 1984, nearly 25% of the total population in the zone comprising the Senegalese groundnut basin, Gambia, and the Burkinabe Mossi

Plateau lived on only 2% of the total area; here population density approached almost 60 persons/km².⁷⁹ Comparative density figures for the United States and Canada are... More startling is the fact that 80% of the region's population live on 25% of the total area south of the Sahelian zone, with 40% of those people inhabiting just 6% of the total area. Excessive population concentration can adversely affect soil fertility. In the Burkinabe Mossi Plateau, for instance, "population pressures have forced a reduction in fallow periods that has harmed the land."⁸⁰ As the productive capacity of the land is diminished, "farmers shorten fallow periods to raise enough food, in a self-perpetuating cycle."⁸¹ More extensive production on deteriorated soil is the end result of such a progression.

With this type of land degradation now occurring, one can see why the threat of desertification is not greatest on the desert's fringe as one would naturally assume, but instead in the "heartland" of the Sahel or the narrow Sahelo-Sudanian belt. It is here that population growth has had its worst impact. The growth rate of the population in the Sahel approximates 2.8% per year, which means that population doubles every 25 years. Increases in the population have been accompanied by increases in urbanization; urban population grew faster in Africa over the last two decades than on any other continent (average rate of 6% a year).⁸² Urban population in the Sahel, which totaled approximately 1.2 million in 1959, climbed to approximately 6.5 million by 1984. Senegal is the most urbanized country, with

nearly 40% of its population living in cities. High population growth and mounting urban populations not only foster resource abuse, but also define the main problem of having food production keep up to sustain them. *and extensive production methods.*

For example, Nouakchott, the capital of Mauritania, has grown "from a town of fewer than 20,000 in 1960 to today's city of 350,000."⁸³ Such concentrated population growth severely strains the surrounding countryside. Dunes now encircle the city forcing residents to spend each morning sweeping sand from doors and streets. This city is also severely dependent upon food aid to feed its large refugee population. Mauritania is not alone either regarding loss of land. Fuelwood shortages in the environs around Niamey, the capital of Niger, "have led to the gradual elimination of all savanna woodlands within a 50-kilometer radius from the capital."⁸⁴ All the Sahelian countries have experienced decay of resources. *substitutes for fuelwood.*

Since it concentrates demand at a specific position within marginal environments, urbanization has produced a "multi-faceted impact on the surrounding countryside."⁸⁵ Heavy demand for fuelwood leaves urban centers without surrounding vegetable cover; moreover, the political pressure these areas exert on governments perpetuates policies of low fuelwood prices. From an ecological standpoint, the underpricing of urban foodstuffs is also harmful. Low prices for foodstuffs discourage farmers from planting trees, from using inputs more intensively, or from investing in the land, and the renewable resource maintenance

necessary to sustain the base of rural production.⁸⁶ As long as input and output prices for crops and livestock "do not encourage more intensive production, desertification will proceed as a consequence of widespread extensive production methods."⁸⁷

Policy implications THE ROLE OF LAND TENURE

At present, population control occupies only a small part in current development programs or government policies in the region. If control of the desertification dilemma is even to be attempted, this must change. Better integration of the population problems in overall development strategies is a must! Given the difficulties that high population growth cause, it is not unfair to say that population growth just might determine whether "the region in the future will go from crisis to catastrophe."⁸⁸

Antidesertification measures include: sand dune fixation, reforestation, creation of wood lots, establishment of greenbelts, and the provision of substitutes for fuelwood. Although one can identify basic measures that might arrest the desert's advance, ultimate success or failure will rest with the overall type of approach that is adopted. Any approach must emphasize providing better incentives to the rural population, so that millions of decision-makers will respond correctly to government antidesertification measures. Thus the correct approach should be holistic in nature; one that takes account of the diverse causes of desertification and that tries to integrate combative measures. The fight against desertification should not constitute a separate sector, but should integrate parts of all

projects. Establishing a greenbelt is ineffectual, for example, if the rural farmers receive improper incentives for its maintenance. Finally, desertification must be seen for what it is, a slow insidious process without a quick-fix solution.⁸⁹

THE ROLE OF LAND TENURE

In agrarian countries, conditions of land tenure set the context within which all efforts to raise agricultural output must function; its reform, therefore, can be one of the more commanding influences on economic development.⁹⁰ Referring to the way in which people hold land for themselves or rent it to others, land tenure policies involve such privileges as the length or security of a tenant's tenure, his capacity to alienate or sell the land, and to bequeath it, and what proportion or share of the crop he may retain, all make up a land tenure system.

Traditional Landholding System

Because the Sahel is so land intensive, land policy naturally affects almost all activities in the region. A traditional land tenure system is still practiced almost exclusively in the Middle Valley of the Senegal River. Its application is also prevalent in other parts of the Sahel. Under such a system, the diéri, or rain-fed farmland, belongs to the people who clear and cultivate it. Because unlimited quantities of this land are available, "it is not subject to a strict, clearly defined system of landholding."⁹¹ The soil of this land and uncertainty of rainfall, enable farmers to produce only

moderate yields on such tracts. *Others prefer possession through*

line. The oualo land, on the other hand, is that land which is flooded each year according to the level of the rains, remains more or less limited to an area that is always relatively the same, and is subject to more elaborate customary laws than diéri land. Holding the land collectively, the village elders share out the oualo among the male descendents, "with ownership of the land thus acquired lasting for life."⁹² There are some additional provisions, by which individuals who do not belong to the lineage group may rent land, but at no point whatsoever may an individual alienate his share of land and at no time does the lineage group relinquish its right of ownership. Restrictions on the sale of inheritable property still apply, in the northern Mossi Plateau in Burkina Faso.⁹³ *Some areas and others are pending.*

Chang These laws are to prevent communal land from becoming so fragmented that it would be impossible to administer. Given the omni-present specter of famine and the annual variations in both rainfall and flooding, this traditional type of land tenure is well suited to the environment. Under this system, each family is assured of at least part of the oualo land and of harvesting something, regardless of the degree of flooding. *each farmer and*

not. It has often been suggested, however, that a communal tenure system "provides individuals with little incentives to make any long-term on-farm investments."⁹⁴ In practice, however, this argument does not conveniently fit all of West Africa. Not all types of communal systems are the same. Some systems entail

ownership by a chief while others prefer possession through lineage. Many of the systems, moreover, have evolved to such a degree as to accommodate individual ownership and management control. In the south of Niger, for example, land has been sold, mortgaged, and inherited for over 50 years.⁹⁵ Finally, security of tenureship may not always be foremostly achieved through individual ownership. The desert-fringe areas provide the clearest example; here uncertainty of rainfall ensures that security can only be accomplished with some mobility. Individual ownership is inappropriate for these lands.

Changes in the Land Laws

Although the communal system remains a viable option for many farmers and pastoralists, innovations in land tenancy have already been initiated in some areas and others are pending. Changes in the parcelling of holdings has led to the development of speculation, or the buying and selling of land, in some parts. Since 1981, in the areas of Podor and Matam, Senegal, the appearance of a small number of private irrigated enclosed farms, on land which traditionally had belonged to lineage groups has occurred. Recent development projects in Mauritania have been initiated under elements of modern law. Here, each farmer and not a lineage group receives a parcel of land, under penalty of dispossession if it remains unfarmed for two years. Such laws are attempts to shift decision-making ability away from the former landowners and towards the peasant farmers.⁹⁶

With respect to increasing output in rainfed agriculture,

any drafting or amending of land laws, should take into account the rural population's wants.⁹⁷ Like the recent projects in Senegal, policies should be adopted which will eliminate the danger of concentrating property in the hands of a minority. Such laws, by insuring a "permanent and transferable right of use," promote investment and improvement of the soil.⁹⁸ Because of the desertification threat, all new land laws must aim to promote soil protection, which can be accomplished through water conservation, land rehabilitation, and reforestation. Improved fallow practices, diversification of crops, and other anti-erosion measures, constitute other available options. Most importantly, though, these measures should comprise only a part of an overall strategy which attempts to favorably alter farmer's incentives.

Just as improvements in tenancy laws are seen as essential in raising rainfed productivity, alteration of land use laws can also play an important role in a livestock strategy. In the absence of privately owned rangeland, proper laws need to be implemented to assure that these lands are not mismanaged. Land use policy, whether for privately or communally owned land, should emphasize "the division of land between crop and livestock raising."⁹⁹ Better demarcation of community, individual, and government lands, would aid greatly in deciding legal cases involving land ownership and use. Other measures such as better control of brush fires, the establishment of a stocking rate, and increased monitoring of forage and non-forage crops, will also

increase production in livestock. But as with an approach for increasing rainfed productivity, adopted measures must send to the pastoralists the correct incentives.

IMPLEMENTING ANIMAL TRACTION

With its abundance of land, one would think that the spread of mechanical equipment would be more advanced in Africa, and that the use of the hand hoe would be declining.¹⁰⁰ But this is not the case in Africa, as the use of animal traction and tractorization in food production have extended to only isolated pockets. The Sahel is no different from the rest of Africa; mechanization has arrived at only a few restricted areas.

Many factors influence the adoption of animal traction or mechanical powered equipment. Chief among these is the length of the growing season. The shorter the interval of land preparation, the lower the rate of utilization of agricultural mechanization, since the limited time of use confines the timing of plowing and limits multiple users of the same equipment. The short growing season throughout most of the semiarid Sahel, thereby causes the "costs per unit of area that is to be cultivated" with mechanization, to be so high as to discourage use.¹⁰¹ In these arid areas, agricultural profitability is best realized with forest-fallow systems, "where hand-hoe cultivation is capable of producing output at the lowest cost per unit."¹⁰²

On sandy soils, cultivation is best accomplished with the hand hoe, since the ease of working the soil minimizes the weeding and preparation time during planting. Tillage of coarse

sands is thus unnecessary; only with deep clays does it become absolutely essential. Only when the soil is difficult to work and when maintenance of the soil's fertility requires much input of labor (not cut and burn), does the plow become a viable option.

Because they promote agricultural intensification, population density and better access to markets encourage use of the plow. When population density rises, heavier soils such as clays, start to be used. Only a large population can supply the labor needed for the investments in irrigation and drainage, which heavier soils require. Better roads and transport facilities, which improve access to markets, similarly encourage plowing or the adoption of multiple-crop systems. In areas such as the Sine Saloum in Senegal(groundnuts), and in Southern Mali and southwestern Burkina Faso(cotton), mechanization is well advanced. Here, vertically integrated market institutions for cash crops "provide short term credit,(fertilizer) medium term credit,(animals) and assured markets."¹⁰³ Table VII. summarizes the need for land preparation by land type.

TABLE VII.
Soil Characteristics and the Benefits of Plowing

Type of Soil	Waterlogging and waterholding capacity	Risk of drought	Difficulty of land preparation	Effect of land preparation on yield
Clay	High	Low	High	High
Clay loam				High
Silt loam				Intermediate to high
Sandy loam	to	to	to	Intermediate to high
Loamy sand				Low
Sand	Low	High	Low	Nil

Source: Agricultural Mechanization and the Evolution of Farming Systems in Sub-Saharan Africa. p. 58.

Tilling versus Sowing

Once the transition from a forest-fallow or bush-fallow farming system, with its hand-hoe cultivation, is achieved, continued tilling of the soil improves its physical condition. By increasing the soil's total porosity, tillage changes "the pore-size distribution, thus improving aeration, root penetration, and water infiltration."¹⁰⁴ Although tilling improves the land, a farmer nonetheless faces a trade-off between plowing and sowing. At the same time that tilling increases yields it also inevitably delays sowing. Delayed sowing translates into decreased yields. Thus for sowing to be advantageous, its influence on yields must outweigh any loss resulting from delays in sowing. This trade-off is most severe in those areas of the Sahel where the growing period is shorter than 60 days. Here a farmer is better off sowing a larger area by hand, than a smaller more intensive area with a plow.¹⁰⁵

Just as a farmer must decide on the relative merits of tilling, he must also determine what to harvest, since crops do not respond alike to tillage. In dry tropical areas, like the Sahel, "the incremental yields gained from tilling vary from crop to crop, being highest for rainfed rice and lowest for groundnut."¹⁰⁶ These conclusions were based upon 250 experiments the Institut de Recherches Agronomiques Tropicales (IRAT) conducted in French-speaking West Africa from 1952-1969. But since increased use of fertilizer usually accompanies use of the plow, it is impossible to determine how much of the increase in yields is attributable to tillage. Given the larger role that rice has come to play in Sahelian diets, however, policy makers should keep in mind the crop's responsiveness to tillage, when addressing food self-sufficiency questions.

The use of animal traction has most potential in the semi-arid zones where rainfall is high and the growing season is longer than on the desert fringe. Here the deep and heavy soils of the valleys and savannas are quite receptive to measures of intensification. Thus, areas of the Sahel where mechanized rice cultivation is now in place, include the Hauts Bassin, Burkina Faso; Casamance, Senegal; and Mopti, Mali.¹⁰⁷ In addition to favorable soil, these areas also contain high population densities and easy access to markets which sustains high market demand.

One interesting function that animals not assigned to tilling can perform arises in Western Senegal, with horse-drawn

groundnut seeders. Despite a short growing season and light and sandy soil, animal use is still productive here. Because time is so important when sowing, a horse-drawn seeder can cultivate a larger area than sowing by hand. This case illustrates the adaptive nature of Sahelians to their environment.

In summary, the profitability of animal traction depends on the farming system, soil type, and growing season. Where conditions are favorable for its use, the plow has been adopted in the Sahel. Any government attempts to promote mechanization will be best accomplished at the regional or sub-regional level; it is the conditions at this level that will ultimately determine the effectiveness of mechanization.

It goes without saying that Sahelian attempts to improve the quality of their natural environment, will be at best, minimally successful over time. Attention, therefore, must be focussed upon the policy environment. Some short-run constraints that governments could improve upon include: the availability of credit, access to markets, veterinary services, training programs for animals and farmers, and blacksmith training.¹⁰⁸ An extended learning period for both farmers and their traction animals ensures that "at least six to eight years are required to achieve full farm level benefits," from the adoption of mechanization. But over this time-span farmers must repay credit and their animals are at risk to sickness. Under such conditions, animal traction could not be adopted without government aid. Furthermore, animals tend to be "grossly under utilized unless

transportation is also mechanized."¹⁰⁹ These two circumstances illustrate that the availability of credit and markets, as well as the government's role in improving both, cannot be overemphasized.

PROBLEMS OF TRANSFERRING TECHNOLOGY

Nearly twenty years have passed since the green revolution produced India's food miracle. But similar attempts at repeating the green revolution, "that is, using the new seeds and their attendant technology," to increase yields, have met with little success so far in Africa.¹¹⁰ One could almost say that "the first wave of green revolution passed tropical Africa," and in no way has helped stop deterioration in food production.¹¹¹ But comparisons between the Punjab plain, "with its uniform farms, sun and irrigation," and Tropical Africa are misleading.¹¹² Besides having more favorable growing conditions, Punjab's system of land tenure, education, and investment allowed farmers to take full advantage of the green revolution's opportunities. The same cannot be said for sub-Saharan Africa. Resulting from its unfavorable climate, from deficiencies in infrastructure, and from pressures of disease and pest, Africa still lacks the proper state to embark on a green revolution of its own. Unpleasant conditions, therefore, require that highly adaptive specific research be developed for Africa, rather than just transfer of results from Asia, if the greening of the dark continent is to occur.

In most instances, agricultural technologies are introduced

in packages that include several components, "for example, high-yielding varieties (HYV), fertilizers, and corresponding land preparation practices."¹¹³ Usually a "production package" is prepared by a team of a half-a-dozen scientists, who have trudged through the African bush for a few years, testing the suitability of innovations at different locations. At present, the Sahel has too few research workers. Taken as a group, "the mean number of research workers per million rural inhabitants is 7 for Chad, Somalia, Mali, Burkina Faso, Niger and Mauritania."¹¹⁴ Without a greater commitment from both Sahelian governments and donors to the research sector, the creation of new seed types will be delayed.

Given the dearth of researchers, it is not surprising, therefore, that in 1985 probably less than 2 percent of total sorghum, millet, and upland rice area in West Africa is sown to cultivars [improved varieties] developed through modern genetic research."¹¹⁵ With respect to rice, a major import in Sahelian countries, research prospects are bleak. The West Africa Rice Development Association (WARDA) recently reported "that only 2 of over 2000 imported varieties were yielding as well as the best local varieties." There has been recent progress, however, in sorghum research. After a 12 year research program in the Sudan, "in which 5,000 varieties were tested; 3 of the 5,000 turned out to be promising."¹¹⁶ One of the hybrids introduced in the Sudan has produced yields nearly 52 percent higher than local varieties at an experimental station. The new challenge is now to develop

a seed industry, since hybrid seed must be replaced every year.

Adopting and evaluating production packages

But only focusing on yields as a measure of a program's success can be misleading. Changes in a farmer's agricultural behavior "and their preparedness to innovate are a function of several variables." Because agricultural production in the Sahel is almost always part of a social system, such basic characteristics as the "land tenure system, the power and authority of structure, and conduct code of a village" can all influence adoption of new techniques. Any proposed agricultural extension project must therefore "address the village as a social system not simply a collection of individuals."¹¹⁷

Besides a farm's setting, its size can also affect the rate of adoption. Factors such as "fixed adoption costs, risk preferences, human capital, and credit constraints," determine the relationship between farm size and the employment of new techniques.¹¹⁸ Large farms usually produce for the market and market through formal channels; this is not the case of traditional smallholders. One can easily see why, larger farmers embrace more quickly innovations involving higher fixed costs, than smaller farmers. "Innovations which are neutral to scale are eventually adopted by all classes of farmers," but larger farmers are typically among the early adopters.¹¹⁹

When considering the promotion of a production package, policy recommenders must realize that some innovations can be complementary to a certain degree. If means of developing an

assured and regulated water supply are also provided, "a HYV fertilizer package is more profitable and less risky."¹²⁰ The same holds true for improved credit and on going supervision of the site. Easier access to credit reduces the overall risk of the package, while continued visits increase the communication networks in rural communities, thereby heightening dissemination of the new methods. Because HYV technology usually requires more labor inputs, ox cultivation technology which is laborsaving is not complementary.

The use of the two, however, should not be viewed as mutually exclusive. Adoption decisions are not always dichotomous events; "for many types of innovations, the interesting questions may be related to the intensity of use," or how much fertilizer per hectare to use.¹²¹ The Sine Saloum project in Senegal was intended to boost the production of groundnuts. During this project, farmers adopted only part of the project's components concerning groundnuts, and adopted other measures which emphasized improvements of the land. The common concern of risk caused farmers to adopt those innovations associated with less risk, even if they were not directly related to increasing the output of groundnuts.

In sum, it will still be many years before we could even hope to see modest gains in African agricultural productivity resulting from a new green revolution. Indeed, much more research and aid are needed if African agricultural is to reverse its stagnation of the past decade. When the appropriate

technology is forthcoming, however, Sahelian governments must assure that they make its adoption by farmers as rewarding as possible.

Factors such as the predictability of producer prices, the efficiency and availability of marketing arrangements, and the availability and prices of key farm inputs (fertilizers) all directly influence farmer's behavior. Government policies have in fact been blamed for the continued failure in African agriculture. The Berg Report has maintained that "trade and exchange rate policy is at the heart of the failure to provide adequate incentives for agricultural production in much of Africa."¹ Another writer has commented that one of the major keys to Africa's agrarian malaise lies ultimately in government policies over the years.² Overvalued exchange rates, increased import restrictions, and low pricing policies, backed by parastatals, all amount to discrimination against the agricultural sector. When this bias overshadows any and all beneficial sector specific policies, thus negating any positive effect.

PRICING POLICIES

Any trade and exchange rate system that heavily relies upon import restrictions and/or export taxes, serves to hold down the prices farmers receive for their export crops. Such a policy is particularly harmful to those crops in which a major source of agricultural income for African countries. Mauritania receives

V. THE GOVERNMENT SECTOR:

As already mentioned, the "incentive structure" or those aspects of a farmer's environment which affect his willingness to produce and sell, are the key determinants for mobilizing the rural population.¹²² Because the national government can affect the predictability of producer prices, the efficiency and stability of marketing arrangements, and the availability and prices of key farm inputs (fertilizer), it directly influences farmer's behavior. Government policies have in fact been blamed for the continued failure in African agriculture. The "Berg Report" has maintained that "trade and exchange rate policy is at the heart of the failure to provide adequate incentives for agricultural production in much of Africa."¹²³ Another writer has commented that one of the major keys "to Africa's agrarian malaise seems to lie ultimately in government policies over the years."¹²⁴ Overvalued exchange rates, increased import restrictions, and low pricing policies pursued by parastatals, all equate to discrimination against the agricultural sector. Often this bias overshadows any and all beneficial sector-specific policies, thus negating any positive effect.

PRICING POLICIES

Any trade and exchange-rate system that heavily relies upon import restrictions and or export taxes, serves to hold down the prices farmers receive for their export crops. Such commodity taxes on export crops do provide, in fact, a major source of government revenue for African countries. Mauritania receives

nearly 80% of its government revenue from import taxes. If the government allows the real exchange rate to appreciate, moreover, traded agricultural goods become less profitable than non-traded goods, which further discourages agricultural production. Not only are exports hurt by an appreciation in the currency, but cheaper imports become more competitive compared with domestic production.

An overvalued currency is thus an implicit subsidy African governments provide to their urban populations. Most urban consumers are dependent upon imported wheat and rice; cheaper import prices keep the masses happy. Such a policy is politically expedient for government leaders, since urban populations are politically active while the taxed rural sector is not. Communal land holding practices reduce the number of enfranchised rural farmers; ranging nomads prove a difficult group to organize. Although dictatorships must depend to some extent upon popular support, for the most part it is only an urban backing that matters. A World Bank official noted that "if the urban population goes hungry, they rise up in revolt," but if the rural farmers go hungry "they just die of starvation."¹²⁵

In addition to political expediency, cultural values also help explain the presence of an "urban bias" in less developed countries. To most people in such countries urbanization and industrialization represent progress. Only by industrializing can their countries become as developed as the Western economies, proponents of rapid development proclaim. Moreover, for them,

agricultural production seems to inherently signify backwardness. Advocates of rapid industrialization forget that it is efficient production in agriculture initially, which releases the labor force making possible other productions, and not the other way around. Misinterpreting result for cause, such planners would bypass the critical developmental stage of gains in agriculture followed by gains in industry. Unfortunately, many governmental development agencies are staffed by such personnel.

Agricultural price supports in the industrialized Western nations follow a contrary policy, however. In the more advanced countries it is the farmers who are indulgently subsidized, and the urban consumers who foot the bill. Powerful, outspoken cooperatives protect farmer's interests in Western economies; such is not the case in less developed countries. Ironically, the rural farmers, the group which holds the key for economic advancement in the LDCs, has been locked out of the development future by the government.

Recent price trends

The setting of official producer prices has been the most direct way in which governments have subsidized their urban populations. It is not uncommon for some African governments to pay their producers, "half the world price for grains (or even less), and then spend scarce foreign exchange to import food."¹²⁶ Thankfully this has not been the recent case in the Sahel. From the late 1970's until 1984, real producer prices have increased for millet and sorghum, except in Senegal and Mauritania.¹²⁷

After 1980 the upward trend is even more pronounced. At the same time, groundnut yields declined. Because of the increase in official prices, growing millet is now more profitable than growing cotton or groundnuts, almost everywhere in the Sahel. No longer Niger's main export crop, groundnuts have been replaced by the more profitable cowpeas.

Although these estimates are based upon official prices they still give a good indication of a rise in farmer's incomes. Since official marketing of cereals now accounts for only about 10% of total marketings, parallel markets, where the prices have generally been higher, made up the rest. In Niger, cowpeas are traded almost exclusively on parallel markets; the annual volume of "unofficial" production of cowpeas is "believed to be 250,000-300,000 tons, while legal exports have never amounted to more than 30,000-40,000 tons.¹²⁸ Either by selling to a parastatal or on the black market, rural producers have received a better price for their wares. In recent years, therefore, "official producer prices have become a less significant policy instrument," for the governments.¹²⁹ Table VIII. verifies the upward trend in millet and sorghum prices from 1980-85, a time when the CFA franc's value remained stable.

TABLE VIII.
 Producer Prices in Niger and Neighboring Countries, 1980-85
 [In CFA francs per kilogram]

	1980/81	1981/82	1982/83	1983/84	1984/85
Millet-Sorghum					
Niger	40	70	80	80	100
Mali	35	38	45	45	50
Senegal	40	50	50	55	50
Burkina Faso	45	50	60	66	
Rice Paddy					
Niger	55	70	85	85	85
Ivory Coast	65	65	75	76	95
Mali	35	50	55	55	80
Senegal	42	52	52	60	60
Burkina Faso	63	66	68	74	
Groundnuts					
Niger	50	50	90	90	100
Mali	40	45	45	45	45
Senegal	50	70	70	70	70
Cotton					
Niger	62	80	120	120	120
Benin	60	80	85	100	
Ivory Coast	80	80	80	100	115
Mali	58	65	65	65	75
Senegal	60	68	70	70	70
Togo	60	65	65	75	90
Burkina Faso	55	62	62	70	

Source: Cereals Policy Reform in the Sahel: Synthesis Report, p. 25. Appendix C provides comparisons between official producer prices of millet, sorghum, and rice with open market price.

Consumer and Panterritorial Pricing

Just as the rent controls imposed in New York City are intended to provide affordable housing, official consumer prices in the Sahel are supposed to be ceiling prices. Of course ceiling prices generally do not work in practice. Ceiling prices

always disturb allocative efficiency and create administrative problems. The costs of complying are thus too great for suppliers, and the benefits usually accrue to a small minority. Retail food grain prices in the Sahel since 1977 confirm this conclusion. In this period, retail prices were generally 30-100% higher than official prices. The objective of providing low food prices to urban consumers has, therefore, not been fully achieved; "rents or unearned income has accrued to those with access to official prices," while those who do not "must pay the higher open market price."¹³⁰

Panterritorial or panseasonal official pricing, or the maintaining of a single price over the course of the year, is also employed on equity grounds. Part of the Sahelian worldview is a belief in "just prices," or that everyone in the same country should pay uniform prices for basic staples; "the ubiquitous policy of pan-territorial pricing is rooted in this sentiment."¹³¹ But such a policy is costly, inefficient, and often promotes undesired economic behavior. Because farmers resent selling their crops at less than fair market value, much productive land remains underutilized. Finally, just as consumer ceiling prices are unfair in that every one does not have equal access, those who enjoy subsidies from panterritorial pricing are rarely the poorest.

MARKETING AGENCIES

Marketing agencies or parastatals which amount to "de jure public monopolies that sell agricultural inputs, and market

outputs," are the government agencies responsible for setting and maintaining price ceilings and price floors in developing nations.¹³² Establishment of these "state owned enterprises" (SOEs) in developing nations, has been justified on many grounds. That the private sector is inefficient and can be monopolized by a few traders, is the most common explanation governments give for establishing marketing enterprises. The singular difference in price between what a product is sold for in the city, and what the farmer receives, usually has little to do with monopoly profits. The markup in price results almost exclusively from the high costs of transport which accompany a general and rudimentary distribution system. But the creation of parastatals hardly ever corrects such market failures; instead one inefficiency is merely replaced by another. Increased private trading, or the liberalization of markets, is the best means of protecting small farmers from unprincipled private traders, and not the retarding of trade which normally accompanies public monopoly. In effect, the government's creation of a public monopoly to counter the threat of a private one, inevitably leads to less competitiveness.

Other inefficiencies associated with parastatals include, "overmanning, inadequate nonsalary budgets, and management scarcities," all of which lead to an upward spiraling of the parastatal's operating costs.¹³³ As is the case with patronage positions in any government enterprise, key managers are sometimes chosen for political and not administrative reasons.

Complex centrally administered organizations are also ripe sites for corruption. Inefficiencies in the export of a parastatal's crop may also result from a lack of competition. Problems also arise in the procurement of the crop. Many widely dispersed farmers wish to sell several varieties of crops at differing prices to the marketing board. The marketing agency, however, usually offers only one, or at most two, purchase prices throughout the year and for all locations.¹³⁴

Present conditions in the Sahel, however, do justify the creation and continuation of national cereal agencies as long as they remain properly managed. That is to say, as long as they give more attention to productive efficiency, and less to bureaucratic waste. At the very least, cereals agencies could administer national stock reserves, manage and coordinate commercial food imports and food aid programs, as well as prepare and coordinate emergency food plans.¹³⁵ Some export marketing boards have indeed help increase exports through imposing quality control standards, arranging shipping, and providing technical advice and information. Since grain markets are not fully developed in the Sahel, there is general agreement that grain agencies should continue to play some part in grain marketing. The nature and extent of that role, especially with respect to price setting and the size of reserves, provokes continued disagreement.¹³⁶

A parastatal's maintenance of a floor price is one policy that donors have often attacked. After setting the official

price, the cereals board essentially acts as a buyer of last resort. A guaranteed market and definite price should provide sufficient incentive for increased production, proponents of marketing agencies maintain. But the maintenance of such a floor price is often costly. In bumper years, as market prices plummet, cereals boards face high costs in purchasing an enormous crop. The high financial costs associated with the carrying of large stocks and the losses incurred from spoilation, further undermine cereals board's effectiveness.

Some agencies can even go bankrupt trying to maintain a floor price. This was the case in 1979 with SISCOMA, the agricultural implements producing parastatal of Senegal. Moreover, if "border trade" is substantial, a floor price might provide "more income to farmers in neighboring countries than to home producers," certainly an unwanted outcome.¹³⁷

Even if the efforts to provide a floor price were successful, the resulting benefits are at best minimal. Because the parastatals acquire only a fraction of the actually produced crop, the payment of the above market price provides little producer incentive. Although it is expected that the floor price would affect prices throughout the market, it does not send buoyant signals to all producers. Rather the paid price "is mainly an income transfer to those farmers lucky enough to have sold" to the marketing board.¹³⁸ As is the case with all transfer payments, some group is subsidizing another group. If the desired goal is to indeed subsidize producers, a direct cash

payment from the government to the farmers would be more efficient!

Obstacles to reform

Although parastatals continue to operate poorly and inefficiently, governments persist in relying on them for procuring and marketing crops. The hesitancy for change seems to stem from an uncertainty concerning any clearcut alternative. Analytically, there is no quarrel that prices should be raised to reflect producer costs, but when it comes to deciding upon how much to raise domestic prices above international prices, uncertainties arise.¹³⁹ Let us assume that to depress consumption of rice imports, encourage domestic rice production, and to increase demand for millet and sorghum, the Senegal government levied increased import taxes on rice. The ramifications of such a "correct" policy could be quite startling. With the rise in prices consumer's real incomes would fall, they would have less to spend on food, and their nutritional status would worsen.¹⁴⁰ In the pursuit of self-sufficiency in millet and sorghum production, Senegal pays the price of seeing another of its goals--adequate health for its populace--worsen.

Moreover, the overall impact of such a policy on national income, on the balance of payments, and on the state budget, could in fact be negative. If the rise in millet prices is not sufficient to raise millet production to the desired level, producer prices for groundnuts would also have to be lowered.

The corresponding fall in groundnut production would reduce rural incomes. Thus in pursuit of its food self-sufficiency objective Senegal necessarily pays a price in terms of other income and export-related goals.¹⁴¹ For many governments, food self-sufficiency is indeed a higher priority goal than efficient resource use; if this is so, then the attendant reduced income and slower growth which accompany it are viable.

Proposals for reform

Governments must balance different goals when determining agricultural policies. And many times the best means, or surest methods of achieving these goals remain unclear. Especially when transformation of current agricultural policies could have deleterious effects on the economy as a whole. Yet reform of the agricultural agencies is essential. The reliance upon parastatals stunts the growth of small traders and transporters, indigenous intermediaries, as well as craftsmen and small entrepreneurs. The present policy mix threatens to delay the emergence of this group of individuals. Without the development of appropriate rural institutions, the transformation of African agriculture will surely never take place!¹⁴²

But not all news is bad concerning marketing agencies in the Sahel. Recently, reform programs and innovative policy changes have been implemented in Mali, and Niger. After careful review between donors and Malian officials, a reform program encompassing widescale changes in the running of Mali's cereals marketing board was adopted. Liberalization of grain trade,

including the abolishing of OPAM's legal monopoly on trade and the allowing of any trader to import, has led to higher prices based on actual costs. Most impressively, these reforms and the ensuing higher prices, were maintained during 1984, a period which saw spectacular increases in prices.¹⁴³

As a result of the policy changes, OPAM is now much more efficient. With a well planned food distribution program, better information concerning market trends, and much improved capacity to organize emergency relief, OPAM is a much better organization now than in 1980.¹⁴⁴ Because of the OPAM success, there is now a less reluctance to rely upon the private sector for transport, and a greater acceptance of other market solutions.

Niger has likewise enacted similar reforms in an attempt to streamline its cereals marketing board. OPVN has seen its monopoly to import and market millet/sorghum ended. Reduction of input subsidies, as well as the liberalization of the domestic grain market, and the export of cowpeas has also been vigorously pursued. Further actions include a promise from the government to eliminate subsidies on agricultural implements before the end of 1985, as well as a commitment that after 1988, fertilizer subsidies are not to exceed 15% of the price the cooperatives charge farmers.

Although these policy measures suggest a step in the right direction for Sahelian governments, the recentness and complex effects of the reforms do not permit in depth analysis. Some general observations are available, however. As already

mentioned the reform process is complex, and the actual outcomes are not always the expected or desired ones. The implementation process is thus one of discovery, and not a straightforward application of principles which guarantees selected outcomes. As such, Sahelian governments and aid organizations must continue to work closely together in the formulation, adoption, and implementation of policy and goals.

DONORS AND FINANCIAL AID

From 1975 to 1984, almost 15 billion dollars of official development aid was committed to the CILSS member nations.^{145*} Aid expanded from \$4.8 billion in 1975 to \$7.8 billion in 1983, an average increase of 6.1%. No other underdeveloped region in either Sub-Saharan Africa or Asia has received aid on the order of the Sahel. The main purpose of this aid was to help the Sahel prepare for the future. Funds should therefore have been directed towards projects that would increase the productivity of the rural sector and protect the natural environment.

In 1984, however, nearly 50% of all aid was of the so-called "non-project" type, aid that did not contribute to financing investments and preparing the Sahel for the future. Instead much of the aid consisted of food aid. This is especially true of the United States, which although it doubled its aid commitment in 1984, still gave \$120 million out of a total of \$290 million of aid in the form of food.¹⁴⁶ With the recent dramatic increases in food aid the Sahel now finds itself dependent upon shipments.

* See figure one for relative amounts in aid from 1971-1984.

Goals and outcomes of aid

Food aid shipments from food surplus industrial nations to food deficit Third World nations can serve an effective purpose. In times of drought, flooding, epidemics, or famine, deliveries of food aid can avert large scale genocide or, at the very least can mitigate acute distress. Whatever the future climatic conditions, the Sahel countries will not be able to do without some food aid for a number of years.

Food aid, however, is not exclusively a stopgap measure in times of emergency. For over thirty years world shipments of food aid have been an integral ingredient of development aid. Conceivably, food aid can be remarkably beneficial to developing countries. After receiving food aid deliveries, governments might sell basic foodstuffs at reduced prices, thereby improving income distribution. This occurrence, however, depends both on whom buys the food and who distributes it. Through the use of counterpart funds generated by sales of the food aid, domestic food production could be increased. By increasing the net total of resources in the country, food aid could allow governments to direct resources otherwise used, into long-term investments, such as education or infrastructure. If its role has been properly examined and defined, so that it is applied correctly, food aid can have a positive impact on the development of a region. At the very least, food aid deliveries to the Sahel should contribute to improved production that are less vulnerable to drought.

Yet, more often than not, food aid accomplishes little of lasting value. The food offered by foreign donors frequently does not suit the eating habits of the recipients. A steady inflow of such food aid also enables recipient countries to defer measures of their own to raise agricultural productivity. This has been the case in the Sahel. If food aid depresses producer prices, it could undermine the incentives for increasing agricultural production. Furthermore, resulting from deficiencies in transportation, distribution, and storage, insufficient food rarely reaches the truly needy. Because they are landlocked, Chad and Niger face strict logistic problems in procuring food aid. A large proportion of total flows to these countries is dependent upon transit through Nigeria.¹⁴⁷

Given the disparity between the potential benefits of food aid and the actual harmful effects it can induce, donor and recipient nations must take greater care over its execution. For the most part, food aid does not attack the root causes of hunger, which lie in poverty and the resulting lack of purchasing power. Instead, food aid only treats the symptoms. Thus, if the Sahel is to achieve food self-sufficiency, industrial nations must emphasize types of assistance, other than food aid.

Fungibility and absorptive capacity

Other concerns of the granting of aid entail the principles of fungibility and absorptive capacity. The principle of fungibility asserts that economic activities are interdependent and substitutable for one another, and that therefore granting

aid for particular projects is pointless.¹⁴⁸ This is not to say that project evaluation is useless, but that one must consider what projects would have been undertaken without aid. If aid is merely being used to boost short-term consumption and to delay measures for increasing agricultural productivity, then its delivery must be seriously reconsidered.

A country's absorptive capacity is its ability to use additional investment funds productively. Since 1980 all the Sahel's countries have experienced the following trend: the investment ratio (domestic investment as a % of GDP) has stagnated or increased while the GDP growth rate declined. As a result investments are decreasing in effectiveness, and it now takes more CFA francs to obtain an additional unit of product.¹⁴⁹ With the drop in effectiveness of investments, donors and Sahelians must consider the upper limits of aid promises, and work at increasing the usefulness of present disbursements.

Since 1980 a growing amount of aid to the Sahel was going to "survival" of the region, and not to its long-term development. With even less aid going to development, the Sahel's economic position will surely continue to digress. The effectiveness of aid must be expanded, if the Sahel's digression is to stop. Top priority should thus be given to those projects that will "really enhance the productive base of the economy."¹⁵⁰ All too often, the Sahelian countries have found themselves unable to handle the burden of mounting recurrent costs for maintaining development projects. These projects were originally designed to increase

productivity in the Sahel; obviously increases in productivity have come by not nearly enough.

See also published title: "The Sahel: A Study of the Role of Trees and Forestry in the Development of the Sahel", by the author, 1967, and "The Sahel: A Study of the Role of Trees and Forestry in the Development of the Sahel", by the author, 1967, National Development Report, 1967.

WHAT WORKS BEST IN THE SAHEL?

It is indeed true that simple things are the ones that work best in the Sahel. An improved plow that turns over the soil and better fencing of a farmer's fields, and additional planting of trees that serve as windbreaks, are all appropriate policies for developing the Sahel. Such policies directly affect the rural population, since they have a clearly immediate, positive impact. One observing and implementing "what works" in rural areas is most important, it is in these areas where the inhabitants have their survival to the "democracies" of the land, that the fundamental strength of the Sahel lies.

All future development programs, therefore, must take into account the uncertainty of the region, the adaptive nature of the lifestyles and support systems of the area's inhabitants. In doing so, those areas that receive the most benefit in dry years, periods subject to the area's prevailing conditions. Other important resources include participating just as much as to the Sahel, at least so many days within a day's walking distance of the Sahel, etc. This type of approach focuses attention on the possibility that human activities in the Sahel can affect the climate, not only negatively but positively.

VI. Conclusion:

Man has punished this barren realm, stripping it of trees and bankrupting the soil. Abetted, the desert advances and the region edges towards catastrophe.

Source: "Africa's Sahel: The Stricken Land," National Geographic, August, 1987.

WHAT WORKS BEST IN THE SAHEL?

It is indeed true that simple things are the ones that work best in the Sahel. An improved stove that burns less fuelwood, better fencing of a farmer's lands, and additional planting of trees that serve as windbreaks, remain appropriate policies for developing the Sahel. Such policies directly affect the rural population, since they have a visibly immediate, positive impact. Thus observing and implementing "what works" in rural areas is most important; it is in this area, where the inhabitants have fine tuned their survival to the idiosyncracies of the land, that the fundamental strength of the Sahel lies.

All future development programs, therefore, must take into account the one certainty of the region--the adaptive nature of the lifestyles and support systems of the area's inhabitants. By moving to those areas that receive the most rainfall in dry years, nomads adjust to the area's prevailing conditions. Other adaptative measures include "apportioning just so many cattle to graze for just so many days within a cow's walking distance of just so much water."¹⁵¹ This type of approach focuses attention on "the possibility that human activities in the Sahel can affect its climate," not only negatively but positively.¹⁵²

But all too often, the actions and recommendations of aid donors and government officials have not taken this fact into account. In the past, projects have been set up as independent units, which appear external to the people. Such projects have only achieved spotty success, far short of the amount necessary to offset the deleterious effects of high population growth rates and rapid urbanization. The low level of success shows that development cannot be imposed from above, but must come from and include the populations. Inclusion of the rural Sahelians in the formulation and adoption of development plans, has in fact become a new strategy. The goal of this strategy is to ensure the men and women of the Sahel once again "play an active role in their own development."¹⁵³

In conclusion, governments and aid donors can create favorable conditions for development and provide needed investment capital, but ultimately success or failure lies with the people themselves. The "logic" of a donor project becomes very illogical if it does not fit into the thinking of the rural population. The reasoning of the rural population has in fact been shaped by, and adjusted to the unfavorable Sahel environment. Such expertise should be consulted before projects are designed. For to ignore such knowledge smacks of the Mossi proverb which states: "Foreigners see only what they already know."

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LIVESTOCK STATISTICS IN 1977

(in thousands of animals)

	Cape- Verde	Gambia	Upper Volta	Mali	Mauri- tania	Niger	Senegal	Chad	Total
Cattle	11	290	1,900	4,076	1,400	2,900	2,440	3,716	16,733
Sheep	2	95	1,300	4,437	4,700	2,560	1,760	2,440	17,302
Goats	20	92	2,377	4,057	3,100	6,200	395	2,440	19,189
Camels	--	--	5	100	700	265	6	316	1,480
Horses	2	--	90	160	16	210	216	145	839
Donkeys	8	4	170	429	100	370	200	300	1,661
Pigs	19	9	150	26	--	28	166	6	412
Poultry	60	260	7,460	10,284	2,900	7,400	6,016	2,860	38,040

Source :Elements for a Livestock Development Strategy
in Sahel Countries, 1977, p. 29

Appendix C

Prices of Millet in the Sahelian Zone

Appendix B

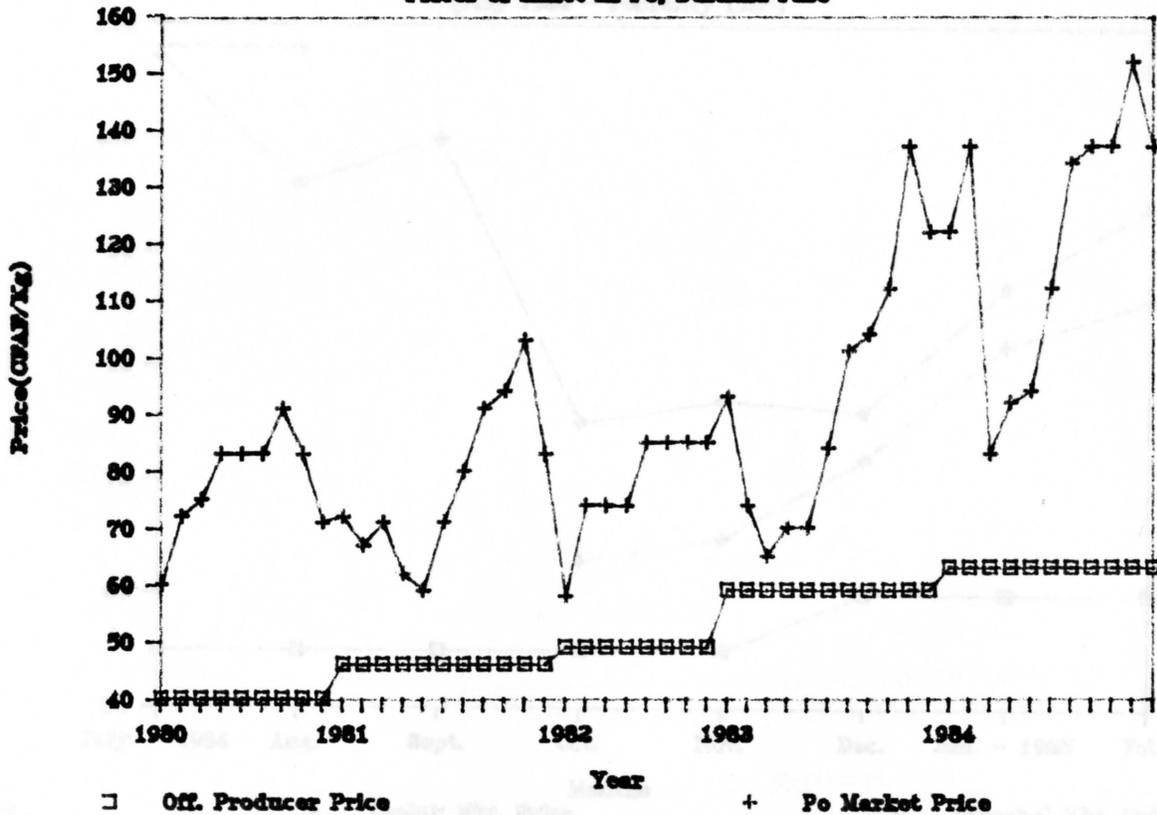
Summary Information Concerning the Level of Mechanization at Farming Sites in Burkina Faso.

Village Sites	Annual rainfall (milli-meters)	Popu-lation density	Access to markets	Farming system	Tools used	Primary crop	Second-ary crop
1. Boromo region	950	40	Excellent	Short fallow	Animal traction	Sorghum	Millet
2. Volta Noire	1,050	35	Good	Short fallow	Animal traction	Sorghum	Maize
3. Ouagadougou	550	80	Fair	Emerging annual cultivation	Animal traction	Millet	Sorghum
4. Yatenga	850	50	Very poor	Emerging annual cultivation	Hoe	Millet	Groundnut

Source: Agricultural Mechanization and the Evolution of Farming Systems In Sub-Saharan Africa

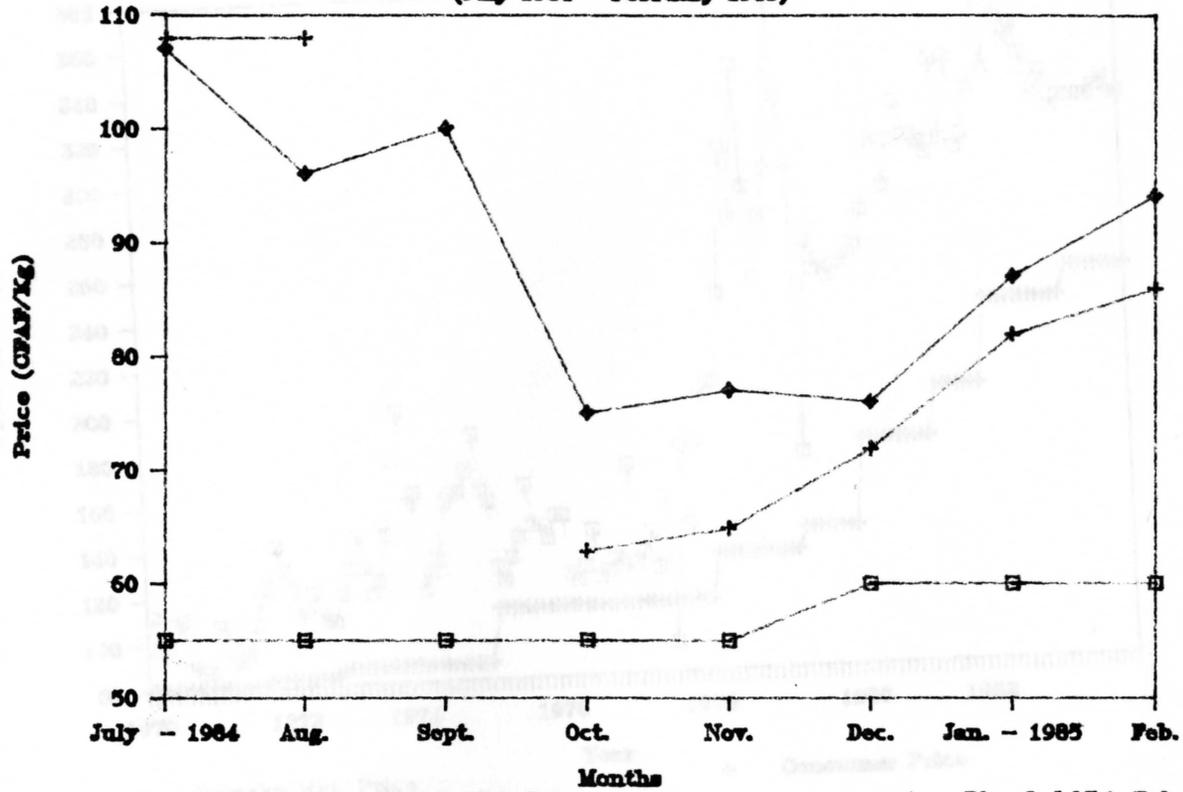
Appendix C

Prices of Millet in Po, Burkina Faso



Different Prices of Millet in Senegal

(July 1984 - February 1985)



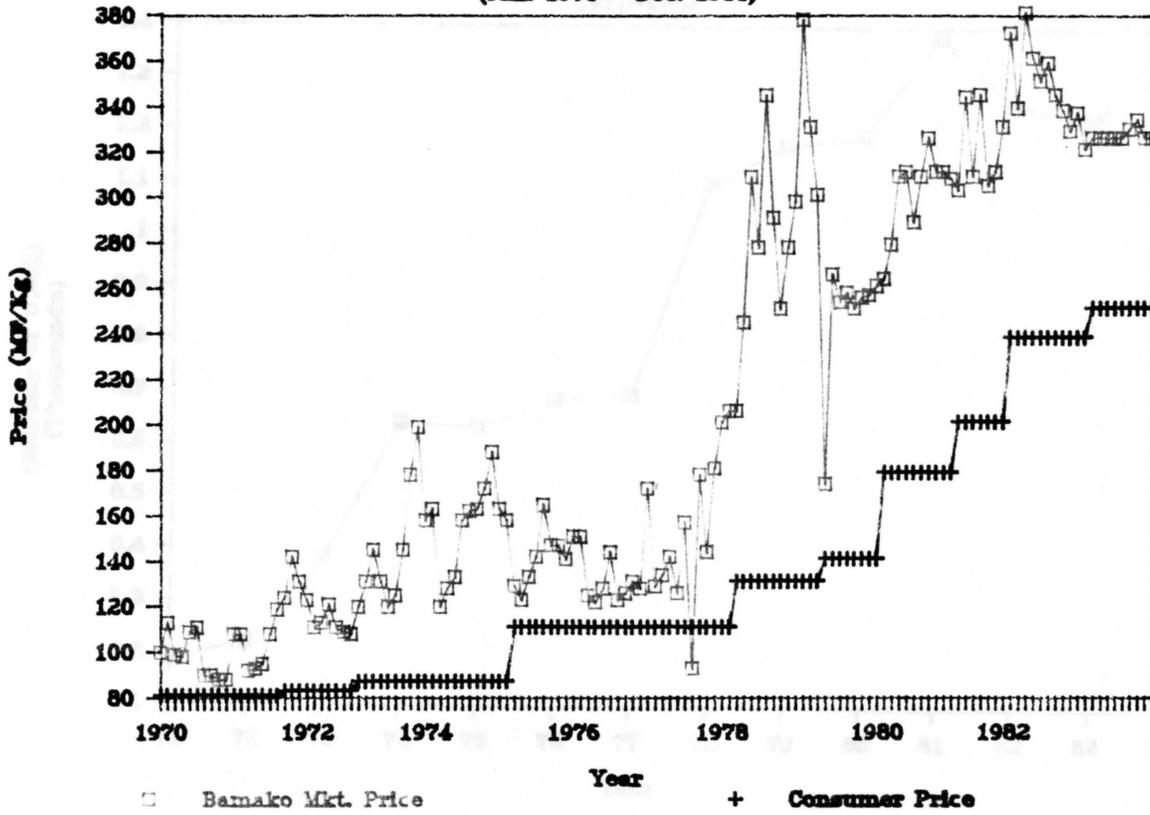
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+ Kaolack Mkt. Price

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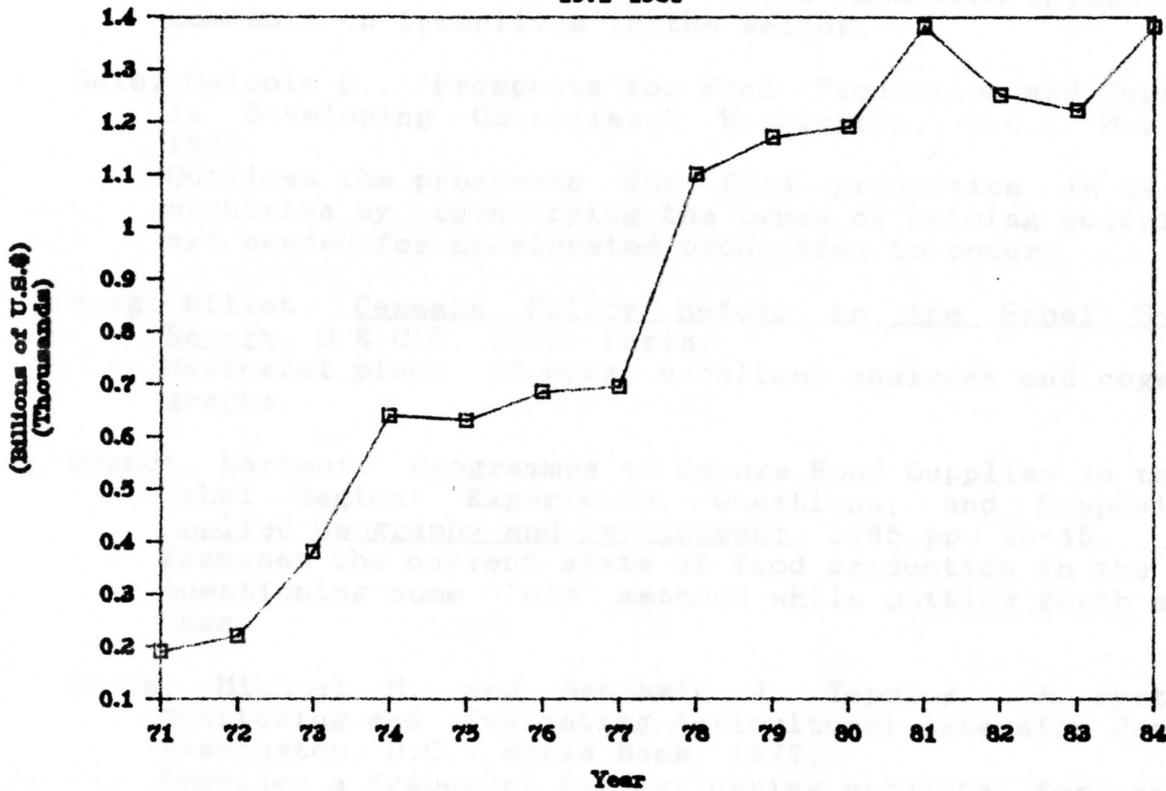
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Net Disbursements to Sahelian Countries

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