

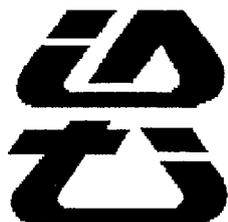
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Senegal Agricultural Sector Analysis Update

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LIST OF ACRONYMS

ANCAR	Agence Nationale de Conseil Agricole et Rural
CDH	Centre de l'Horticulture
CERP	Centre d'Expansion Rurale Polyvalent
CFD	Caisse Francaise de Developpement
CID	Consortium for International Development
CIF	Cost Insurance Freight
CILSS	Comite Inter-etat de Lutte Contre la Secheresse au Sahel
CNCR	Conseil Nationale de Consertation et de Cooperation des Ruraux
CNCAS	Caisse Nationale de Credit Agricole du Senegal
CONSERE	Conseil Superieur des Ressources Naturelles et de l Environnement
CPSP	Caisse de Perequation et de Stabilisation des Prix
CRAF	Centre de Recherche en Economique Appliquee
CRODT	Centre de Recherche Oceanographique de Dakar Thiaroye
CSE	Centre de Suivi Ecologique
CSPT	Compagnie Senegalais Phosphate de Taiba
CSS	Compagnie Sucriere Senegalais
DESIM	Division des Semences
DPDA	Declaration de Politique de Developpement Agricole
EIU	Economist Intelligence Unit
ENDA	Environment and Development Action
ESAF	Enhanced Structural Adjustment Facility
EU	European Union
EUROSTAT	European Union Statistical Office
FAO	Food and Agriculture Organization
GDP	Gross Domestic Product
GIE	Groupement d'Interêt Economique
GOS	Government of Senegal
GRAF	Groupe Recherche-Action-Formation
GRS	Groupe de Reflexion Strategique
GTZ	German Aid Agency
ICRISAT	International Research Institute for the Semi-Arid Tropics
ICS	Industries Chimique du Senegal
IFAN	Institut Fondamental d'Afrique Nord
IFPRI	International Food Policy Research Institute
IITA	International Institute of Tropical Agriculture
IMF	International Monetary Fund
IRRI	International Rice Research Institute
ISRA	Institut Senegalais Recherche Agronomique
ITA	Institut de Technologie Alimentaire
KFW	German Technical Assistance
LAPD	Letter of Agricultural Development Policy
MEPN	Ministry of the Environment and the Protection of Nature

NEAP	National Environmental Action Plan
NGO	Non-Governmental Organization
OMVS	Organisation pour la Mise en Valeur du Fleuve Senegal
ORSTOM	Office Recherche Scientifique dans les Territoires d'Outre-Mer
PASCO	Private Sector Adjustment and Competitiveness Credit
PDRG	Programme de Developpement de la Rive Gauche
PISA	Programme d'Investissement du Secteur Agricole
PNAE	Plan Nationale d'Actions pour L'Environnement
PNVA	Programme Nationale de Vulgarisation Agricole
PRDF	Plan Direction de Developpement Forestier
PTIP	Programme Triennal D'Investissement Publics
PVO	Private Voluntary Organization
RASP	Rice Sector Adjustment Program
SAED	Societe National d'Aménagement et d'Exploitation des Terres du Delta du Fleuve Senegal et des Vallees du Fleuve Senegal et de la Faleme
SAF	Structural Adjustment Facility
SAFGRAD	Semi-Arid Food Grains Research and Development
SAL	Structural Adjustment Loan
SASA	Senegal Agricultural Sector Analysis
SECAL	Sector Adjustment Loan
SEFICS	Societe d'Exploitation Ferroviaire Industrie Chimique du Senegal
SENCHEM	Societe de Commercialisation des Industries Chimique du Senegal
SISMAR	Societe Industriel Sahelienne de Mecanique de Materiels Agricole de Representations
SODAGRI	Societe de Developpement Agricole et Industriel du Senegal
SODEFITEX	Societe de Developpement des Fibres Textiles
SODEVA	Societe de Developpement et de Vulgarisation Agricole
SONACOS	Societe Nationale de Commercialisation des Oleagineux
SONAGRAINES	Societe Nationale des Graines
SRDR	Societe Régionales de Developpement Rural
UNIS	Union Nationale Interprofessionnelles des Semenciers
USAID	United States Agency for International Development
VAT	Value Added Tax
WARDA	West Africa Rice Development Association
WAEMU	West African Economic and Monetary Union

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EXECUTIVE SUMMARY

The Executive Summary is divided into four parts. First, there is a description of macroeconomic policy since 1993. The second part is a short analysis of some of the impacts of structural adjustment on the agricultural and natural resource sectors. Third, we present some of the remaining constraints to increasing agricultural production. Finally, we suggest some possible ways that USAID might provide support in the agricultural and natural resource sectors.

1 MACROECONOMIC POLICY

Over the past decade, the Government of Senegal (GOS) has demonstrated courage by liberalizing its economy. The liberalization program, which began with the adoption of the Nouvelle Politique Agricole in 1984, was a response to two decades of poor economic performance. During that time Senegal experienced the lowest Gross Domestic Product (GDP) growth rate of any African state not affected by war or civil strife.

Between 1983 and 1993 the GOS implemented a package of structural and macroeconomic policies under its Medium and Long-term Structural Adjustment Program. The adjustment program was aimed at alleviating the obstacles to sustained growth in per capita incomes, controlling inflationary pressures in the national economy, and redressing certain domestic and external financial imbalances.

In the agricultural sector, the most significant improvements of the period came in the following areas:

- Deregulation of domestic coarse grains markets,
- Elimination of subsidies on most agricultural inputs,
- Reduction in public enterprise involvement in sector activities and greater enforcement of financial accountability through management contracts,
- Willingness to use agricultural price and trade policies to affect improvements in terms of trade and income disparities, and
- Greater control over the allocation of available budgetary resources, coupled with greater transparency in accounting practices.

In early 1994, the Government decided to adopt a comprehensive adjustment strategy, including the devaluation of the fcfa in coordination with other members of the West African Economic and Monetary Union (WAEMU), in order to achieve sustained economic growth and financial viability over the medium term. The medium-term strategy involved, in addition to the adjustment of the exchange rate parity, strong fiscal and monetary policies designed to contain inflation and restore competitiveness on a lasting basis, and the acceleration of structural reforms aimed at improving incentives for the private sector.

Starting in 1994 the Government with support from the World Bank and other donors has undertaken a major restructuring of the economy and the agricultural sector. This restructuring includes

- 1 liberalizing the agricultural sector international trade regime
- 2 liberalizing domestic marketing and pricing of all agricultural products
- 3 privatizing the production processing and marketing of groundnuts and rice
- 4 developing a new policy on decentralization, and
- 5 undertaking a structural reform of the Ministry of Agriculture

Macroeconomic policy is on the right track, but will require sustained support by the donor community if the benefits of an improved macroeconomy are to be felt by Senegalese farmers. However, the task, of translating an improved macroeconomic environment into increased agricultural productivity has only just begun. Few farmers today would agree that their financial situation is better now than it was three years ago. They have seen little of the benefits of the improved economic picture.

2 STRUCTURAL ADJUSTMENT AND ITS IMPACT ON AGRICULTURE

Devaluation, structural adjustment and decentralization have resulted in a major shift in paradigm. This shift is having a fundamental impact on the agricultural and natural resource sectors and the impact will likely accelerate over the next few years. As the Government moves out of production, marketing and processing there have been short-term economic impacts on the agricultural system. For example

- the price of imported agricultural inputs have increased as a result of devaluation,
- the availability of agricultural inputs have decreased because the parastatals that used to supply them no longer supply them and the private sector traders have not yet picked up the slack,
- the ability of farmers to purchase agricultural inputs has diminished, partly due to price increases, partly due to lack of physical availability, and partly due to the reduced availability of credit, and
- finally, the reduced use of inputs has had a negative impact on yields and production

The combination of lack of availability of fertilizer, its increase in price (the price of Urea increased 157% in the last six years) and lack of credit has reduced the amount of fertilizer that has been used in the last three years. Fertilizer use has declined from 51,595 mt in 1993, to 38,600 mt in 1994, to 30,701 mt in 1995, and to 32,437 mt in 1996.

The reduction in the use of agricultural inputs has had a negative impact on yields and production. Since 1989, the last production year analyzed in the USAID Agricultural Sector Analysis, groundnut production and yields have decreased substantially, never approaching 1989 levels. In fact, production and yields have decreased at accelerated rates compared to the previous 20 year period. Between 1988 and 1996, production and yields have decreased on average 2.3% and 2.4% respectively per year.

The principal cause of the decline in production is the decrease in the use of certified seed and fertilizer for the reasons mentioned above. In the absence of credit for certified seed or fertilizer, many farmers are responding by employing seeding rates well beyond recommended levels to increase productivity and foregoing the essential rotation of crops. While this may be an effective short-term solution, this practice will have dire medium-term effects on the already limited soil fertility.

As would be expected, the significant decline in groundnut production has had an adverse impact on the amount of raw material entering the SONACOS oil plants. Plants are now running at 30% of capacity. The decline in delivered raw material, however, has far outstripped the decrease in groundnut production. This is clearly attributable to the continued development of the parallel market which offers producers substantially higher prices than SONAGRAINES, the GOS parastatal.

Millet and sorghum production and yields have essentially stagnated during the last seven years. Subsequent to the 1994 devaluation, the anticipated substitution of local millet for imported rice has not occurred.

Since the publication of the USAID Agricultural Sector Assessment in 1991, the rice sector has undergone a complete transformation. The January 1994 devaluation and the implementation of the GOS Rice Sector Adjustment Program has had profound impacts on consumers and rice producers. Since devaluation and the concurrent liberalization of the rice trade, the average nominal increase in price of rice has been 23%. This has had a severe impact on Senegal's most financially vulnerable groups. Despite increased costs, however, there appears to be no decrease in rice consumption. As a result of liberalization, consumers today have a far greater choice of rice in terms of quality and price. Rice production in the Senegal River Valley is in sharp decline. Despite devaluation, local production remains uncompetitive due to high production costs, decreased availability of credit, poor quality product and an ineffective tariff protection system. It is unlikely that local producers can, in the medium term, be competitive with broken rice imports. If Senegal can improve yield and product quality, it has an opportunity to be competitive in the whole grain rice market.

Since 1989, horticulture has been one of the more dynamic productive activities within the agriculture sector. Prior to devaluation, production trends were already on the rise. This was accentuated after the currency realignment. Devaluation did indeed have the anticipated consequence: import substitution. Exports, however, to both European and regional markets declined slightly. Domestic production, storage and marketing techniques are rudimentary in

nature. With the exception of a handful of commercial sized growers, production is typically on plots of less than half a hectare. Yields and quality are generally low due to the use of inappropriate seed varieties, low fertilizer and insecticide use and frequent problems with saline irrigation water.

Senegal is a marginal player in the European market. Green beans, melons and lantern peppers account for over 80% of the country's horticultural exports, primarily to France. Senegal's market share is insignificant and its direct competitors during Senegal's growing season are mostly countries who have a long-standing and highly developed agricultural export sector. Opportunities for horticultural export marketing to Europe are very limited. Potential, however, does exist to significantly increase exports to Mauritania and the Cape Verde Islands.

Small scale horticultural production for the local market merits encouragement. In addition to providing good returns on a per hectare basis, its potential impact is far larger. It provides farmers with an economic activity during the dry season, improves nutrition and is a source of revenue for rural women. Perhaps most importantly, it has the potential to slow the rural exodus and can provide capital to permit cereal and cash crop producers to finance inputs to increase their productivity.

3 CURRENT CONSTRAINTS TO AGRICULTURAL DEVELOPMENT

Factors that inhibit agricultural development in Senegal can be found at all levels: the natural resource base, macroeconomic policy, and production and marketing. The following paragraphs summarize some of these problems.

3.1 Resource Base and Natural Resource Management

Since the publication of the 1991 USAID Agricultural Sector Analysis little has changed in the physical resource base. The major physical constraint is the combination of poor **soils**, inadequate **water** availability, and a relatively large and rapidly growing **population**.

Soils that are suitable for agriculture are limited. It is estimated that (a) only 19% of the surface area of Senegal has soils that are deemed suitable for agriculture, and (b) some of these limited soils are suffering from degradation from overuse and erosion. The situation with water supply is equally bad. Rainfall has been decreasing since the 1960s. While the enormous seasonal and annual variations that are typical make trends difficult to detect, this decline shows no signs of reversing. Surface water suffers from (a) strong seasonal and annual variation in flows, (b) chemical pollution from agricultural runoff, and (c) salinization from sea water invasions in the lower Casamance basins. Finally, the ground water situation suffers from (a) insufficient knowledge of aquifer capacities, (b) over exploitation of certain aquifers, (c) weak recharge capacities, and (d) excessive mineral content in some aquifers. Associated with this

inadequate and deteriorating natural resource base is a population that is growing rapidly and will reach an estimated 9 million in 2000

Two major shifts have, however, taken place in the natural resource management paradigm during this period. The first is the evolution of the concept of decentralization making the people most closely concerned with the resource responsible for its management. The second is integration coordinating all the functions relating to natural resource management that were previously widely scattered throughout the government through a newly established Ministry of Environment and Protection of Nature under the umbrella of the forthcoming National Environmental Action Plan (NEAP)

Other problems associated with the natural resource base and its management include

- deforestation is decreasing the availability of fuelwood,
- natural resource information is poorly organized,
- the land tenure system favors agriculture over forestry,
- lack of involvement of stakeholders,
- a "command and control" mentality from the center, and
- lack of management skills at all levels

3.2 Macroeconomic and Agricultural Sector Policy

Starting in 1994, the Government, with support from the World Bank and other donors, has undertaken a major restructuring of the economy, the agricultural sector and the natural resource sector. This restructuring includes

- 1 devaluing the fcfa in January 1994 to promote primary sector exports and to encourage import substitution,
- 2 liberalizing the agricultural sector international trade regime,
- 3 liberalizing domestic marketing and pricing of all agricultural products,
- 4 privatizing the production, processing and marketing of groundnuts and rice,
- 5 undertaking a structural reform of the Ministry of Agriculture,
- 6 developing a new policy on decentralization,
- 7 developing the National Environment Action Plan, and
- 8 creating the Ministry of the Environment and Protection of Nature

Macroeconomic policy is on the right track, but will require sustained support by the donor community if the benefits of an improved macroeconomy are to be felt by Senegalese farmers

3.3 Agricultural Production and Marketing

There have been changes in recent years in (a) the availability and affordability of agricultural inputs, (b) production techniques and (c) the marketing of agricultural products. Some of these changes are described below. There are many agricultural production and input deficiencies that constrain agricultural production including (a) land (b) credit, (c) seeds (d) fertilizers & pesticides, and (e) equipment.

The quantity and quality of agricultural land in Senegal is deteriorating over time. This results in a reduction in the per capita land that is available for agricultural production and a further reduction in the amount of land in fallow and soil quality. Finally, the need to use or sell peanut hay, millet stalks and cereals for livestock use rather than incorporating these back into the soil to improve the organic matter content also results in a loss of fertility.

Short-term credit for cash crops was historically provided by parastatals. As these organizations move out of providing credit, the lack of credit has become an increasingly important constraint. The slack in providing credit has not been taken up by suppliers of inputs or purchasers of outputs, partly because of past poor repayment rates. The consequences of this lack of credit is a reduction in the purchase of other inputs such as improved seeds, fertilizers, pesticides and new agricultural equipment. In summary, the lack of credit results in a decline in the purchase of inputs which in turn results in a reduction of agricultural output.

Production techniques have changed somewhat as a result of policy changes, changing rainfall patterns, and changes in relative prices of inputs and outputs. For example, unavailability of good quality seed and late seeding of groundnuts have had a substantial impact on yields. Some of the reasons invoked include (a) untimely distribution of groundnut seed, (b) absence of farmer's own good quality seed stocks, (c) reducing risk of late rains or early droughts by planting later, and (d) competition for use of seeders and tillers which results in favoring food crop production rather than cash crops. Furthermore, imported inputs such as fertilizer and equipment have increased in price more than producer prices. This has resulted in a decline in the use of these imported inputs.

By way of example, devaluation has, in many regions, improved the profitability of groundnuts relative to millet. In the absence of credit for certified seed or fertilizer, many farmers are responding by employing seeding rates well beyond recommended levels to increase productivity. Length of fallows is also decreasing. While this may be an effective short-term solution, this practice will have dire medium-term effects on the already limited soil fertility.

Marketing is also undergoing significant changes which have had an impact on production and the amount of surplus available for off-farm sales. For example, the decrease in outlets for fertilizer sales and collection points has had a substantial negative impact on groundnut production. At present, certified groundnut seed is available only at SONAGRAINES collection points two months prior to planting season. Moreover, it is sold only in 50 kilogram sacks. The limited number of commercial outlets and the size of minimum purchases hinder acquisition.

Another important constraint for improving agricultural performance is that the linkages between agricultural research and the development institutions are weak. There is evidence that new packages and practices developed by researchers do not always get transferred to farmers. The national agricultural extension service is itself fragmented.

4 POSSIBLE OPTIONS FOR USAID SUPPORT

Senegal is in the midst of a period of tremendous change. During the last four years the Government has devalued its currency, liberalized both domestic and international trade, disbanded many parastatals, privatized others and reduced the services and subsidies for yet others, embraced the concept of the market economy and an increased role for the private sector, embarked on a process for revamping policy and investment in agriculture, and started a major process of decentralizing the delivery of government services. These changes, in turn, have had an impact on the meso and micro economies of agriculture. Marketing channels for inputs and products have undergone significant transformation, the price and availability of inputs such as fertilizers, improved seeds and pesticides have been altered, and farmers have reacted to these changes by changing the combination of crops and varieties grown and the proportion of inputs used to grow them.

Structural adjustment was essential for macroeconomic and financial reasons. Most of the changes that have taken place at the meso and micro level were required, even though in the short to medium term they will be disruptive at times and will create winners and losers. An important role for the donors, USAID included, is to assist Senegal in making this essential transformation from a centralized, state dominated and dirigiste economy to a decentralized one where individual consumers, producers, free markets and the private sector make most of the day to day decisions in a liberalized economy.

The following options are proposed within USAID's philosophical framework of private sector promotion, fostering of beneficial competition and results-oriented development activities. While all of the activities may not have a direct impact on enhancing productivity, they strive to promote the enabling environment necessary for its accomplishment.

4.1 Supporting Continued Liberalization

First, USAID should consider continuing to provide support for market liberalization, privatization and the development of the private sector both at the macroeconomic level and at the agricultural sector level. Structural adjustment will inevitably result in segments of the economy being hurt and pressure being brought to bear on the Government to provide relief through such means as import restrictions and price controls. These restrictions and controls, while making short-term political sense, will be harmful to the economy in the longer term. The donors, especially the World Bank and USAID, should provide support to the Government so that it can resist the pressures to the extent possible. This assistance might take the form of a

combination of activities such as the RSAP moral support and, perhaps other forms of financial support

4.2 Decentralization and Natural Resource Management

Secondly, USAID should consider providing support for both decentralization and the National Environmental Action Plan (NEAP). The Government is currently in the process of re-engineering with an aim to fostering greater participation and responsibility by its citizens in governance and defining a cohesive approach to the management of its natural resource base. The process revolves around two major policy changes. The first of these is the Decentralization Law which went into effect on December 31, 1996 and is intended to devolve responsibility for many aspects of governance and natural resource management from the state to regional and local levels. The second initiative is the NEAP which is now being finalized and is scheduled for adoption after validation in June of this year. It is intended to provide an overall, unified foundation upon which the necessary institutions, regulations and policies for rationally managing natural resources and the environment can be constructed.

The emerging decentralized framework and the adoption of the NEAP are bold and promising initiatives which can provide the means for improving the management of the productive resource base. These initiatives, however, will require the coordinated and sustained support of Senegal's partners. Areas for potential USAID attention include

- 1 Strengthening the planning, programming and management capacities of regional, communal and local councils in NRM related areas by providing appropriate training and technical assistance, and structuring interventions in a manner that reinforces these agencies rather than bypassing them, as has so frequently happened in the past,
- 2 Improving the government's ability to provide technical support in agriculture and natural resource management by reinforcing the skills of the future national extension service, particularly in new areas included in their expanded mandate such as marketing and farm-level financial advisory services,
- 3 Continuing to support key natural resource management agencies involved in monitoring and coordination activities such as the Centre de Suivi Ecologique and the Conseil Supérieur des Ressources Naturelles et de l'Environnement, and
- 4 Taking a broad holistic approach that considers the interrelated nature of environmental factors when planning rural development and research interventions, avoiding a concentration on single, isolated production factors

4.3 Support to Agriculture

Finally, USAID might consider continuing support for some of the more traditional interventions in the agricultural sector. Devaluation and the partial withdrawal of the state from supplying inputs and purchasing outputs has resulted in a further reduction in both the availability and affordability of agricultural inputs and credit. There is widespread consensus that the availability and affordability of agricultural inputs and agricultural credit are the two most important constraints to increasing agricultural productivity. Next is an effective extension and research-extension-farmer linkage. There are a number of possible interventions in these areas.

First, USAID might wish to consider developing partnerships with private sector seed, fertilizer and agricultural chemical producers whereby USAID would partially finance promotional efforts of these private sector firms. The private sector firms would reimburse USAID out of increased sales. This option would entail investment in updating improved seed, fertilizer and pesticide demonstration response trials but has the advantage of being (a) private sector oriented, (b) relatively easy to quantify and monitor, and (c) directly linked to the desired result of increased productivity.

Second, increasing farmers demand for productivity-enhancing inputs is, of course, only half of the equation. Facilitating access to affordable credit is a prerequisite for purchasing more inputs. However, experience has shown that credit schemes where the state is the sole lender have not been successful. The recent evolution of rural credit unions merits close examination by USAID. There would appear to be significant needs in financial management training, program and policy development and liquidity.

Third, in addition to agricultural input demand constraints which need to be addressed, increasing the supply of quality seed is also critical. ISRA, in collaboration with international research centers, has identified improved varieties for most major crops grown in Senegal. The availability of good quality seed in adequate quantities from UNIS is a major constraint to increased crop production, particularly regarding food crops. During interviews conducted by the team, the Permanent Secretary of UNIS emphasized the need for technical assistance for training in food crop seed production, control and certification.

One final area which might warrant further investigation is in horticultural exports. Although the opportunities for developing significant horticultural export marketing activities are very limited and are, in any case, being supported by the European Union, the non-perishable dried fruit, pulp and herbal tea export market might be examined as demand has increased sharply for nutritional snack foods in health conscious Western markets. The possibility of exporting to the regional market should also be explored.

INTRODUCTION

Purpose of Report

The purpose of this report is to (a) provide an up-to-date agricultural and natural resources management sector analysis (b) provide options for alternative strategies for the period 1998-2005, and (c) make recommendations on the alternative strategies

Methodology

Three sources of information were used in preparing this report (a) published documents available in USAID and elsewhere in Dakar, (b) interviews with government officials and representatives of the donor community in Dakar and (c) electronic data provided by the Ministry of Finance and CSE. The list of published documents that were reviewed and the list of persons met are presented at the end of the report. The team did not make any field trips outside of Dakar during the eight week mission.

Organization of Report

The report is divided into five chapters. Chapter 1, prepared by James Bucknall, describes the changes that have taken place in macroeconomic policy over the last decade and the impacts that these changes have had on the agricultural and natural resource sectors. Chapter 2, prepared by Douglas Brown, discusses the natural resource situation in Senegal, the impact that a growing population is having on these natural resources, and the changes in natural resource management policies that have taken place during the last seven years. Chapter 3, prepared by Geoffrey Livingston, examines the impact that structural adjustment and evaluation has had on the production, marketing and pricing of Senegal's principal commodities. Chapter 4, prepared by Robert Kagbo, highlights the changes in production techniques since 1989. Chapter 5, which provides possible options and alternative strategies, was prepared by the team as was the Executive Summary.

CHAPTER 1 GOVERNMENT POLICY AND AGRICULTURE

1 1 INTRODUCTION

Senegal is in the midst of major economic and political change which will have a profound impact on agriculture and natural resource management. This change involves macroeconomic policies such as devaluation, structural adjustment and agricultural sector structural adjustment, a fundamental rethinking of the agricultural sector's programming and investments, and a program of decentralization involving the creation of a new elected level of government and the passing of significant powers from the central government to regional and local governments.

The purpose of chapter 1 is to describe, using a broad brush, some of these changes and the impact that they might have on agriculture and natural resource management. Section 1 2 describes the Government's overall structural adjustment program. Section 1 3 and 1 4 describe the agricultural sector structural adjustment program. Sections 1 5 and 1 6 describe the new approach to investment in agriculture, the current investment program in the primary sector, and selected donors programs in agriculture, environment and natural resource management. The final section briefly describes the Government's new policy and law on decentralization.

1 2 SENEGAL MACROECONOMIC ADJUSTMENT PROGRAM

1 2 1 Prior to August 1993

In the first two decades following independence (1960-80), Senegal's economic performance was poor. Senegal experienced the lowest Gross Domestic Product (GDP) growth rate of any African state not affected by war or civil strife. GDP grew on average by 2.1% in real terms per annum, compared to a population growth rate of 2.8%, resulting in a decline in per capita income. By 1981, all key economic indicators reflected serious financial and structural imbalances: the fiscal deficit stood at 12.5% of GDP, the current account deficit reached 25.7% of GDP, the inflation rate soared to 12% per annum, savings were negative, and total consumption exceeded GDP. The total stock of debt represented over two-thirds of GDP and the debt service represented nearly one-fifth of total exports [Senegal Stabilization, Partial Adjustment and Stagnation, World Bank, 1993].

Between mid-1983 and 1993 the Government of Senegal (GOS) implemented a package of structural and macroeconomic policies under its Medium and Long-Term Structural Adjustment Program. The adjustment program was aimed at alleviating the obstacles to sustained growth in per capita incomes, controlling inflationary pressures in the national economy, and redressing certain domestic and external financial imbalances.

The discrete components of the adjustment program implemented in the 1980s were supported by successive Stand-by Arrangements from the International Monetary Fund (IMF), as well as arrangements under its Structural Adjustment Facility (SAF) and the Enhanced Structural Adjustment Facility (ESAF) Major support for the adjustment process was also provided under four World Bank Structural Adjustment Loans (SAL I, II, III and IV) Additional support was provided through bilateral and multilateral creditors and donors, including a large French debt relief agreement [Macroeconomic and Sectoral Adjustment Programs in Senegal, Erikson, 1990]

During the period 1983 to 1993 the GOS took steps to

- Liberalize the national economy,
- Reduce agricultural and industrial production distortions,
- Strengthen public investment programming,
- Initiate reform of the public enterprise sector,
- Reduce its overall fiscal deficit,
- Pursue an appropriate credit policy, and
- Put in place a prudent external debt management policy

These macroeconomic policy changes contributed to a revitalization of the national economy to a dampening of inflationary pressures and to a strengthening of the country's external sector position

In addition to the general macroeconomic improvements induced by structural adjustment, the program had several elements which bore directly on the agricultural sector These elements included changes in the regulatory environment affecting commercial marketing of agricultural inputs and outputs, efforts to stimulate greater private sector participation, a reduction in the scope of public enterprise involvement in the sector, price policies affecting the terms of trade between rural and urban inhabitants, and a greater effort by government to improve its allocation of budgetary resources

In the agricultural sector, the most significant improvements of the period came in the following areas

- Deregulation of domestic coarse grains markets,
- Elimination of subsidies on most agricultural inputs,
- Reduction in public enterprise involvement in sector activities and greater enforcement of financial accountability through management contracts,
- Willingness to use agricultural price and trade policies to affect improvements in terms of trade and income disparities, and
- Greater control over the allocation of available budgetary resources, coupled with greater transparency in accounting practices

1 2 2 Post August 1993

With the implementation of an Emergency Plan adopted in August 1993 which was aimed at restoring public finances, and devaluation in the fcfa in January 1994, the Government has sought to re-emphasize the need for stringent macroeconomic management

In early 1994, the Government decided to adopt a comprehensive adjustment strategy, including the devaluation of the fcfa in coordination with other members of the West African Economic and Monetary Union (WAEMU), in order to achieve sustained economic growth and financial viability over the medium term. The medium-term strategy involved, in addition to the adjustment of the exchange rate parity, strong fiscal and monetary policies designed to contain inflation and restore competitiveness on a lasting basis, and the acceleration of structural reforms aimed at improving incentives for the private sector and strengthening growth.

The adjustment efforts of Senegal were supported initially by a standby arrangement from the IMF. This was replaced in August 1994 by a three-year arrangement under the ESAF. Senegal also received support from the World Bank under an economic recovery credit, a Private Sector Adjustment and Competitiveness Credit (PASCO) and an Agricultural Sector Adjustment Loan (AG-SECAL). Moreover, Senegal benefitted from assistance from other multilateral sources, including debt rescheduling from the Paris Club and other bilateral creditors.

The Government's 1994-96 adjustment program, as described in the Sixth Policy Framework Paper (PFP) of July 1994, has four main objectives:

- 1 achieving a real GDP growth rate of 4.7% in 1995 and 4.8% in 1996,
- 2 increasing the investment-to-GDP ratio from 14.1% of GDP in 1993 to 16.7% in 1996 and improving the efficiency of public investment,
- 3 achieving primary surpluses in the Government's budget, and
- 4 containing the external current account deficit, excluding official transfers, to 9.8% of GDP in 1994.

The Government's strategy also included measures to improve public sector management consisting of:

- 1 adopting a three-year public investment program taking into account the devaluation of the fcfa,
- 2 reducing the wage bill through an audit of the civil service, and
- 3 continuing the Government's divestiture program by privatizing 12 of the remaining public enterprises over the period covered by the PFP.

As a first step immediately after the devaluation, the Government

- 1 established a maximum 45 % limit on import tariffs including the 5 % stamp duty,
- 2 reduced the number of Value Added Tax (VAT) rates from five to three, with a maximum rate of 20%,
- 3 increased energy and utilities prices to reflect more realistically their current economic costs of production, and
- 4 passed through the benefits of the devaluation to agricultural producers

The Government also announced its determination to accelerate structural reforms necessary to bolster the supply-response through long delayed reforms to liberalize external trade the labor market, and the agricultural sector

1 3 SENEGAL AGRICULTURAL SECTOR ADJUSTMENT PROGRAM

1 3 1 The Agricultural Sector in Senegal An Overview

The agricultural sector, including forestry, livestock and fishery, accounts for a modest share of approximately 20% of GDP and for 60% of employment. Arable land in Senegal is estimated at 3.7 million hectares of which some 2.3 million hectares are cultivated annually. Rain-fed agriculture predominates with production under irrigation accounting for about 4% of cultivated area. On average, export crops, principally groundnuts and cotton account for about 50% of cultivated area with food crops, principally millet, rice, sorghum and maize, comprising the rest. Rangeland is estimated at 12 million hectares, but its productivity is variable. Overgrazing of rangeland is a serious threat while the availability of water resources is the main obstacle to the development and intensification of the livestock sub-sector.

During the second half of the 1980s, total agricultural production registered a modest increase of 2.7% per annum. While this was better than the early 1980s which was poor as a result of draughts, it was still barely enough to keep up with the population growth. This modest performance has been accompanied by

- a sharp decline in traditional exports, especially groundnut oil and cake
- large deficits of parastatals involved in groundnut and cotton exports,
- degradation of soils due to the combined effect of drier than normal rainy seasons, soil erosion, salinization, acidification, deforestation and overgrazing, and
- high overall population growth, coupled with a rural exodus of young men and women

1 3 2 Past Agricultural Sector Adjustment Performance

One of the main constraints to sustainable growth in Senegalese agriculture has been the involvement of the state in all aspects of agricultural production and marketing. The state has been omnipresent in input pricing and distribution, imports of agricultural products and agricultural inputs, setting and administering the prices of most agricultural commodities, and in the processing and marketing of agricultural products.

Past SALs have attempted to address this constraint. SAL I included a number of policy reforms to begin liberalizing the agricultural sector. The Government, however, was not able to implement certain reforms and the second tranche of the reform was cancelled in June, 1983. The thrust of SAL II & III consisted of revitalizing agriculture to increase and diversify agricultural production and exports. The strategy consisted of

- 1 fostering private sector initiative through a change in incentive policies and a progressive withdrawal of the state from direct involvement in production activities,
- 2 liberalizing the internal and external trade regime,
- 3 achieving greater efficiency of public investments, and
- 4 reforming public agencies.

The record of SAL II was generally good. Significant progress was made on

- 1 the development of cereals production through the provision of adequate protection for domestic cereals and the liberalization of internal marketing and pricing,
- 2 the liberalization of the groundnut sector with the Government withdrawing from seed distribution and with the elimination of subsidies to cover oil milling costs,
- 3 the decontrol of fertilizer imports and the reduction of price subsidies, and
- 4 the scaling back of the activities of the Societe d'Aménagement et d'Etude des Terres du Delta Fleuve Sénégal (SAED) and the Société pour le Développement des Fibres Textiles (SODEFITEX), the rural development agencies responsible for irrigation and cotton development respectively.

Under SAL III, the achievements of SAL II were consolidated and the reforms extended to include

- 1 establishing a weekly price information system for the major cereals markets,

- 2 reducing the farmgate prices of groundnuts in response to a sharp drop in international prices, rationalizing the Société Nationale de Commercialisation des Olegineux (SONOCOS) operations to reduce costs and initiating external management and financial audit of this oil milling parastatal,
- 3 completely eliminating fertilizer subsidies in 1988/89 and totally decontrolling compound fertilizer imports,
- 4 decontrolling meat prices and eliminating the monopoly on hide and skin trade, and
- 5 developing coherent policies on pricing and farm credit

The SALs, however, were less successful in eliminating rents associated with import monopolies. No progress was made on the liberalization of rice imports. There were significant delays in the adoption of measures for SONACOS under SAL III and the privatization of SONACOS, proposed under SAL IV, was not achieved. Regarding sugar, the government was not prepared to address the issue of CSS monopoly and eliminate its excessive fiscal advantages.

The devaluation of the fcfa has considerably changed the situation. Rents associated with the import of rice have vanished. SONACOS no longer earns huge margins on imports of vegetable oil and CSS margins on the imports of sugar have been appropriated by the Government [Senegal Agricultural Sector Adjustment Credit, World Bank, 1995]

1 3 3 The Government's Medium-Term Agricultural Sector Strategy

Between 1991 and 1993, there was a hiatus in World Bank and Government dialogue as the Government failed to undertake reforms agreed with the Bank, especially in the rice and groundnut subsectors. In the fall of 1993, the Government reopened formal discussions on the AG-SECAL with the Bank and various other donors. As a result of these discussions, the Government announced, in June 1994, its intention to prepare a new sectoral strategy and program based on the need to

- 1 create an environment conducive to agricultural investment,
- 2 give support to new and innovative agricultural technology,
- 3 develop rural infrastructures,
- 4 give more attention to the management of natural resources,
- 5 leave decisions concerning production practices to producers and produce private sector initiatives, and

- 6 focus the Government's role on the provision of production-supporting social infrastructure and services to improve efficiency of service delivery [Declaration de Politique de Développement Agricole (DPDA), June 1994]

These general principles were fully reflected in the Letter of Agricultural Development Policy (LAPD) of April 1995. In this LAPD, the Government sets out six main objectives for its medium-term agricultural development strategy:

- 1 a target agricultural growth rate of 4% per annum,
- 2 improved food security through intensification of production,
- 3 the creation of agricultural employment to increase rural purchasing power,
- 4 improved management of natural resources guided by a National Environment Action Plan (NEAP),
- 5 promotion of private sector investment, and
- 6 improved efficiency in public sector resource management

To ensure the successful implementation of the agricultural sector program, the Government has established an interministerial committee to monitor the implementation of the program.

1.3.4 Overview of Bank and Donor Support

As a result of this positive dialogue between the Government and the donors, the Bank and the Government agreed to the AG-SECAL. The overall objective of the Bank's assistance to Senegal in the agricultural sector is to promote sustainable agricultural growth. To this end, the program supported by the AG-SECAL has four elements:

- 1 liberalizing domestic marketing and pricing of all agricultural products,
- 2 reforming the agricultural trade regime through liberalizing external trade in those agricultural products still under Government control, including
 - eliminating all prior authorizations for the import of rice, vegetable oils, groundnut oil seeds, sugar, and wheat flour, and
 - determining appropriate protective tariffs for these key agricultural commodities, and, in the case of cotton and groundnuts, linking domestic producer prices to world prices
- 3 privatizing the production, processing and marketing of agricultural products in those subsectors still dominated by parastatal, namely groundnuts and rice

(SONACOS and the Caisse de Péréquation et de Stabilisation des Prix (CPSP)),
and

- 4 preparing a three-year rolling investment program for the agricultural sector which respects clear sectoral priorities established in consultation with donors

The adjustment program has successfully completed the first three of these objectives and, through the Groupe de Reflection Stratégique (GRS), the Government is currently working on the fourth

1 3 5 The Policy reform Program

These general policy reforms have been accompanied by specific reforms in the principal agricultural sub-sectors of cereals, groundnuts, cotton and sugar. These more specific reforms are described below.

1 3 5 1 Cereals

The Government has five objectives in reforming the sector:

- 1 liberalize all imports, subject to an import levy that would provide partial stabilization of domestic prices,
- 2 remove all controls on domestic trade,
- 3 privatize rice milling,
- 4 transfer most irrigation operation and maintenance costs to producers, and
- 5 end price controls and public sector intervention in the paddy and rice markets

This Rice Sector Adjustment Program (RSAP) is supported through an agreement signed by USAID and the Government. The implementation of the RSAP has gone fairly smoothly. The private sector, when finally freed from needless restrictions from the public sector, has done a good job in keeping the country supplied with rice [Senegal Rice Policy Reform Program Second Situation Report, January 1997].

1 3 5 2 Groundnuts

Actions under the AG-SECAL in the groundnut sector are centred on a number of structural adjustment measures:

- 1 breaking the monopoly of SONACOS and the privatization of SONACOS and the Société National de Graines (SONAGRAINES)

- 2 liberalizing the domestic pricing and marketing of groundnuts
- 3 elimination of prior authorization requirements for vegetable oil imports,
- 4 permitting unrestricted export of unprocessed oilseed groundnuts,
- 5 regarding confectionary groundnut activities, Government activities will be limited to creating new seed varieties, encouraging expansion of production, and the creation of a "Groundnuts from Senegal" label

1 3 5 3 Cotton

The quasi-permanent financial crisis in SODEFITEX led the Government to put in place an emergency adjustment program in 1987 with assistance from the French aid agencies, particularly the Caisse Française de Développement (CFD). These reforms, supported by all donors, but under CFD leadership, emphasized the following

- 1 improvements in technical performance and internal (SODEFITEX) economy measures,
- 2 the linking of seed-cotton prices to international fiber prices and the elimination of direct Government role in the setting of seed-cotton prices
- 3 the demarcation of SODEFITEX costs between commercial activities and public service activities in relation to financing and distribution of benefits,
- 4 greater management autonomy relative to the state, and
- 5 and greater involvement of producer organizations in the management of all activities related to the subsector

Specific measures included in the AG-SECAL included

- 1 liberalization of marketing of seed cotton, cotton fiber and seed and
- 2 preparation of an action plan for the cotton subsector based on the lettre de mission

1 3 5 4 Sugar

In the LAPD, the Government proposes to liberalize the sugar subsector by eliminating all barriers to entry in the

- 1 cultivation of sugar cane,

- 2 sugar processing and refining,
- 3 imports of sugar, and
- 4 marketing of sugar

To these ends, the Government signed a new agreement with CSS in January 1995. This new agreement

- 1 eliminates all monopoly privileges on sugar cane production, sugar imports, sugar processing and refining, and sugar distribution,
- 2 eliminates prior authorizations for imports and replaces them with tariff protection,
- 3 eliminates all special fiscal and tax benefits, and
- 4 fully liberalizes prices and margins in the sugar market

1.3.5.5 Other Agricultural Reforms

A number of other reforms were included in the AG-SECAL including

- 1 In fruits and vegetables the government agreed to leave this subsector strictly to private initiative and not to interfere in the pricing, import and marketing of products and proposed to eliminate prior authorizations on potatoes, onions and bananas originating from zones outside of the WAEMU,
- 2 With respect to agricultural inputs, the Government agreed to remove all prior authorizations for the import of agricultural inputs (except for health, phytosanitary or environmental protection), and
- 3 Regarding land tenure and natural resource management, a major study of land tenure practices is being carried out

1.4 STRUCTURAL ADJUSTMENT AND AGRICULTURE

It is still too early to say definitely what the long-term impact of devaluation and the macroeconomic structural adjustment programs have had on the economy of Senegal. However, early indications are positive. Table 1.1 shows the percentage real growth in GDP in the year prior to devaluation and the two subsequent years for the seven CFA area countries. In 1993, the year prior to devaluation, the real growth of GDP in Senegal was -2.0%. In the two years subsequent to devaluation GDP grew 2.0% and 4.5% respectively. Senegal's performance was

in the bottom half of the seven countries Benin, Côte d'Ivoire, Mali and Togo performed better than Senegal and Burkina Faso and Niger fared worse

Table 1 1 Real GDP Growth, Percentage

Country	1993	1994	1995
Benin	3.2	3.2	6.3
Burkina Faso	0.5	1.2	4.0
Côte d'Ivoire	-1.1	1.8	6.5
Mali	-4.5	2.4	5.2
Niger	0.2	1.4	4.0
Senegal	-2.0	2.0	4.5
Togo	-13.7	16.3	8.8

Source Economist Intelligence Unit (EIU) Country Report, Q4, 1996

There was almost no inflation in Senegal in 1993. Table 1.2 shows that, as expected inflation spiked in 1994 in all seven countries. In the case of Senegal it rose 32.3% in 1994 but declined to a reasonable 8.0% in 1995. Regarding inflation performance, there was not a great deal of variation between the seven countries some did slightly better than Senegal and some did slightly worse.

Table 1 2 Consumer Price Inflation, Percentage

Country	1993	1994	1995
Benin	0.5	38.5	14.5
Burkina Faso	1.7	24.7	7.8
Côte d'Ivoire	2.2	26.0	12.0
Mali	0.9	28.0	8.0
Niger	-1.2	35.3	11.0
Senegal	0.5	32.3	8.0
Togo	-3.6	41.0	7.2

Source EIU Country Report, Q4, 1996

Table 1 3 shows that, again as expected, exports from Senegal increased as a result of the devaluation. This was also true for the Côte d'Ivoire and Togo. Exports declined in the other four countries of the fcfa area.

Table 1 3 Exports, FOB, \$million

Country	1993	1994	1995	% Increase 93-95
Benin	341	301	300	-12.0%
Burkina Faso	277	226	226	-18.0%
Côte d'Ivoire	2,652	2,875	3,380	27.4%
Mali	341	320	420	-23.2%
Niger	238	226	230	-3.4%
Senegal	719	794	890	23.8%
Togo	136	162	222	63.2%
Total CFA Region	6,697	6,898	7,663	14.4%

Source: EIU Country Report, Q4, 1996

Table 1 4 shows that imports into Senegal increased over the period 1993 to 1995 by 17.5%. Comparing data in Tables 1 3 and 1 4 shows that imports into Senegal between 1993 and 1995 increased by \$193 million whereas exports from Senegal increased by only \$171 million.

Table 1 4 Imports, FOB, \$million

Country	1993	1994	1995	% Increase 93-95
Benin	539	366	380	-44.3%
Burkina Faso	643	365	365	-43.2%
Côte d'Ivoire	1,801	1,566	1,950	8.2%
Mali	446	422	480	7.6%
Niger	244	245	220	-9.8%
Senegal	1,102	1,027	1,295	17.5%
Togo	251	212	332	32.3%

Country	1993	1994	1995	% Increase 93-95
Total CFA Region	7,019	6,197	7,017	0 0

Source EIU Country Report, Q4, 1996

1 5 SENEGAL INVESTMENT PROGRAM IN AGRICULTURE

As mentioned above one of the four pillars of the World Bank supported GOS program was preparing a three-year rolling investment program for the agricultural sector which respects clear sectoral priorities established in consultation with donors. The Unité de Politique Agricole (UPA) prepared a first draft of the PISA in 1996. However, upon reflection, the Government and some of the donors thought it advisable to form a special group to study the issues in greater depth.

1 5 1 GRS/PISA

As a result of this decision, Le Groupe de Réflexion Stratégique sur le Programme d'Investissement du Secteur Agricole (GRS/PISA) was created by Decree on July 5, 1996 by the Minister of Agriculture. The objective of the GRS/PISA, as described in the decree, is to formulate, within the context of the LPDA, recommendations on

- 1 long-term strategic choices in agriculture which are coherent with other government objectives and the rational management of natural resources,
- 2 ways and means of reconciling the objectives of the agricultural producers and marketers with the objectives and constraints of the Government, and
- 3 the preparation of programs and investment projects in the agricultural sector [Groupe de Réflexion Stratégique, Rapport d'Etape April 1997]

The GRS/PISA is made up of the following people

Cheikh Amidou Kane	President, Ancien Ministre du Plan et de la Coopération, Ecrivain
Abdoulaye Sene	Vice President, Chef de la Mission d'Aménagement des Vallées Fossiles au Ministère de l'Hydraulique
Baba Dioum	Rapporteur, Coordinateur de la Conférence des Ministres de L'Afrique de l'Ouest et du Centre (CMA/AOC)
Jacques Faye	Rapporteur, Directeur Général de l'Institut Senegalais de Recherche Agricole (ISRA)

Abdoulaye Diagne	Directeur du Centre de Recherche en Economie Appliquée (CRAF)
Emmanuel Ndione	Coordonnateur de Groupe Recherche - Action - Formation (ENDA-GRAF)
Abdoulaye Bara Diop	Ancien Directeur de L'Institut Fondamental d'Afrique Nord (IFAN)
Safietou Toure Fall	Chercheur à l'Institut Senegalais de Recherche Agricole (ISRA)
Galaye Sall	Directeur du Service de l'Alimentation et de la Nutrition Appliquée au Sénégal
Mame Cor Sène	Directeur de l'Unité de Politique Economique au Ministère de l'Economie, des Finances et du Plan
Malick Sarr	Directeur de la Production et du Développement rural à la Société d'Aménagement et D'Exploitation des Terres du Delta (SAED)
Ibrahima Seck	Président de la Commission Environnement et Développement Durable du Comité National de Concertation des Ruraux (CNCR)
Oussouby Touré	Secrétaire Permanent du Conseil Supérieur des Ressources Naturelles et de L'Environnement (CONSERE)

The GRS is supported by a five-person secretariat and has opened its own bank account thus permitting it to commence its work in earnest. In its first phase of activities, the GRS has initiated a number of studies. Terms of reference have been developed for several studies, consultants have been engaged, and two or three members of the GRS have been appointed to each group of consultants to act as a Steering Committee. This first phase consists of the following five studies:

- 1 Identification of Strategies for Ameliorating Rural Poverty,
- 2 The Role of the Private Sector in Agriculture and Agro-business,
- 3 Institutional Reform and Cooperation for Implementation of Rural Policies and Strategies,
- 4 Identification of New Sources of Growth in the Agricultural and Agro-Industrial Sectors, and
- 5 Long Term Vision for Agriculture

The Steering Committee of each study has engaged 3-5 consultants for a period of approximately 10 weeks to conduct each study. The schedule for completing these studies is:

- Organization and conduct study April/May 1997
- First Preliminary Draft in GRS May 20, 1997

- Circulation of First Draft to Partners May 31, 1997
- Discussion of Final Report June 10, 1997

In addition to these five principal studies, the members of the GRS have decided to commission a number of secondary studies, including

- Livestock,
- Rural Credit,
- Horticulture,
- Water management,
- Supply of Agricultural Inputs,
- Rural Infrastructure, and
- Valley of the River Senegal

Finally, the GRS has established a policy and has developed a program for involving as wide a range of participants as possible. With this in mind, the GRS engaged an FAO expert to help them organize a workshop on horticulture. The workshop was held on March 12, 1997 and brought together many actors from the public sector, the private sector and producer organizations. A second workshop on horticulture is planned for May 2, 1997. Two symposia are also planned: the first to discuss the initial draft and the second to review and reflect on the suggestions and recommendations of the GRS on the long-term vision and the revised PISA [Groupe de Reflection Stratégique, Rapport d'Etape, April 1997].

1.5.2 The Programme Triennal D'Investissements Publics

The Programme Triennal D'Investissements Publics 1997-1999 (PTIP) has a total value of 867,963 million for the three year period of which 261,655 million was in the primary sector¹

1.5.2.1 Primary Sector PTIP by Sub-Sector

Table 1.5 and Figure 1.1 show the amount of money that will be spent in the various sub-sectors of the primary sector and the percentage that this is of the total for the primary sector. More detailed information of the primary sector PTIP is presented in the Annex tables, A1.1, A1.2 and A1.3. The three largest sub-sectors, agriculture (42.0%), rural and agricultural water (19.2%), and institutional support (15.4%) account for two-thirds of total investment in the primary sector. Most of the agricultural investments are in the Saint Louis region, most of the rural and agricultural water investments are classified as multi-regional, and most of the institutional support is in the Saint Louis and multi-region.

¹ The numbers used in this section were derived from the electronic data obtained from the Ministry of Finance and computed by the Team. There are small differences in the numbers derived by the Team and the numbers published in the PTIP.

Table 1 5 Primary sector PTIP by Sub-Sector

Sub-Sector	Millions of fcfa	Percentage
Agriculture	107,764	42 0
Elevage	6,152	2 4
Eaux et forêts	28,421	10 9
Pêche	22,893	8 7
Hydraulique rurale agricole	50,278	19 2
Etudes et recherche primaire	3,884	1 4
Appui-Renforcement institutionnel	40,522	15 4
Total	261,655	100 0

Source Electronic data provided by the Ministry of Finance

1 5 2 2 Investments by Sub-Sector and Region

Table 1 6 and Figure 1 2 show the primary sector PTIP by regions The Saint Louis region receives 30 5% of the total investment in the primary sector The next two largest regions are "multi-regional" and "national" receiving 25 9% and 20 8% respectively The remaining nine true regions receive 22 8% combined

Table 1 6 Primary Sector PTIP by Region

Region	Millions of fcfa	Percentage
Dakar	3,381	1 3
Ziguinchor	8,371	3 2
Diourbel	1,185	0 5
Saint-Louis	79,458	30 5
Tambacounda	6,768	2 5
Kaolack	6,693	2 5
Thies	4,983	1 9
Louga	348	0 1
Fatick	5,479	2 1

Region	Millions of fcfa	Percentage
Kolda	22,827	8.7
Multi-Regional	67,893	25.9
National	54,270	20.8
Total	261,655	100.0

Source: Electronic data provided by the Ministry of Finance

1.5.2.3 Primary Sector PTIP by Major Funding Source

Table 1.7 and Figure 1.3 show the primary sector PTIP by major source of funds. No single source of funds dominates the primary sector. The five largest sources are: European Union (11.5%), the Government of Senegal (10.4%), Japan (9.8%), the World Bank Group (8.9%), and the Federal Republic of Germany (8.8%).

Table 1.7 Primary Sector PTIP by Major Funding Source

Source of Funding	Millions fcfa	Percentage
European Union	30,139	11.5
Government of Senegal	27,329	10.4
Japan	25,757	9.8
World Bank	23,271	8.9
Federal Republic of Germany	22,968	8.8
African Development Bank	15,165	5.8
republic of China	15,000	5.7
France	11,708	4.5
USAID	8,261	3.2
Others	82,057	31.4
Total	261,655	100.0

Source: Electronic data provided by the Ministry of Finance

Figure 1.1: Primary Sector FTIP by Sub-Sector

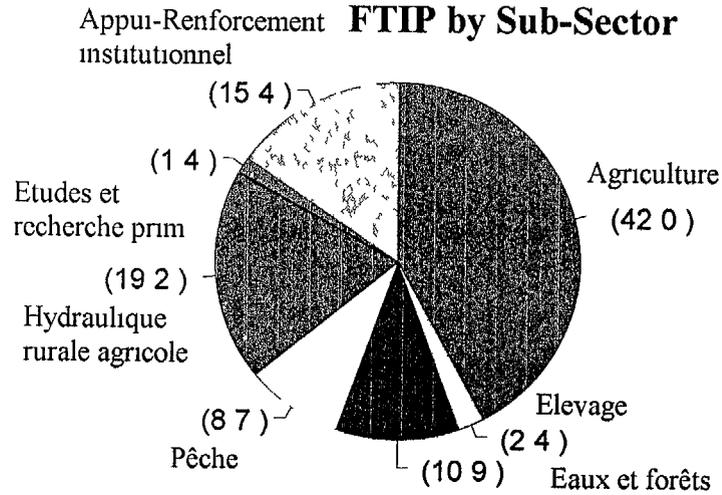


Figure 1.2: Primary Sector PTIP by Region

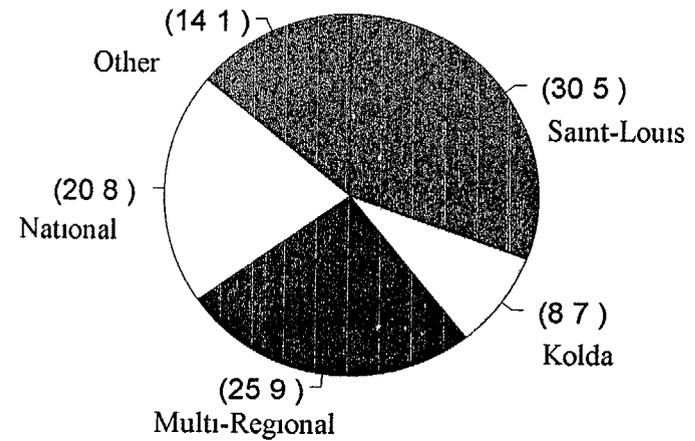
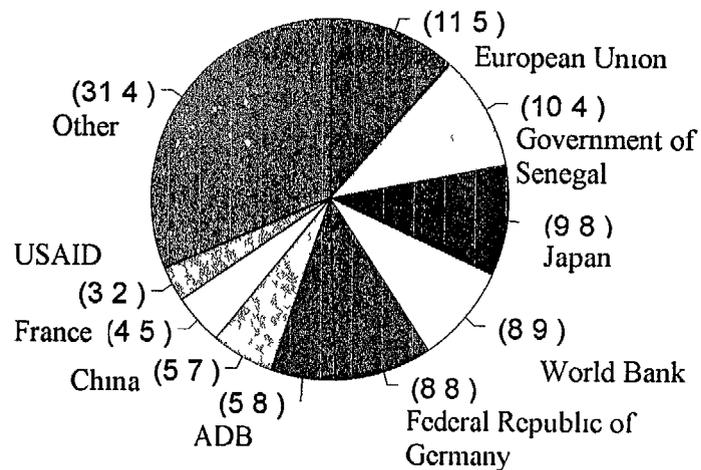


Figure 1.3: Primary Sector PTIP by Major Funding



1.6 DECENTRALIZATION

In the same way that structural adjustment will have an enormous impact on the macroeconomy of Senegal, the policy of decentralization potentially will have a similar impact on the government and administration of the country. There are well-known constraints with the centralized government of Senegal: distance, tardiness and lack of accountability. The primary objective of decentralization is to remove these constraints. [Patrick Hubert, *Décentralisation les objectifs du gouvernement, La Décentralisation au Sénégal*, 1994]

Decentralization has been a continuing government policy since Independence. The law of January 13, 1960 divided the country into seven regions, which were further divided into cercles, and finally the cercles were divided into arrondissements. The three levels of government were administered by a Regional Governor, a Commandant de Cercle, and a Chef d'Arrondissement respectively. At the level of the arrondissement, a Centre d'Expansion Rurale (CER) was created. The purpose of the CER was to coordinate rural development services.

The law was modified by decree on April 3, 1964 making the Regional Governor a delegate of the president. The cercle became a Département administered by a Préfet. Regrettably, due to a poor definition of powers at each of the levels, this administrative system became dysfunctional.

Another law was passed on May 29, 1972 to help overcome this problem and a further law was passed on October 8, 1990. As a result of this evolution, Senegal consisted of 48 Communes and 320 Communautés rurales for a total of 368 collectivités locales. [Textes de Lois de la Décentralisation, 1996]

On June 25, 1992, the Prime Minister created by Decree four working groups which were charged with the responsibility of developing a policy of further decentralization including local financing, planning and budgeting, institutional development and decentralization. On September 24, 1992, the President announced that he proposed to submit to the National Assembly an Act on decentralization. This Act, Textes de Lois de la Décentralisation, became law in 1996.

The essence of the law is to create 10 new collectivités locales at the regional level thus increasing the number of collectivités locales to 378: 10 Conseils Regionaux, 48 Communes and 320 Communautés rurales and then to transfer significant additional responsibilities from the State to these Conseils Regionaux, Communes and Communautés rurales.

In future, the region will be the principal administrative unit. Each region will have the same status, the same responsibilities, and proportional human and financial resources to carry out these new responsibilities. The objective of decentralization is to allow each region to promote its own economic, social and cultural development and natural resource management.

The regions will be the basic judicial and financial unit. Each unit will be administered by a Conseil Régional. The regional Governor, as representative of the state, will be responsible for the legal control of all government organs in the region.

1.6.1 The Conseil Régional

The regional councillors who, together, make up the Conseil Régional, are elected for a five-year period by universal suffrage. The number of councillors per region depends on the population of the region, ranging from 42 in regions with less than 800,000 inhabitants to 62 in regions with more than 1,500,000 inhabitants. The region is responsible for promoting economic development, education, social services, health, culture and science. The regions' actions will be complementary to those of the State, the Communes and the Communautés rurales.

The Conseil Régional elects a President and Cabinet (Bureau) from among its members. The Conseil Régional also creates four commissions: (a) judicial and administrative, (b) education, health, social & cultural, and youth & sports, (c) finance, planning and economic development, and (d) environment, and rural and urban development. The Conseil Régional has the right to enter agreements with other bodies such as other regions, the Communes and the Communautés rurales.

1.6.2 The Communes

Communes are administered by a conseil municipal. Councillors are elected for a five-year period. The largest communes can be further divided into communes arrondissements. The role of the conseil municipal is local planning and programming within national and regional guidelines. The municipal council is responsible for all areas transferred to it under the law.

The mayor is supported by assistants, the number being a function of the size of the commune up to a maximum of 18. Both the mayor and the assistants are elected from among the members of the municipal council. The mayor and his assistants comprise the bureau municipal. The municipal council may enter into agreements with other communes and communales urbaines.

1.6.3 The Communauté Rurale

A Communaute rurale is a legal entity made up of a number of neighboring villages. The Communaute rurale is governed by a Conseil rural and a president du conseil. Rural councillors are elected for a five-year period and the president and two vice presidents are elected from amongst the councillors. The conseil rural is responsible for all matters that are delegated to it under the law, including: (a) use of rural land, (b) natural resource management, (c) building permits, (d) budgeting, (e) human resource investments, and (f) all other local matters. The president, in the name of the state, publishes and administers laws and regulations, administers local policing, and ensures local law and order. The president is also responsible for budget preparation and financial administration. The Communaute rurale has the right to enter agreements with other Communes and Communautés rurales.

During the first stage of decentralization, the following sectors are transferred to the collectivités locales (Regions, Communes and Communautés rurales)

- Property,
- Environment and Natural Resource Management,
- Health, Population and Social Services,
- Youth and Sports,
- Culture
- Education,
- Planning,
- Land Management, and
- Buildings and Lodgings

It should be noted that agriculture has not been decentralized in this first round of decentralization

1 7 SUMMARY AND CONCLUSIONS

1 7 1 Summary

In 1993 the macro economy and the agricultural sector economy faced a number of structural problems including

- 1 a currency that was severely overvalued relative to other currencies outside of the CFA zone,
- 2 an international trade regime that was rife with non tariff barriers such as state import and export monopolies, quantitative restrictions in the form of prior authorities to import, and price controls,
- 3 a domestic trade regime that was even more restrictive because of price controls, numerous monopolies and monopsonies, and a plethora of parastatals that were inefficient, non-transparent and required frequent injections of subsidies to remain in existence,
- 4 a private sector which was mistrusted by the Government which mistrusted the Government, and which faced numerous Government policy changes which made planning extremely difficult,
- 5 government policy, planning and implementation institutions which were overstuffed, underfinanced and generally control oriented rather than service oriented, and

- 6 an agricultural sector public investment program which was not coherent from a policy and program point of view and was almost completely reliant on external donors as a source of funding and therefore often satisfied individual donor priorities as much as Senegalese priorities

To overcome these constraints, the Government, with support from the World Bank and other donors, has undertaken a major restructuring of the economy and the agricultural sector. These measures include

- 1 a devaluation of the CFA in January 1994,
- 2 a major overhaul of the international trade regime, especially the agricultural sector international trade regime through liberalizing external trade in those agricultural products still under Government control, including
 - eliminating all prior authorizations for the import of rice, vegetable oils, groundnut oil seeds, sugar and wheat flour and
 - determining appropriate protective tariffs for these key agricultural commodities, and, in the case of cotton and groundnuts, linking domestic producer prices to world prices
- 3 liberalizing domestic marketing and pricing of all agricultural products,
- 4 privatizing the production, processing and marketing of agricultural products in those subsectors still dominated by parastatal, namely groundnuts and rice (SONACOS and CPSP),
- 5 undertaking a structural reform of the Ministry of Agriculture, and
- 6 creating the GRS which will undertake studies, prepare a coherent policy and program framework for investment in the agricultural sector and prepare a three-year rolling investment program for the agricultural sector

The impact of devaluation has already been felt as have preliminary results of the liberalization of the internal and external trade regime. However, many of the other reforms have only just been introduced issues are still in the planning phase and their impact is still to be felt

1.7.2 Conclusions

- 1 The Government recognized in 1993 that the macroeconomic situation was insupportable, that structural adjustment was necessary, and, with significant support from the World Bank and several other major donors, has embarked on

a comprehensive and coherent structural adjustment program starting with devaluation in January 1994

- 2 Many of the reforms were policy reforms in the agricultural sector in general and in the rice, groundnut, cotton, and sugar sub-sectors in particular and, with considerable support from the World Bank, USAID, France and the European Union, the Government is undertaking comprehensive reforms in these sub-sectors
- 3 There are dozens of donors who have active projects in agriculture and natural resource management in all parts of Senegal. There is no evidence that either the Government or the donors are effectively coordinating this collection of projects. The ensemble of projects is not coherent.
- 4 The Government has recognized this lack of coherence in its investment program but experienced considerable difficulty in developing a coherent program for agriculture and natural resource management that would provide a structure within which the Government and the donors could prioritize their individual investment efforts.
- 5 As a result of this difficulty in developing a coherent framework for agricultural development, the Government has created the GRS, with support from the World Bank and others, which is charged with developing a comprehensive agricultural program and a set of prioritized projects in support of this program.
- 6 The combination of macroeconomic adjustment, agricultural sector adjustment, decentralization, and the development of an agricultural sector program and prioritized projects being put in place by the Government is an essential, comprehensive and coherent set of programs which bode well for the medium and long term future.
- 7 Notwithstanding the hope for the medium and long term, there remain numerous constraints for the supply of many agricultural inputs, and numerous problems with the production and marketing of agricultural products in Senegal. Some of these problems are going to be aggravated by the recent round of structural adjustments.
- 8 It is difficult to forecast with any accuracy the effects that this comprehensive program of adjustment will have on all of the players in agriculture, whether they be importers, exporters, wholesalers, retailers, traders, transporters, consumers or producers. The only thing that can be said with certainty is that the system will be shaken up, that there will be problems, constraints and opportunities, and that there will be winners and losers.

CHAPTER 2 NATURAL RESOURCES

The primary focus of this chapter is the changes in the natural resource base that have occurred affecting agriculture and the natural resources of Senegal since the publication of the 1991 USAID Senegal Agricultural Sector Analysis (SASA) [USAID,1991]. It is quite clear that not much will have changed in the physical resource base in such a short time span. The land surface area of the nation remains unchanged, as does the proportion of it, 19%, that is suitable for agriculture. There are indications that the rainfall continues to decrease, but annual variability is so great that analysis of a five year period is meaningless. The surface and ground water resources have not changed significantly. While there is every reason to believe that the well documented degradation of the vegetation and wildlife resources continues, the change in such a short time span is marginal. Essentially, the natural resource base is the same as it was in 1991.

Very important changes have occurred in Senegal, however. Two major shifts have taken place in the country's natural resource management paradigm during this period. The first is the evolution of the concept of decentralization making the people most closely concerned with the resource responsible for its management. The second is integration coordinating all of the functions relating to natural resource management that were previously widely scattered throughout the government through a newly established Ministry of Environment and Protection of Nature under the umbrella of the forthcoming National Environmental Action Plan (NEAP). To set the stage, this chapter will briefly recapitulate the situation of the natural resource base, noting, where appropriate, the changes that have occurred since the SASA was published. Then the recent structural transformations that have occurred in the natural resources management system will be discussed. The chapter concludes with some suggestions on possible areas of intervention.

Natural Resources form a complex, interconnected web of elements. Each element is inextricably intertwined with every other. Alterations in one part of the web reverberate throughout the system, producing impacts on many, if not all of the other elements. Thus, there is no "natural" starting point or organizational framework on which to base a discussion of natural resources. To facilitate comparison, this chapter has been organized to loosely correspond to the structure of the SASA. It is of the utmost importance, however, that the reader keep in mind the interconnectivity of all the elements as they are discussed individually.

2.1 LAND RESOURCES

Senegal has a surface area of 196,720 square kilometers, approximately one fifth (19%) of which is considered suitable for agricultural uses, one third (32%) of which is classified as suitable for forest or savanna, and the remaining half (48%) is non-cultivable [CONSERE, 1995, p. 25]. These aggregate figures show a 0.6% decrease in arable land, a 3.4% increase in forest and pasture and a 2.5% decrease in non-classified when compared to the figures reported in the 1991 Senegal Agricultural Sector Analysis [1991, p. 41]. These differences probably do not represent significant change, however. First, as the analysis points out [cf. p35], estimates of arable land

vary widely, and second, there is a 1% internal discrepancy between the row and column totals of the table itself

The aggregate figures cited above contain a great deal of regional variation. A more detailed examination of the country is needed to obtain a clear view of Senegal's land use potential. The Senegal Natural Resources Management Assessment Final Report (SNRMA) [USAID, 1990], partitions the country into six regions, which are referred to as Agro-ecological zones. This regionalization is most often used as the framework for the discussion of spatial differences in natural resources. Most data relating to agriculture are organized by administrative regions. Figure 2.1 is a map showing the location of these zones along with Senegal's Regional boundaries.

The Agro-ecological Zone map (Figure 2.1) is one example of one of the key constraints in natural resource management: lack of a coherent natural resources management database. This map shows that there is wide variation between the agro-ecological zone boundaries which are the basis of much data relative to environmental management, and the Regional administrative boundaries, which are the basis for many other important data sets. The World Bank [June, 1994] concluded that, "there are no time series [data] that objectively indicate the extent of environmental changes in Senegal." The problem is not that there is a lack of data. As can be seen in Table 2.1, which gives a partial list of the natural resource management related databases that are available for the country, data are plentiful. The problems are structural. The World Bank cites a variety of factors: 1) weak demand from potential users, 2) data organized to describe problems but not structured to formulate solutions, 3) incompatibilities between data sets (different map projections, incompatible nomenclatures, etc.), 4) weakness of the agencies managing and distributing the information, 5) lack of assessment of data reliability, and 6) the lack of key information infrastructure, especially a digital mapping database.

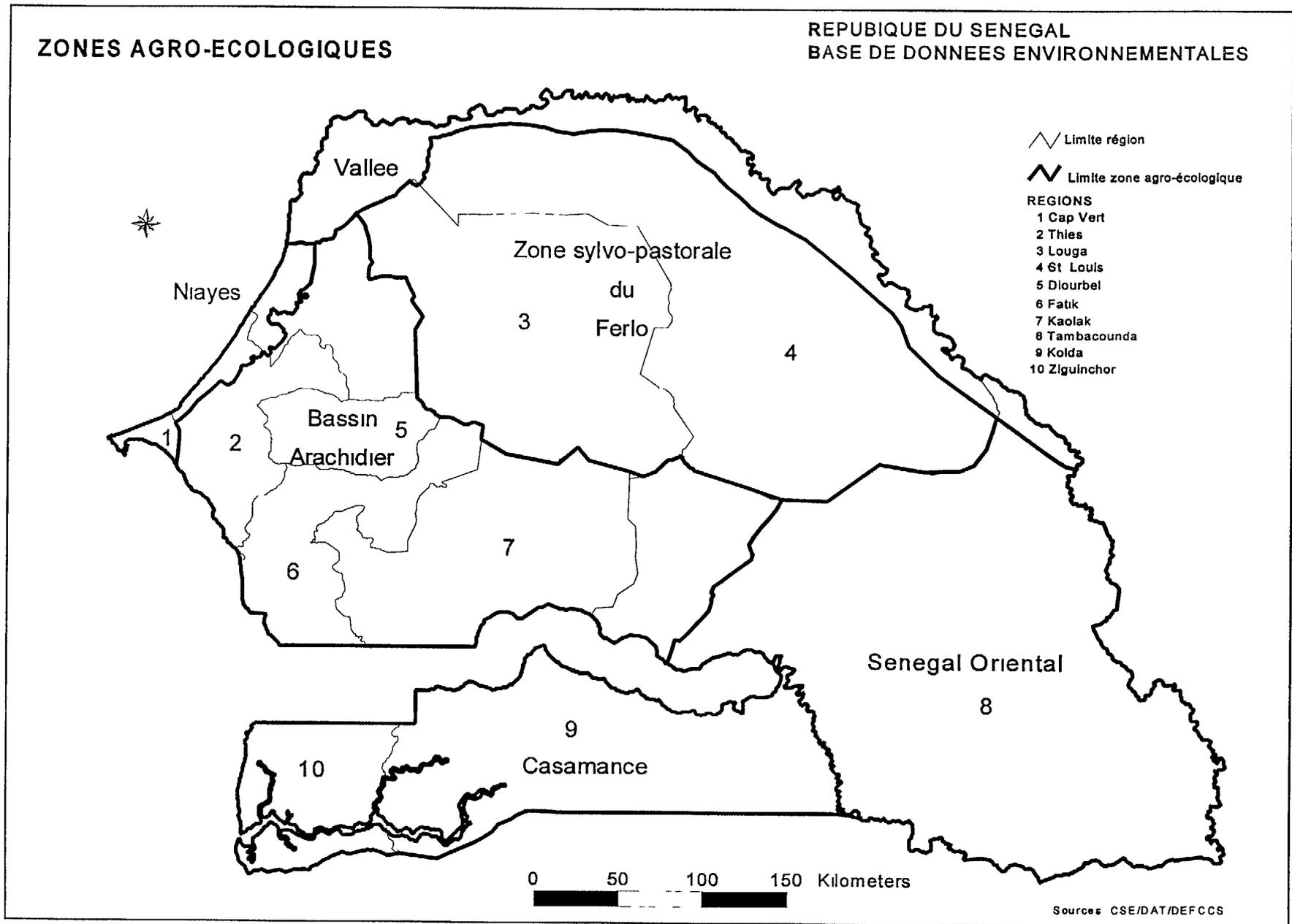


Figure 2 1 Agro-Ecological Zones

27.

Table 2 1 Senegal NRM Data

1 500,000 maps of vegetation cover, forests, erosion risks and rangeland resources produced for the Plan de Developpement Forestièr du Sénégal (1982)
Rangeland Maps for northern Senegal produced by ISRA (1973)
A countrywide Integrated Resource Inventory which includes land use, land suitability, land cover and morphopedology [Stancioff, 1986]
A digitized database of the Stancioff Inventory created by EROS Data Center (1991)
A 1 1,000,000 soil map produced by ORSTOM
Numerous soil maps produced by the Soils office of Senegal at various scales
Water resource database compiled by the Direction de l'Hydraulique
Rangelands monitoring database from 1980 onwards at the Centre de Suivi Ecologique (CSE)
NOAA/AVHRR satellite receiving station and data archive at the CSE
Meteosat receiving station at ISRA's Centre de Recherche Océanographique de Dakar Thiaroye (CRODT)

Source CONSERE, 1995

The Conseil Supérieur des Ressources Naturelles et de l'Environnement (CONSERE) [1995, p 142] reiterates and amplifies these comments, noting the following constraints in the environmental information system

- the absence of a global and coherent documentation policy,
- the lack of an environmental documentation focal point capable of maintaining a functional information network,
- the absence of basic documentation centers outside Dakar and the big cities,
- the lack of interaction between collection, storage, treatment, and distribution of information between organizations concerned with the environment,
- the absence of common data structures,
- the absence of any evaluation of the validity of information that is distributed, and
- the insufficiency of numeric databases (especially cartographic coverage)

The World Bank concludes that at least part of the blame for this situation should be shouldered by the donor community who have 'focused on specialized studies, driven by their own concerns, and neglected the structuring impact that a critical mass of key information, widely distributed, could have on environmental management "

One important exception to this generalization is the long term environmental monitoring activities of EROS Data Center [Tappan, et al ,1994, Tappan and Wood, 1995], in conjunction

with the Centre de Suivi Ecologique (CSE) These activities are greatly enhancing the CSE's ability to manage and disseminate natural resource information The CSE is treated at greater length later in this chapter

Table 2 2 contains a breakdown of land use/potential by agro-ecological zone The percentage of the national territory occupied by each agro-ecological zone is listed in the last row of this table The data in Table 2 2 show that about two thirds (65%) of Senegal's potentially arable land is actually in production This is a 3% increase over the figure reported by the SASA This increase can hardly be considered significant, however, since the Ministry of Agriculture, Department of Statistics figures (Durufle, 1996) for 1986 to 1996 show more than 5% variation around the mean number of hectares in use for this period The graph in figure 2 2 clearly shows that this figure is well within the annual variation and there has been no trend for the last ten years

Table 2 2 also demonstrates that there is considerable regional variation in the percentage of arable land in use, ranging from a high of 81% in the Peanut Basin to a low of 40% in Casamance and 41% in Senegal Oriental

Table 2 2 Land Use and Land Potential By Agro-Ecological Zone (X 1,000 ha)

Land Type	Casa mance	Senegal Orien	Bassin Arach	Zone Sylvo- Past	Fleuve Senegal	Niayes	Total Senegal
Arable Lands							
Rainfed	297 3	161 5	1 748 9	107 8	40 0	17 2	2 372 7
Irrigated	1 2	0 8	0 6		60 0	6 4	69 0
Recessional					30 0		30 0
Not cultivated	451 5	237 7	419 2	42 2	170 0	12 6	1 333 2
Total (19%)	750 0	400 0	2 168 7	150 0	300 0	36 2	3 804 9
Percent of arable land in use	39 8%	40 6%	80 7%	71 9%	43 3%	65 2%	65 0%
Forest and Pasture (32%)	685 0	2 000 0	760 8	2 39 5	750 0	89 3	6 324 6
Unclassified and unsuitable (49%)	1 400 0	3 000 7	1 313 2	1 888 1	1 785 8	154 7	9 542 5
TOTAL	2 835 (14 4%)	5 400 7 (27 5%)	4 242 7 (21 6%)	4 077 6 (20 7%)	2 835 8 (14 4%)	280 2 (1 4%)	19 672 (100%)

Source CONSERE, 1995 p 25

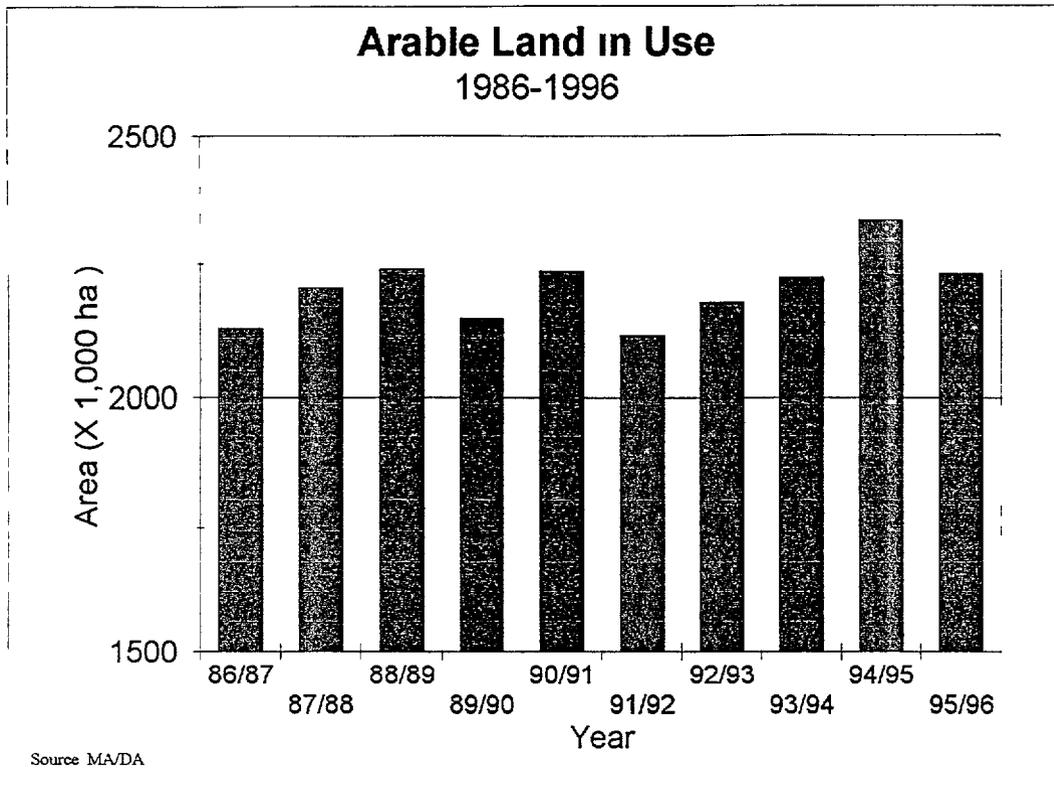


Figure 2 2 Arable Land In Use

The data in table 2 2 was compiled from diverse sources but considerable caution needs to be taken when using these, or any other available statistics about the Senegalese natural resource base. Table 2 3 contains a comparison of statistics derived from different land classifications, and it is readily apparent that the areas vary enormously, depending on the source [World Bank, 1994, p 28]. The discussion below is based on the data in table 2 2 because it reflects the numbers being used by CONSERE, but the problems are obvious, and should not be forgotten.

Table 2 3 Sample of Land Classifications From Different Sources (Square Km)

	WRI, 1992	USAID, 1991	EROS, 1992	PAFS,1992
cropland	23,500	21,690	40,000	
arable land		38,500	80,000	
pastures	31,000	49,000		
steppe			32,000	54,000
savanna			43,061	91,500
forest	106,000	83,000	43,813	22,700
World Resource Institute, 1992, compilation USAID, 1991, from the Plan Cereaher 1986 EROS Data Center, 1992, from original data Plan d'Action Forestier Sénégalais (PAFS) 1992, from 1980 data				

A combination of soil and climatic potential determines the potential for rainfed agriculture. Taking these factors into account reveals large variation in regional potentials as follows [CTSPAF, 1995, p 22]

- **Senegal River Valley**-most of these regions have a notable low rainfed agriculture potential due to acute soil or climatic constraints. Close to 50% of the soils in the Senegal River valley are little suited or completely unsuitable for agriculture, and a further 37% poor soils, suffering from relatively severe constraints. Only 13% of the region has soils favorable to agricultural development.
- **The peanut basin**-potentials in this region vary considerably. Diourbel Region is very homogenous, having a climate favorable to short cycle crops and 85% of the soils classified as poor or of low productivity. The remaining 15% of the soils are of better quality. The climate conditions in the Thies region are similar, except in the Tivavouane Department where 20% of the land fall in climatic zones poorly suited or unsuitable to rainfed agriculture. Seventy five percent of the soils are poor and 13% unsuitable for all agricultural production. Fatik and Kaolack Regions have the best soil-climatic conditions of the peanut basin. Climatic conditions are suitable for medium to long cycle crops, except in certain parts of Fatik and Gossas Departments where they permit short cycle crops. The soil quality is poor to medium except in the Foundiougne where 1/3 of the soils are medium to good.
- **The Casamance**-This zone benefits from very advantageous soil-climatic conditions for rainfed agriculture. It receives adequate rainfall for medium to long cycle crops and 75% of the soils are relatively good.

- **Sénégal Oriental**-This zone is the best endowed in terms of climate for rainfed agriculture. It receives adequate rainfall over its entire extent to grow long cycle crops with little risk. Its soils are very diverse, of extremely unequal quality, sometimes stony, with great variation in relief, all factors which limit intensive agriculture over large areas.

Information about Niayes and the Sylvo-pastoral zone was not available.

In addition to rainfed agriculture, Senegal has the following potentials for irrigated agriculture:

- **The Senegal River Valley**-The studies of the Organisation Pour La Mise en Valeur du Fleuve Senegal (OMVS) and Société de Développement Agricole Industriel (SODAGRI) estimate that a potential 240,000 ha are available for irrigated agriculture as a result of the development of the Diama and Manantali dams. About one fifth of this potential has been actually exploited between Dagana and Bakel in the form of large projects, village scale irrigated perimeters and small private perimeters.
- **Other regions**-The Gambia River system in the Tambacounda Region is an important water resource for irrigation. An estimated 100,000 ha could be irrigated by proposed dam projects (Kékreti and Samba-galou). These estimates are based solely on approximate water availability. Low population densities and onchocerciasis could pose important limitations to their exploitation.

In the Kolda and Ziguinchor Regions various anti-salt and retention dams which are completed or under construction will permit the recovery of 70,000 ha of fluvio-maritime land, more or less contaminated with salt. Interventions by SODAGRI in the Anambé Basin will permit the irrigation of 20,000 ha. In the Ferlo region the Fossile Valley Regeneration Project should provide irrigation potential whose extent is now under study. Irrigation potential is a great deal less in the other regions, principally because of insufficient surface water. Fatick and Koalack Regions have some sites suitable for small dams to irrigate limited areas. In the Louga and Thiés Regions the Cayor Canal will allow, after its completion, the irrigation of 8,500 ha.

- **Groundwater irrigation**-Two thirds of the country, notably the Ferlo, Saloum and Casamance zones and the Niayes sector theoretically have exploitable hydrogeologic resources. Only in Senegal Oriental is the geology particularly unfavorable. Some 100,000 ha has been identified as irrigable by ground water. The high extraction cost of this water requires it be used for high value added crops, particularly horticulture. The climate is favorable for the cultivation of vegetables for export to Europe in the Niayes, Gandiolais, Delta and the lower Senegal Valley. In the other regions the severe climatic conditions reduce the possibility of vegetable production, even of traditional local varieties.

The map in figure 2.3 showing the location of lands with agricultural potential was extracted from the CSE environmental data base [Stancioff, et al, 1986], and shows all of the areas that

were classified as having average potential for agriculture (no areas of high potential for agriculture were identified by the study) The statistics derived from the database indicate that 8,885 9 thousand hectares fall in this category The comparable figure from table 2 2 is 3,804 9 hectares The map in figure 2 4 was also extracted from the same database, and shows all the lands identifies as being used for rainfed agriculture vegetable or fruit production or irrigated agriculture The database statistics put the number of hectares in these three categories at 4,280,000

Table 2 4 contains a summary of the principal constraints to the sustainable use of the land classified by agro-ecological zone

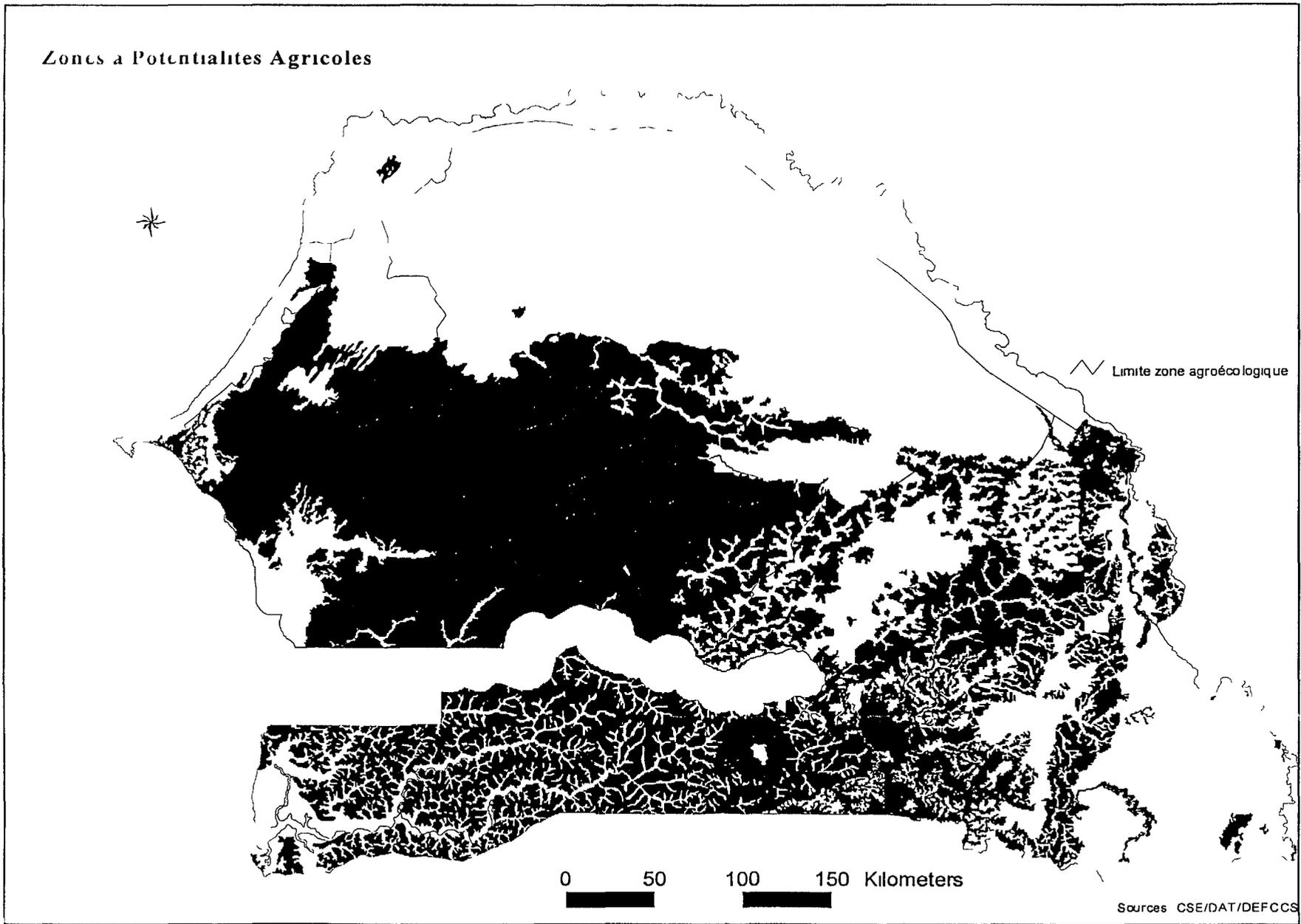


Figure 2 3 Areas With Agricultural Potential

34

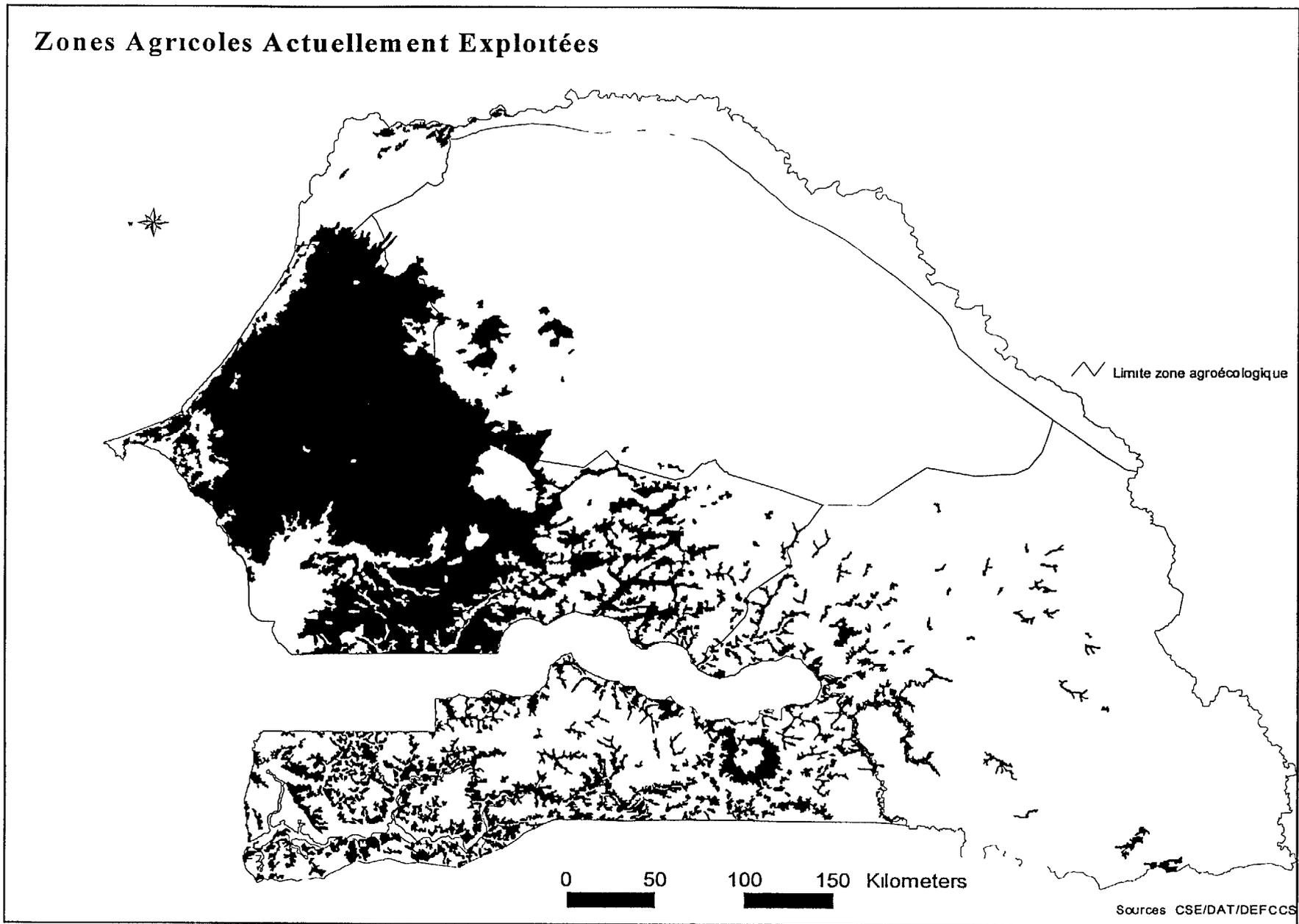


Figure 2 4 Areas Classified As In Agricultural Production

52

Table 2 4 Factors in the Degradation and Constraints to the Sustainable Use of Land Resources Classified by Agro-ecological Zone

Agro-ecological Zone	Principal Constraints
Vallee Senegal	limited and irregular rainfall salinization of the heavy poorly drained soils in the lower Bogue pollution from runoff of agricultural chemicals reduction in recessional cultures pasture potential fisheries reproduction and vegetation due to flood controls changes in the ecology and bird nesting conditions of Djoudj reserve
Zone Sylvo Pastorale du Ferlo	limited and irregular rainfall severity of climate conditions lack of surface water soil poverty overexploitation of pasturage destruction of vegetation cover trampling of soils and vegetation by grazing animals brush fires destroy vegetation cover degrade soils and reduce carrying capacity wind erosion
Casamance	marine incursions into river channels acidification of lowland soils erosion of shallow soils over lateritic base weak drainage flow salinization of lowlands degradation of the mangroves increasing salinization of the rice paddies
Bassin Arachidier	lack of surface water very degraded soils vulnerable to wind erosion lowered soil fertility and weak regeneration of soils due to the abandonment of fallowing destruction of soil structure of the heavy soils of the Sine and Saloum Valleys acidification of the highland soils overexploitation and reduction of pastures reduction in woody vegetation and impoverishment of herbaceous vegetation aquifers often mineralized and lowered in levels during the past decades ground water pumping for Dakar exceeds the recharge limits of the aquifer
Tambacounda (Senegal Oriental)	large areas of poor soils in the highlands excessive relief shallow soils over lateritic base soils vulnerable to wind and gully erosion after deforestation deterioration of vegetation due to charcoal production frequent brush fires onchocerciasis in the valleys
Niayes	insufficient rainfall advance of the "live" sand dunes reactivation of movement of old dunes salinization of soils and wells decline of vegetation on the dunes sand invading the lowlands risk of breaking the equilibrium between fresh and salt water in the subsoil and the danger of sea water intrusion

Source CONSERE, 1995 p 26

Figure 2 5 was extracted from the CSE Environmental data base and shows the location of land that is classified as being in agricultural production but is located on land classified as unsuitable for agriculture There are 1,045 7 thousand hectares that fall in this classification

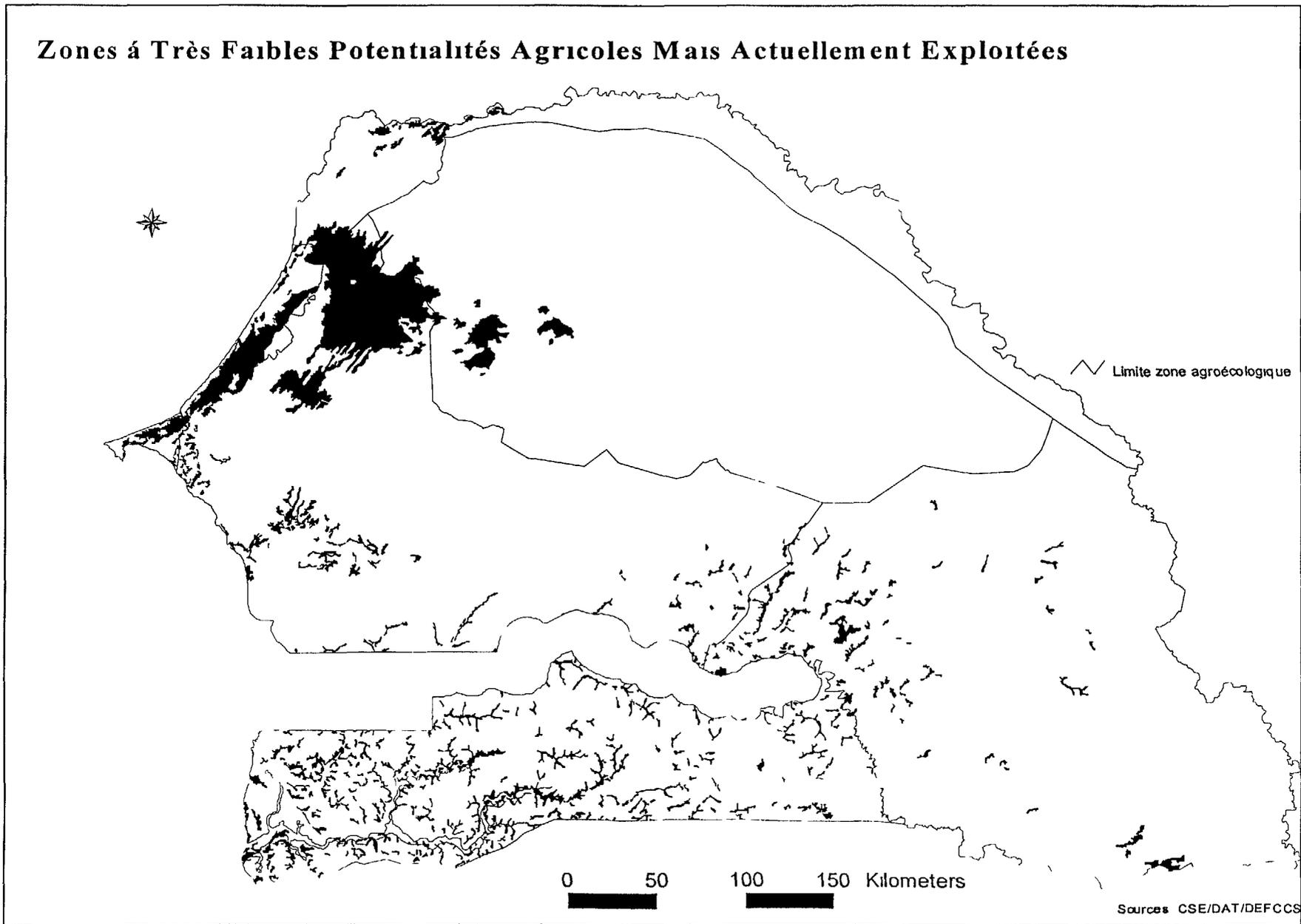


Figure 2 5 Agricultural Production Located in Areas Classified as Unsuitable For Agriculture

27

2 2 WATER RESOURCES

2 2 1 Rainfall

The SASA [USAID, 1991, p 53] concludes that "rainfall and its distribution during the growing season remains the primary determining factor in Senegalese agriculture " Nothing has changed in the past five years to alter this conclusion The map series in figure 2 6 shows that there is a historical trend of decreasing rainfall since the 1960's The 500 mm isohyet, which in the SASA is defined as the outer limit for reliable rainfall [p 94] can clearly be seen in the map to be steadily retreating southward The unavoidable conclusion derived from these data is that the land area receiving adequate reliable rainfall continues to decrease

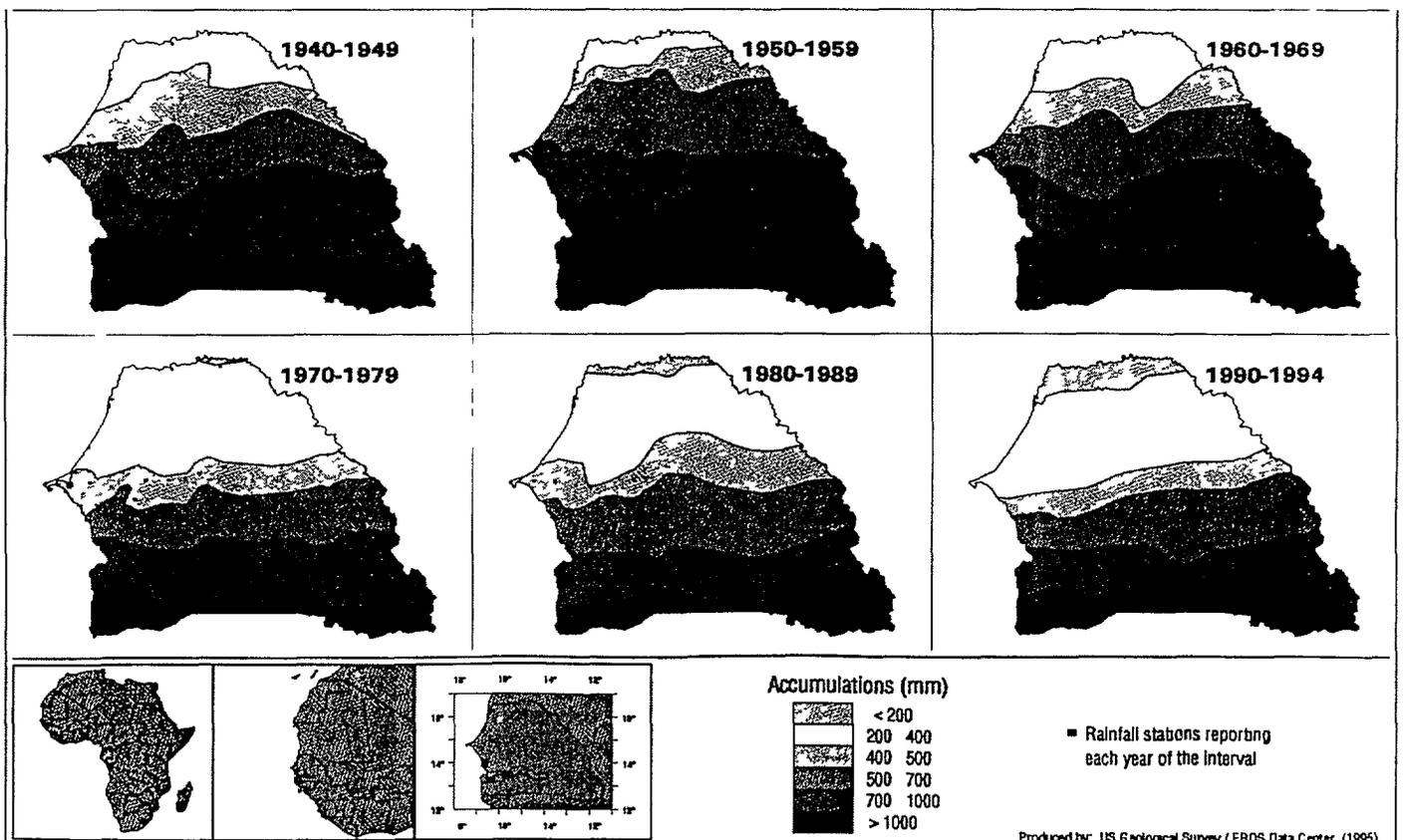


Figure 2 6 Historical Rainfall, 1940 - 1994

The second problem with the rainfall is illustrated by the graph shown in figure 2 7 which gives the annual rainfall for three representative stations Saint Louis in the north, Ziguinchor in the south, and Kaolack in the central part of the country Not only is there a downward trend in the annual rainfall, but there is tremendous variability of total rainfall from year to year This huge variability poses a tremendous risk to farmer

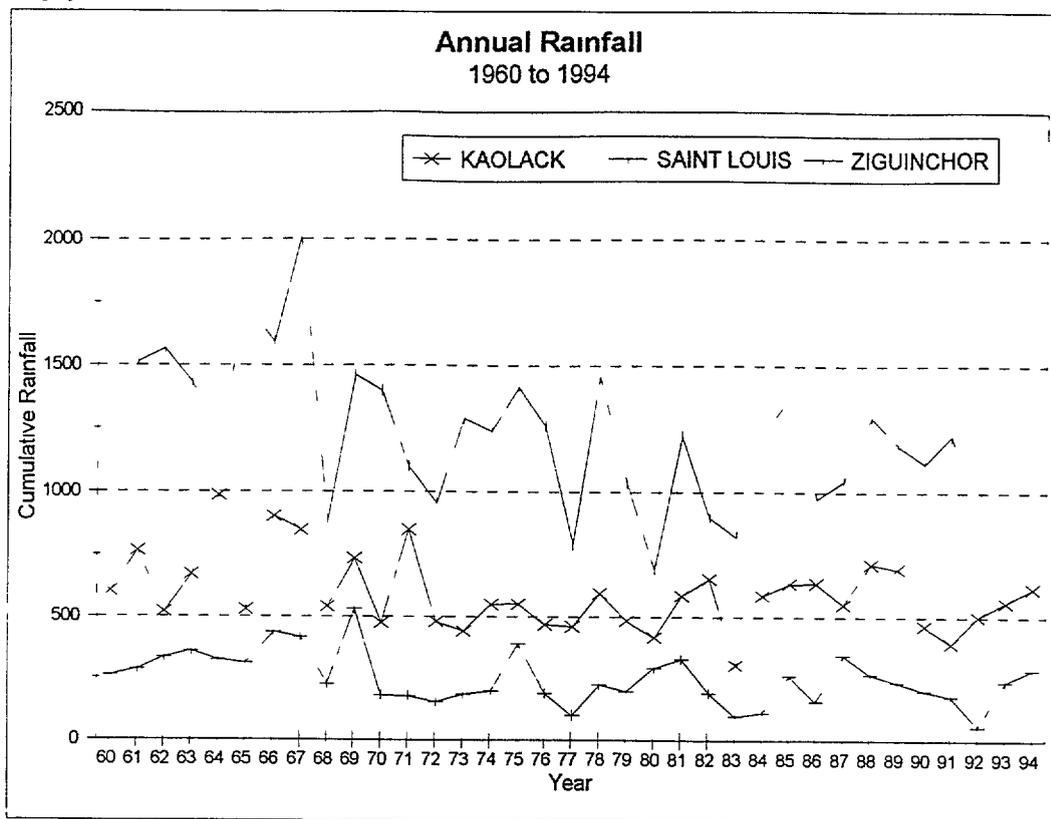


Figure 2 7 Annual Rainfall Graph For Three Selected Stations, 1960 to 1994

The Senegalese climate has two seasons

- the dry season, lasting an average of eight months from November to May, with rare, low intensity rainfalls between December and February, and
- the rainy season, which starts in May in the south with the arrival of the monsoons and moves progressively north Sixty percent of the rainfall is received in August and September [CONSERE, 1995, p 80]

Potential evapotranspiration is estimated at 2000 mm/year throughout the country [World Bank, 1994, p 4], and there is nowhere that rainfall exceeds this figure On average, Senegal receives 100 billion cubic meters of water from rainfall Only 0 6% of this quantity goes to recharge the various aquifers The majority is drained into the sea or returned to the air through evapotranspiration [CONSERE 1995 p 80]

2 2 2 Surface Water

Three large rivers (the Senegal, the Gambia and the Casamance), the Lac de Guiers, water accumulations in the "dead" valleys (Sine, Saloum and Ferlo), and a variety of seasonal streams and lowlands constitute the surface water resources of Senegal

The largest surface water resource is the Senegal River, 1,800 km long, that flows from Mali and forms part of the border between Mali and Senegal and divides Senegal from Mauritania. This river has an average annual flow of 23 billion cubic meters. Two dams have been built on this waterway, an anti-salt dam at Diama completed in 1987 and a flow control/hydro-electric dam at Manantali completed in 1988. Approximately 4 to 5 billion cubic meters of this resource are currently being used, leaving a large quantity to flow out to the sea.

In the south the Casamance River offers relatively low flows of 3 to 4 cubic meters per second at Kolda. Furthermore, during a large part of the year its middle and lower channels suffer from sea water incursions.

The mean annual flow of the Gambia River at Goulombo is 10 billion cubic meters. Only about 300 to 400 km of its 750 km length are located in Senegal.

Lac de Guiers is the principal source of potable water to the Cap Vert region. The control structures on the Senegal River have created a supply potential of from 400-600,000 to 1.2 million cubic meters per day from this body of fresh water [CONSERE, 1995, p. 27]. Dakar's demand in 1990 was 150,000 cubic meters per day [World Bank, 1994, p. 5] but the Societe National d'Exploitation des Eaux du Sénégal (SONEES), the parastatal in charge of supplying water to urban areas, falls short of demand by 15 to 30% [World Bank, 1994, p. 24].

The peanut basin contains the Sine Saloum complex of valleys and ponds which provide seasonal availability of water of marginal importance which suffer from incursions of sea water deep into the land at low flow stage.

The Anambe basin in the south (only a part of which lies in Senegal) contains water which could be used for irrigation and aquaculture.

The principal factors in the degradation of surface waters and the constraints to their optimal use are:

- large seasonal and annual variations,
- very low gradient of water channels limits the possibility of diversion,
- chemical pollution from agricultural runoff (pesticides, fungicides, fertilizers), and
- sea water incursions in the lower valleys (Sine Saloum, Casamance)

These constraints often require large investments (retention dams, anti-salt dams or dikes, levees) to improve the water resource or protect the soils against flooding, salinization, and acidification [CONSERE, 1995, p 28]

The Organisation Pour La Mise en Valeur du Fleuve Sénégal (OMVS) is an regional international organization put in place to manage the Senegal River with the view of providing food self sufficiency, restore ecologic equilibrium, and reduce the vulnerability of the economies of the member states (Senegal, Mali, and Mauritania) to accelerate their economic development through an increase in regional cooperation. The major result of this cooperation has been the construction of the Dama anti-salt dam in 1986 and the Manantali retention dam in 1989. The aim was to provide 375,000 ha of irrigated land, improve river navigation, and produce hydroelectric power [CONSERE, 1995, p 96]

There are three large surface water management projects underway

- Programme de Developpement de la Rive Gauche (PDRG)-In the framework of the OMVS land management is the responsibility of the authorities of each separate country. In Senegal the Cellule Nationale de l'Après-Barrage coordinated the formulation of the Plan Directeur de la Rive Gauche. Two extreme scenarios were considered: 1) the "maximalist scenario" with the use of all water resources for irrigation of 154,000 ha and 2) the "fallback scenario" where an artificial flood with recessional agriculture is maintained on 67,000 ha and 61,000 ha was to be left in forest and pasture. The final plan decided upon envisages:
 - irrigation of 88,000 ha cultivated at 160% (1.6 crops per season)
 - recessional agriculture with a 15 day submersion of the fields
 - 63,000 ha left in forest and pastureExecution of this plan is programmed for twenty five years in three phases [CONSERE, 1995, p 97]
- Mission d'Etudes et d'Aménagement des Vallées Fossiles-Initially conceived as a project to use some of 9 to 13 billion cubic meters of water that annually flows into the sea to restore water to 150 km of the lower Ferlo valley, the project has since grown to a national scope. The original objective was accomplished in 1995, and the plan has expanded to include a network of over 3000 km of dry river beds and canals [PRVF, 1995]. The expanded network is still in the pre-feasibility stage. CONSERE notes that the results of the activities already undertaken have not yet been evaluated, even though the larger scheme has already moved into the planning stage [1994, p 96]
- Mission d'Etudes et d'Aménagement du Canal du Cayor-The canal du Cayor, 240 km long from the Lac du Guiers to the Thiès Region, was first proposed in 1984 to meet the ever increasing demand for water in the Dakar urban area for the next thirty years, and to provide irrigation for 10,000 ha along its route

CONSERE notes that it is important that the construction of large hydraulic works be undertaken with prudence. In addition to technical studies, environmental impact studies should be made before their construction to evaluate the predictable negative effects on the sustainable management of the resources and the ecosystem, and define the necessary corrective measures. Despite its incontestable value, the Diama dam has introduced important modifications in the fisheries, the surface aquifers, and the natural habitats (Djoudj) which remain to be evaluated [1995, p 29]

2 2 3 Ground Water

At a national scale, ground water resources are very abundant, except in the Tambacounda region. The potential for exploiting this resource is highly variable by region depending on the capacity, the depth and the degree of mineralization of the aquifers. The exploitation and management of ground water resources are constrained by the following problems:

- planning is hindered by insufficient knowledge of the dynamics, actual capacities, recharge, suitability for different uses of the aquifers,
- the depth of some aquifers such as the Maestrichtien (150-400m) are very costly to exploit,
- high mineral content of some aquifers, notably the oligio-miocene sands in the Casamance, the quaternary aquifers of the Senegal river valley and the deep aquifers of the peanut basin make them unsuitable for agriculture,
- poor recharge capacity and periodic exhaustion of the Grand Coast sand aquifers, and
- overexploitation of the quaternary aquifers of Cap Vert and the palaeocene aquifers of Sébikotane due to the high demand from Dakar poses a risk of exhausting or contaminating these aquifers with salt intrusions [CONSERE, 1995,p 30]

Table 2 5 shows the capacities and usage rates of the various aquifers of the country. These data show that only about 16% of the available ground water capacity is being used. The global figure masks regional variation, however. This is especially evident in the Dakar region (Cayar at Dakar and infrabasaltic aquifers) where the daily production of drinking water in 1990 was over 150,000 cubic meters per day [World Bank, 1994,p 5]. The data in table 2 5 show that the groundwater resources in these two aquifers are already overexploited.

Table 2 5 Aquifer Capacities

Aquifer	Capacity (cu m/day)	Usage (cu m/day)	Available
Major Aquifers			
Alluvial Sands			
Senegal River	140 000	small	100 000?
Cayar at St Louis	115 000	70 000	45 000
Cayar at Dakar	45 000	45 000	0
Infrabasaluc	15 000	18 000	0
Saloum lens	4 000	small	4 000?
Casamance lens	5 000	small	5 000?
Miocene in Casamance	105 000	5 000	100 000
Eocene Louga Bamgey	14 000	small	14 000?
Palaeocene Pout Sebi Mbo	58 000	59 000	0
Maestrichtien			
Deep aquifers	700 000	70 000	630 000
Recharge zone	420 000	small	400 000?
Minor Aquifers			
Socle	50 000	small	50 000
Eocene east Loug Bam	50 000?	small	small
Palaeocene east Cayar	20 000?	small	small
Various other formations	very small	very small	very small

Source CONSERE 1995 p 29

2 3 BIOLOGICAL RESOURCES

2 3 1 Plants

2 3 1 1 Forestry

The data on Senegal's forests are very old, the most recent available coming from the 1981 Plan Directeur de Developpement Forestier (PDDF) and cited both in CONSERE [1995, p 83] and the Plan d'Action Forestier du Sénégal [1993, p 43]. These figures are give in Tables 2 6 and 2 7 below. Climate is the determining factor of forest type, which ranges from Guinean type forest in the far south to Sahelien type forest in the north. All varieties of soudanaiian type forests are found between these two extremes. The Senegal River contains particularly dense dry

type sahelien formations due to its periodic cycles of flooding. Another exceptional formation of note are the mangroves in the estuaries of the Casamance's principal rivers.

The following tables show the distribution of forest types by region and projected decrease through 1990 as calculated in the PDDF.

Table 2 6 Area Covered by Wooded Formations in 1980, By Species (x1000 ha)

Region	Brush Steppe	Wooded Steppe	Brushy Savana	Wooded Savana	Open Forest	Gallery and Dense Forests	Total
Cap-vert	11 1						11 1
Diourbel	112 0	40 8	24 6	13 1			190 5
Sine Saloum	116 4	72 2	114 0	437 4	29 3		769 3
Louga	803 1	1 183 8		1 7			1,988 6
Fleuve	1 080 6	1 808 9	72 7	299 5			3 261 7
Senegal Oriental		5 4	183 5	3,456 6	897 0	2 9	4 545 4
Thiès	37 2	92 8	51 3				181 3
Casamance			6 5	416 1	1 315 4	36 6	1 774 6
Total	2 160 4	3 203 9	425 6	4,624 4	2 241 7	39 5	12,722 5

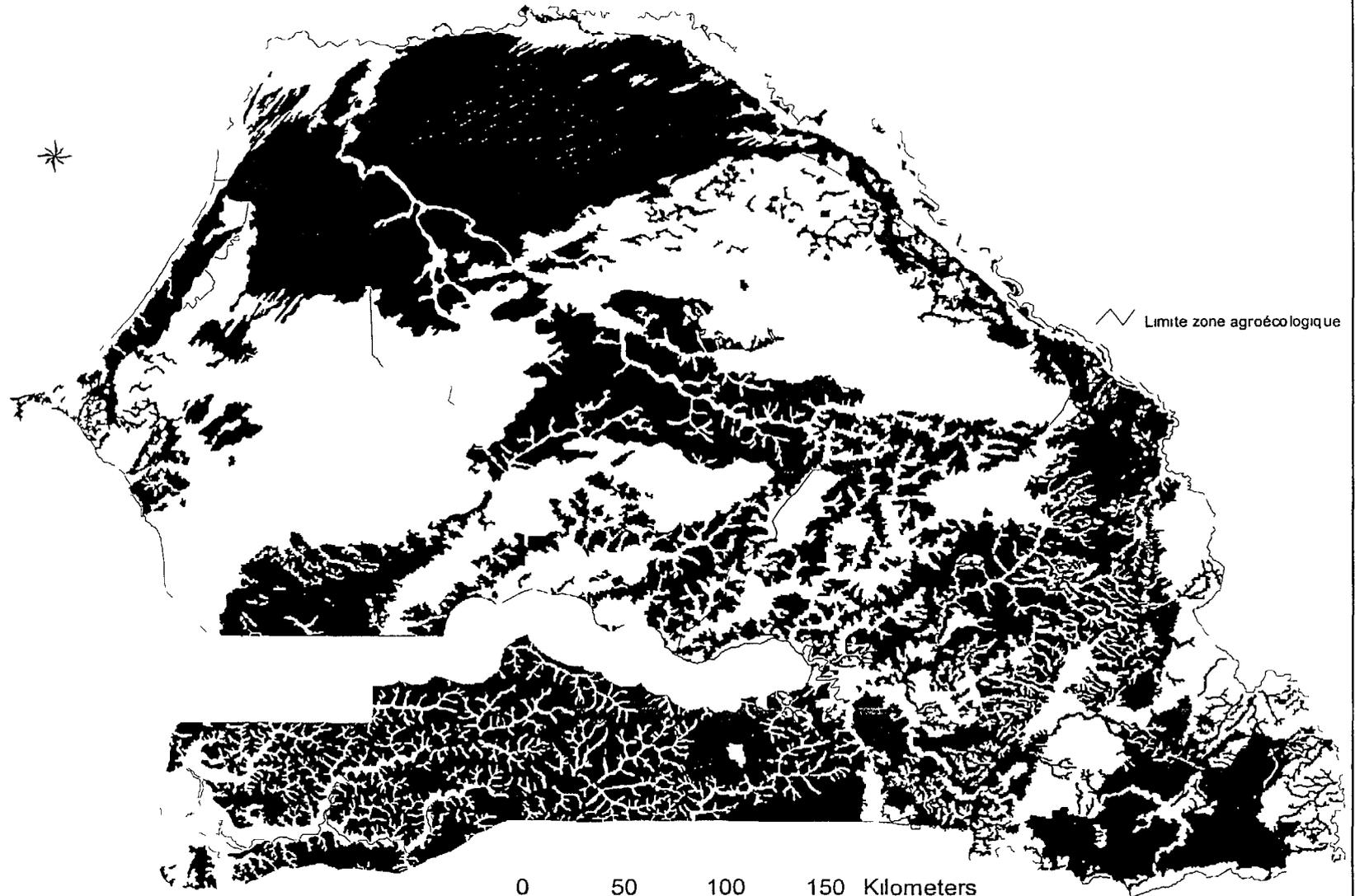
The classified domain, national parks and special reserves combined covered, in 1970, 31.71% of the nation contained in 213 classified forests with a surface area of about 6,240,000 ha and eight zones d'intérêt cynégetique (hunting zones) with approximately 2 million hectares.

The map in figure 2.8 was extracted from the CSE Environmental database and shows the areas that were classified as having at least limited or better potential for improvement or reforestation for production. 9,878.2 thousand hectares fall in this class. Figure 2.9 shows the areas that were identified as covered by forests of all types, and cover a surface area of 7,239 thousand hectares.

Table 2 7 Projected Evolution of Wooded Formations 1980 - 1990 outside National Parks

Region	Rate of Decline 1980-1990	Area (x 1,000 ha)		
		1980	1985	1990
Cap-vert	15 0	11	11	10
Diourbel	15 0	11	182	172
Sine Saloum	15 0	769	736	695
Louga	10 0	1,989	1,930	1,860
Fleuve	10 0	3,262	3,165	3,050
Senegal Oriental	7 5	4 545	4,447	4,325
Thiès	15 0	181	173	163
Casamance	7 5	1,775	1,736	1,689
Total	9 2	12 723	12,380	11,964

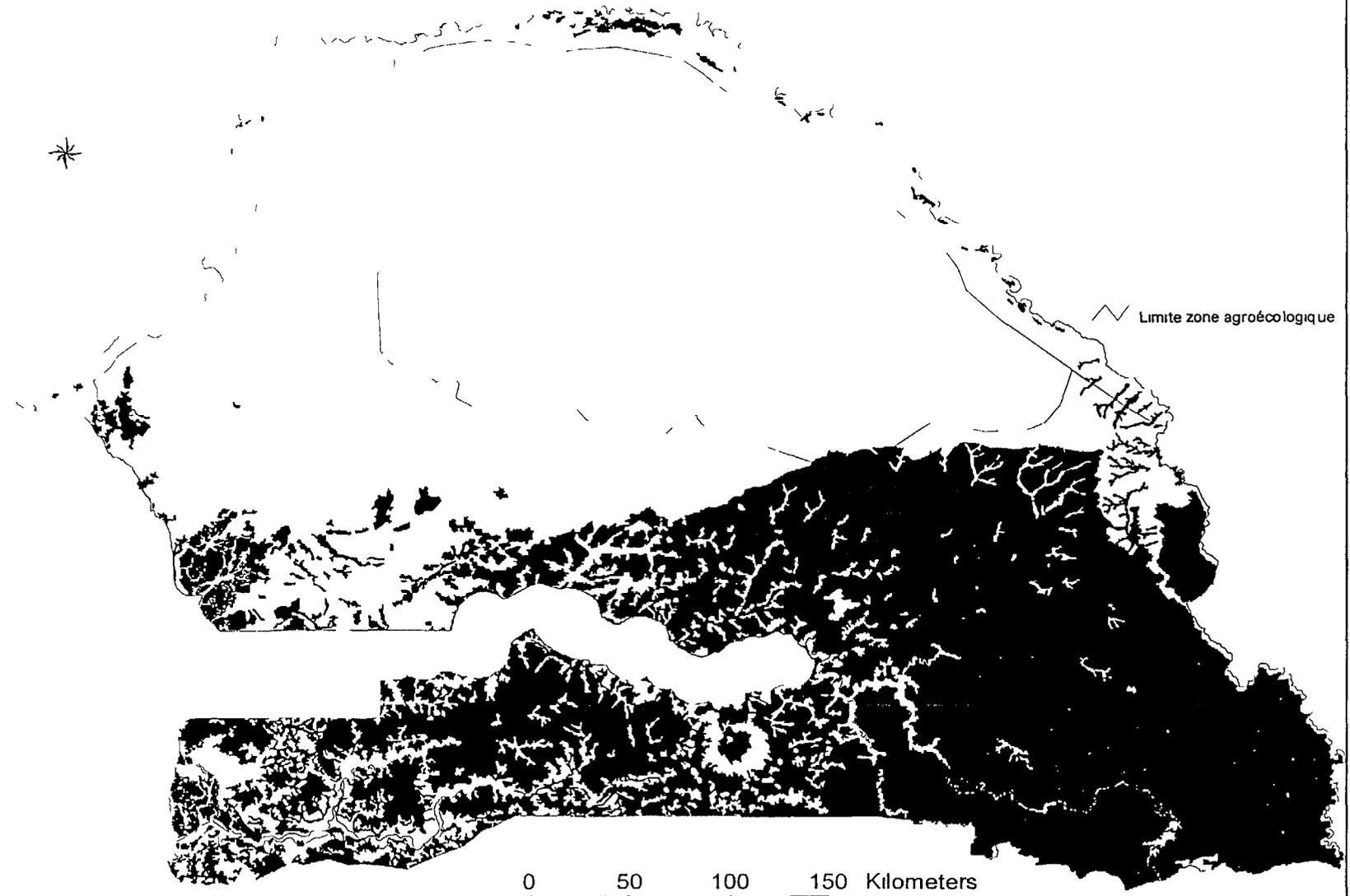
Zones a Potentialites Forestier



Sources CSE/DAT/DEFCCS

Figure 2.8 Areas With Forestry Potential

Zones du Domaine Forestier



Sources CSE/DAT/DEFCCS

47

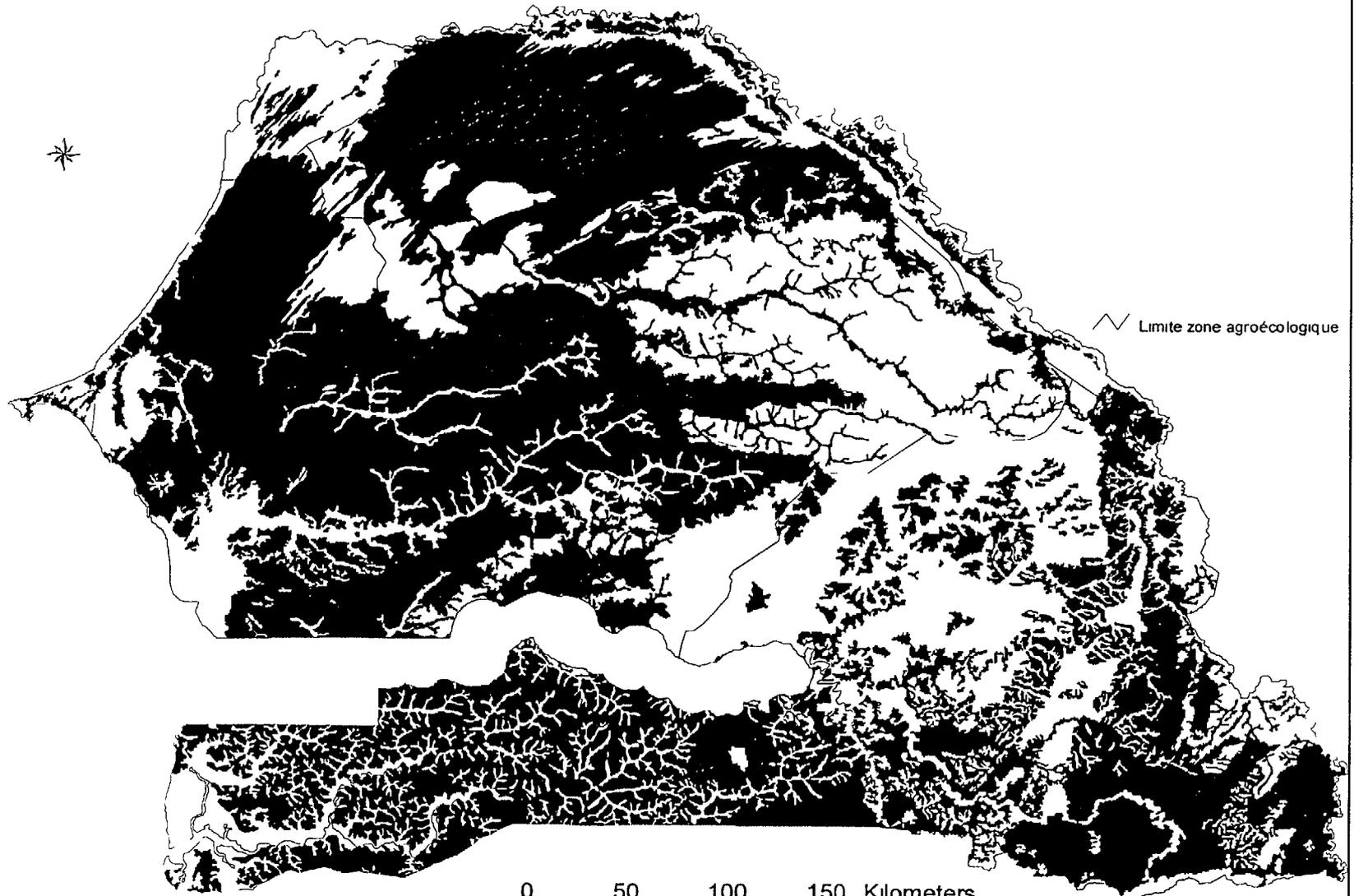
Figure 2 9 Arcas C Classified As Forest Covered

2 3 1 2 Pasture Lands

As with the forests, there is little information available. CONSERE [1995, p. 84] reports that 80% of the cattle feed is provided by natural pastures by means of extensive grazing. These pasture areas are essentially composed of classified forests, sylvo-pastoral reserves, and fallow lands cover an area of 12,500,000 ha. With the decrease in rainfall there has been an unquantified degradation of the pasturage that is characterized by a decrease of the floristic diversity and a reduction in the vegetation, both in the height and lateral development.

Figure 2 10 contains a map derived from the CSE Environmental database showing the location of lands classified as either of good or average quality for use as pasture. A total of 11,634 thousand hectares was so classified. The map in figure 2 11, from the same source, shows the land areas that were found to be in use as pasture of all types. The area found to be used for this purpose is 7,357.8 thousand hectares.

Zones a Potentiaites Pastorales



Limite zone agroécologique

0 50 100 150 Kilometers

Sources CSE/DAT/DEFCCS

49

Figure 2 10 Areas With Pasture Potential

Zones du Domaine Pastorale

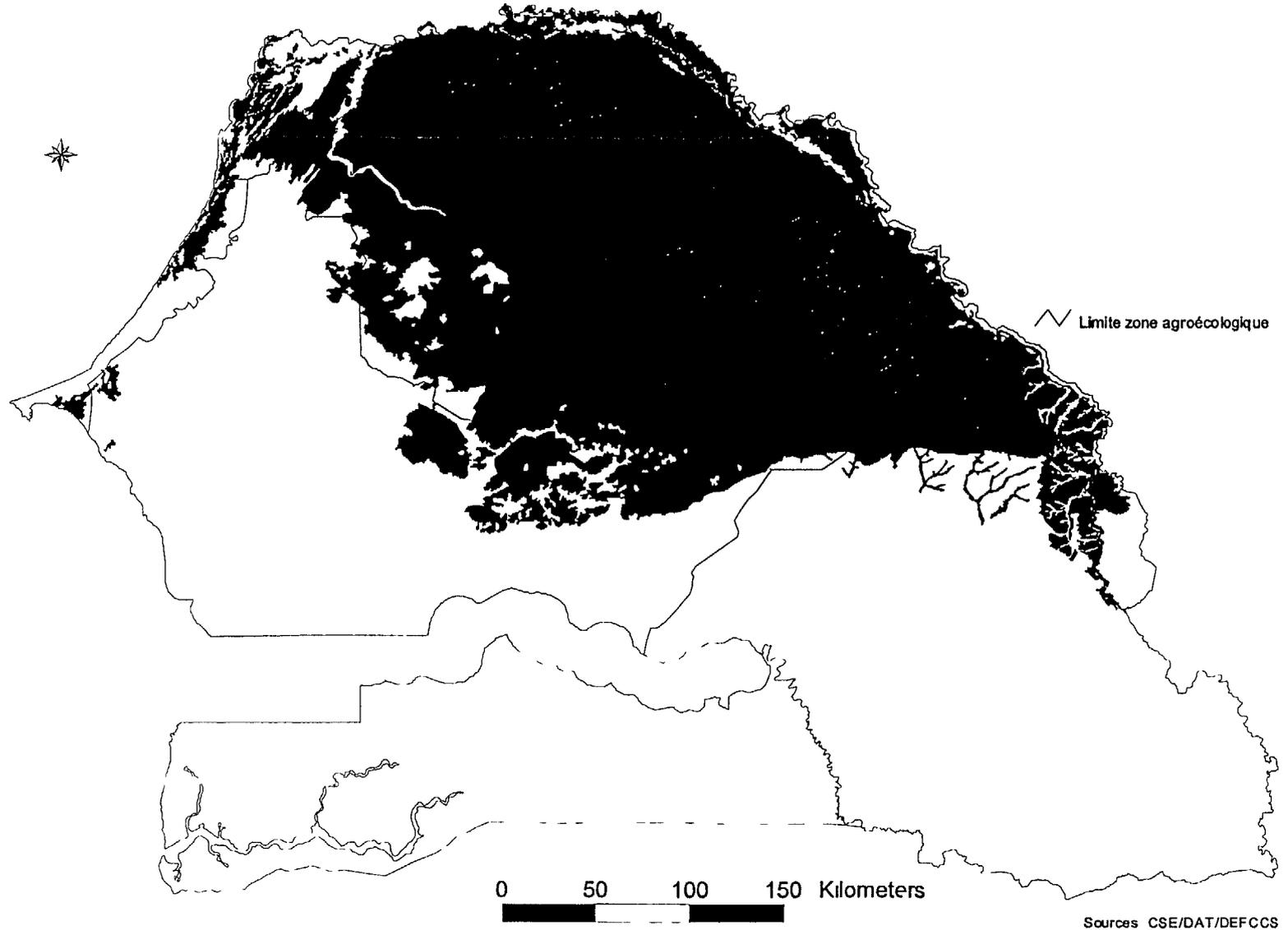


Figure 2 11 Areas Classified as in Pasture Use

2 3 2 Wildlife and Bio-diversity

Senegal's native fauna and flora are typical of the sahel. Habitat destruction brought on by human encroachment has eliminated most of the original wildlife. Some remaining natural habitats are valuable in that they represent the extreme limits of the range of several species. There are also marine and coastal habitats that provide breeding areas for birds and marine turtles, and important staging grounds for migratory water birds on their way to and from Europe. Mangroves are also important to marine mammals such as the African manatee and certain dolphins.

Senegal has made a large effort to create a national park and nature reserve system and use it as a basis for environmental tourism. Some wildlife diversity has been preserved through these efforts, but the overall picture is not encouraging. There remains little left to conserve outside the national parks and many of the remaining large animal species, such as the ostrich, chimpanzee, wild dog, cheetah, African manatee, African elephant, giant eland and red fronted gazelle are close to extinction [World Bank, 1994, p. 18]. Table 2.8 contains a list of the protected areas of the country with the surface area they cover.

Table 2 8 Protected Areas of Senegal

Name	Area (hectares)
Parc National de Niokolo Koba	913,000
Parc National de Basse Casamance	5,000
Parc National des Oiseaux du Djoudj	16,000
Parc National de la Langue de Barbarie	2,000
Parc National des Isle de la Madeleine	450
Parc National du Delta du Saloum	73,000
Réserve Ornithologique de Ndiael	46,550
Reserve de Faune du Ferlo Nord	487 000
Réserve de Faune du Ferlo Sud	663 700
Réserve de Popenguine	1,009
Reserve de Gueumbeul	720
Reserve de Kalissaye	200
Réserve de Kassel	90
Reserve de Djovol	3
Total	2,208,022

2 4 POPULATION

2 4 1 Size and Distribution

The 1988 census reported the Senegalese population at 6,896,808 inhabitants. Given a surface area of 196,720 square kilometers, the overall population density averages 35 persons per square kilometer. Table 2 9 demonstrates, however, that this overall density figure conceals a wide disparity in population distributions. One fifth of the population (21.6%) lives in Dakar region, which contains only 0.3% of the surface area, resulting in an average density of 2,707 people per square kilometer. The one fifth (18%) of the national territory covered by Dakar and the peanut basin (Thies, Diourbel, Kaolack and Fatick Regions) contain almost two thirds (63%) of the nation's population, with densities of 50 to 2,700 people per square kilometer. This contrasts with densities of 6 to 28 persons per square kilometer in the other four fifths of the country. Women predominate over men in the population at 51.4% to 48.6% ratio. Close to three fifths

(57.7%) of the population is under the age of twenty, while only 5% is over the age of fifty, leaving a balance of 37.3% in between. Sixty one percent of the population is classified as rural.

Table 2.9 Regional Population Totals and Densities, 1988

Region	Total Population	Surface Area (km Sq)	Density (pop/km sq)
Dakar	1,488,941	550	2,707
Thies	941,151	6,600	143
Diourbel	619,245	4,359	142
Kaolack	811,258	16,010	51
Fatick	509,702	7,935	64
Louga	490,077	29,188	17
St. Louis	660,282	44,127	15
Ziguinchor	398,337	7,339	54
Kolda	591,833	21	28
Tamba	385,982	59,602	6
Senegal	6,896,808	196,720	35
Source: CTSPAF, 1995, p. 38			

2 4 2 Population Dynamics

Examination of the historical population data shown in Table 2 10 and Figure 2 12 reveal the following characteristics

- a high rate of population growth the average rate of increase of nearly 3% nationally, with rates of 3 9% and 3 4% in the regions of Dakar and Diourbel, respectively Total population has grown from 3 million at independence to a little less than 5 million in 1976 and to just under 7 million in 1988 Rapid population increase is the result of a combination of a falling death rate and a birth rate that remains at a very high 6 6 children/woman today
- inequality of the distribution of population increase, while all regions are increasing, the regions in the west around Dakar are increasing at a higher rate than the average This reflects a migratory trend towards the opportunities of the urban areas

Table 2 10 Regional Population Totals 1976 and 1988

Region	1976	1988	% Change
Dakar	940,920	1,488 941	3 9
Thies	674,440	941,151	2 5
Diourbel	423,038	619 245	3 2
Kaolack	597,501	811,258	2 6
Fatick	408,657	509,702	1 8
Louga	419,599	490 077	1 3
St Louis	514,735	660,282	2 1
Ziguinch	291,632	398,337	2 6
Kolda	439,050	591,833	2 5
Tamba	287,313	385,982	2 5
Senegal	4 997,885	6 896,808	2 7
Source CTSPAF, 1995, p 44			

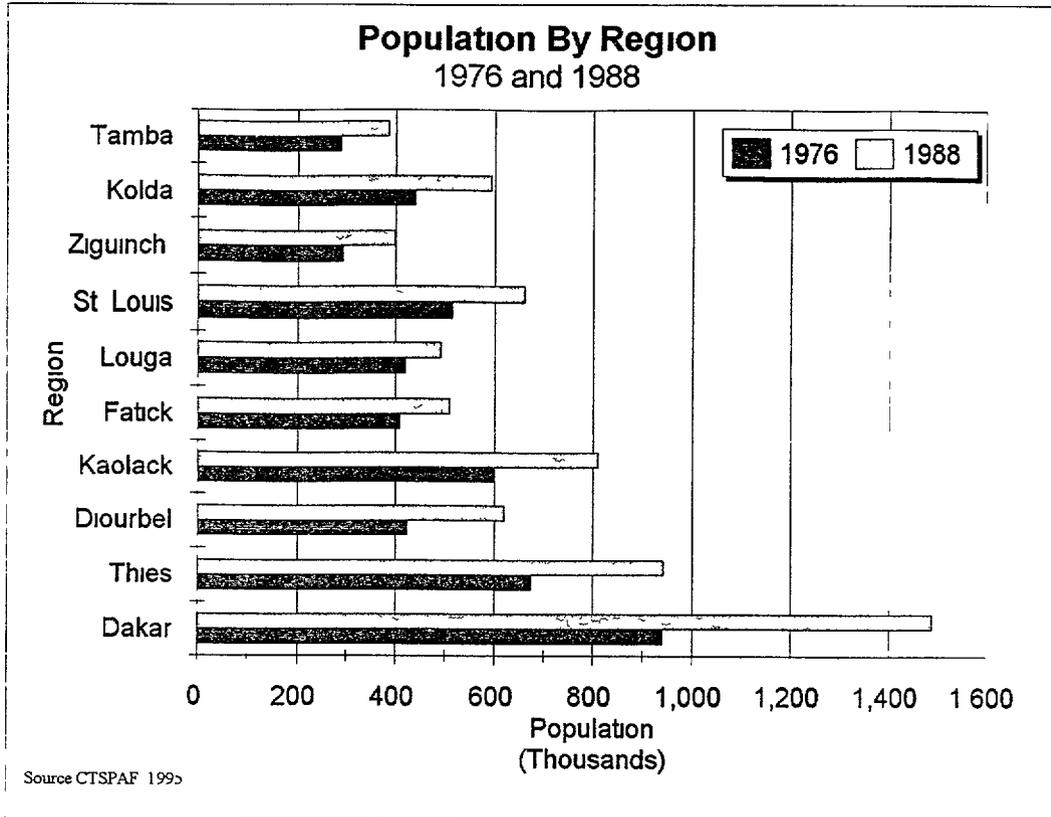


Figure 2 12 Population By Region, 1976 and 1988

The population projections shown in Table 2 11 and Figure 2 13 were made in 1989 by the Direction de la Statistique. The figures represent a scenario with intermediate (i.e. neither high nor low) assumptions for birth rate, death rate, migration, etc. The following points can be drawn from these data:

- the population is expected to nearly double in 25 years, from 6.9 million in 1988 to 13.8 million in 2015,
- the urban population will increase by 2.5 times from 2.7 to 6.7 million. Close to one half of the population (49.4%) will live in cities as opposed to 23% in 1960 and 39% in 1988, and
- the population will continue to concentrate in the Dakar and peanut basin regions. Dakar alone will contain more than one fourth of the population (27%) with a population of over four million. The four regions of Dakar, Thiès, Kaolack and Diourbel will contain almost two thirds of the total population (63%) and more than three fourths of the country's urban population on 14% of the national territory.

Table 2 11 Projected Regional Population Totals 1994 to 2015 (x 1,000)

Region	1994	2000	2005	2015
Dakar	1,869 3	2,326 9	2 774 8	3,822 8
-urban	1804 7	2 248 2	2,682 5	3,699 6
-rural	64 6	78 7	92 3	123 2
Thies	1 114 0	1,310 9	1 494 3	1 889 3
-urban	406 3	510 2	611 8	849 1
-rural	707 7	800 7	882 5	1,040 2
Diourbel	749 9	902 3	1 047 3	1 371 0
-urban	163 3	198 4	232 0	307 5
-rural	586 6	703 9	815 3	1 063 5
Kaolack	947 8	1 100 9	1241 3	1 535 5
-urban	229 2	279 5	327 8	437 7
-rural	718 6	821 4	913 5	1 097 8
Fatick	568 6	628 9	679 2	764 8
-urban	65 7	79 3	92 3	121 4
-rural	502 9	549 6	586 9	643 4
Louga	525 4	555 0	573 5	578 1
-urban	89 7	109 6	128 9	173 1
-rural	435 7	445 4	444 5	405 0
St Louis	748 5	842 4	924 2	1 078 8
-urban	216 9	261 3	303 8	400 1
-rural	531 6	581 1	620 4	678 7
Ziguinche	466 8	543 9	614 0	764 5
-urban	194 7	249 1	302 7	429 6
-rural	272 1	294 8	311 3	334 9
Kolda	688 9	797 1	895 9	1 101 0
-urban	78 8	99 6	120 0	167 9
-rural	610 1	697 5	775 9	933 1
Tamba	448 5	518 0	581 3	712 1
-urban	74 8	91 5	107 4	143 9
-rural	373 7	426 5	473 9	568 2
Senegal	8,127 7	9 526 3	9 725 8	13 617 9
-urban	3 324 3	4 126 8	4 909 4	6 730 1
-rural	4,803 8	5,399 8	5,916 8	6,888 3

Source CTSPAF 1995 p 45

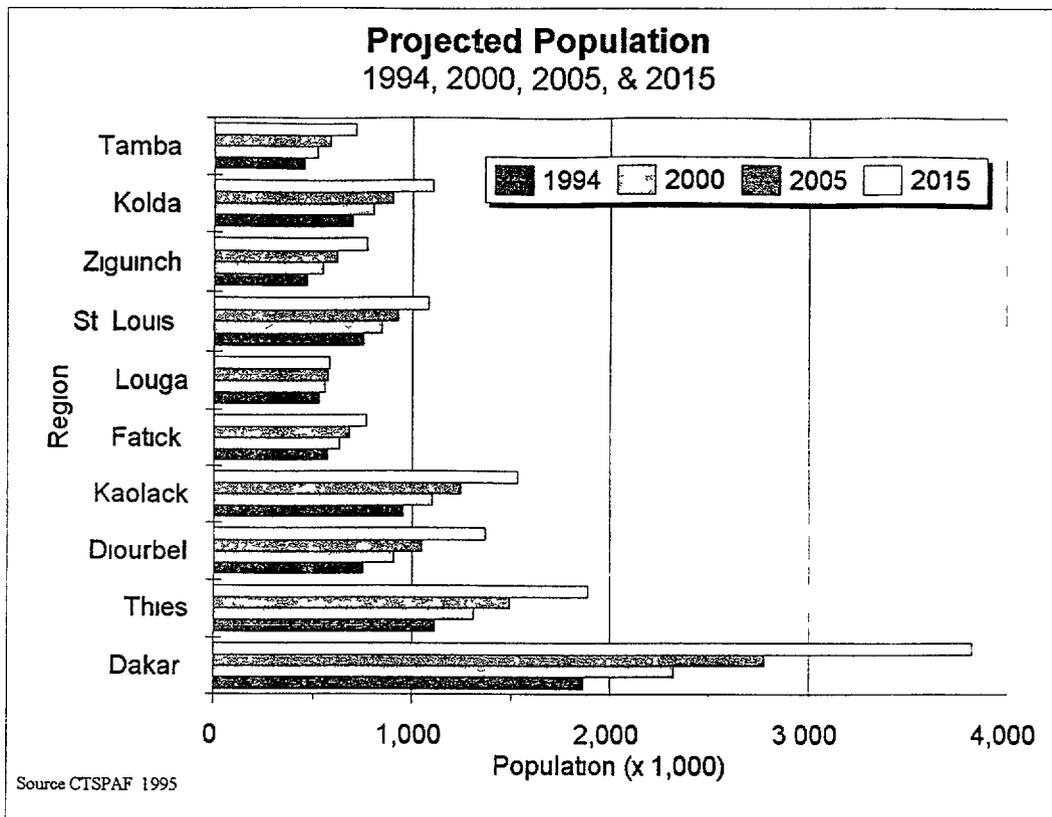


Figure 2 13 Projected Population By Region, 1994 to 2015

2 4 3 Human Carrying Capacity

In 1991, the SASA calculated the human carrying capacity for Senegalese rainfed agriculture to be adequate to support 57% of the population. This figure was arrived at by two different methods. The first calculated it from a 1990 population level of approximately 7.25 million. The second from a 1988 population level of 6.9 million. Both calculations result in the conclusion that approximately 3 million people needed to find their nourishment someplace else.

There is no indication that more land has come into production since then (see figure 2.2). There is no indication that crop productivity has increased in any significant way. There is some debate about shifts in the cash crop/food crop ratio. Some researchers say that the cash crops percentage of the mix has increased, and others argue the reverse. Nobody, however, says that there has been a significant shift.

The one factor that has changed is the size of the population. Projections vary, but extrapolating from the exponential best fit of the data derived from Tables 2.10 and 2.11, Senegal's current population is approximately 8.4 million (see figure 2.14). If, as is argued in the previous paragraph, Senegal's capacity to produce food has not significantly increased, 4.3 to 4.5 million people (51 to 53 % of the population) must now depend on sources of food outside the country.

In the six years since the SASA was published nothing has happened to alter their conclusion that "the long run is not just bleak - it is dismal "

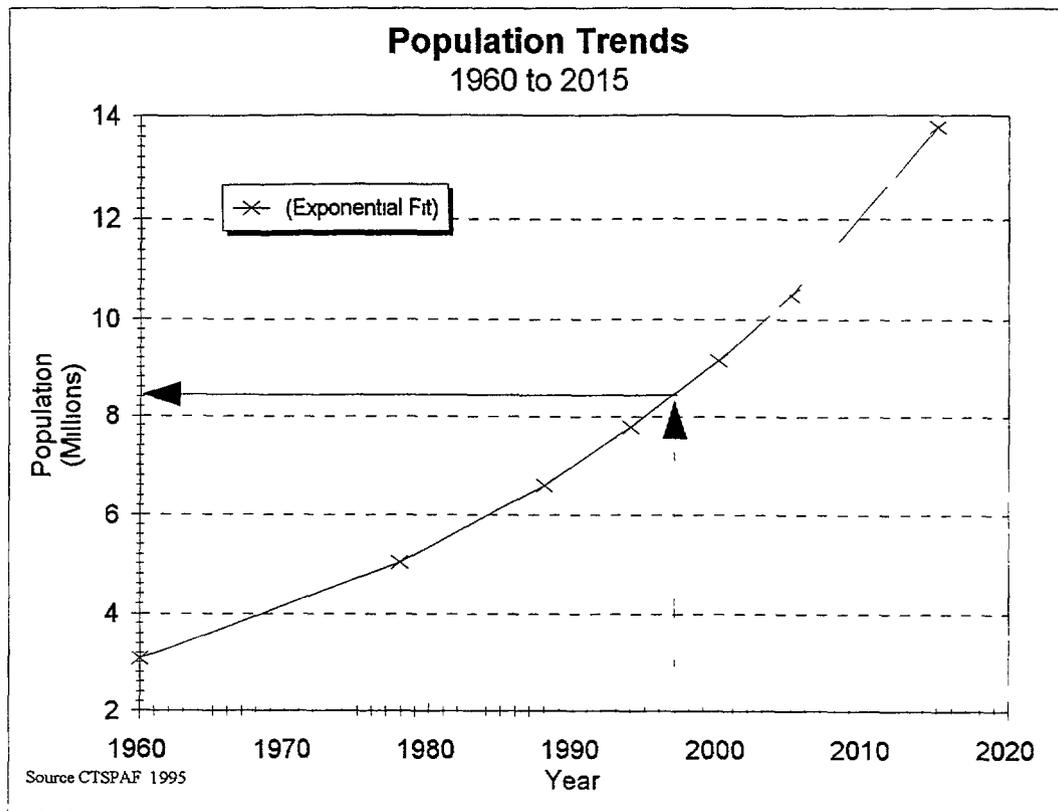


Figure 2 14 Population Trends, 1960 to 2015

2 5 NATIONAL ENVIRONMENTAL ACTION PLAN (NEAP)

The National Environmental Action Plan (NEAP) is meant to be the Senegalese Government's principal management tool designed to provide a strategic, unified framework for environmental planning and management. The process of developing this plan was launched in February, 1995 at a national seminar held in Dakar. The NEAP was to have seven principal components covering all aspects of Senegal's institutional, legal, economic social and cultural life.

- the rationalization of natural resource laws and the institutions needed to enforce them
- the development of exchanges between regions on urban management, territorial planning and economic decentralization through the creation of centers that can contribute to solutions to the urban crisis,
- providing research and education on the environment to improve management of natural resources, their value and accessibility to the people
- formulating a definition of a unified communication strategy and reliable information network,
- resolving the problem of territorial management by decentralizing administration,

- developing an official account of the biological diversity of Senegal, and
- commencing a national strategy to fight against desertification in order to preserve other natural resources

Since the initiation of the planning process at the national seminar the Conseil Supérieur Des Ressources Naturelles Et De L'Environnement (CONSERE), the government agency charged with developing the NEAP has gone through a decentralized process of regional and local seminars designed to solicit the widest possible participation of the Senegalese people. The process started with thirty workshops at the Département level. This was followed by a survey of thirty eight communes and one hundred thirty seven rural communities, the results of which were evaluated in "study days" (Journées des études) where the data from the surveys were discussed to determine the elements to be covered by the Regional Environmental Action Plans in each of the ten Regions. This information was used as the basis for regional workshops where the pre-implementation documents to the Regional Environmental Action Plans were created. These documents have now been sent to the Conseils Régionaux for approval before submission to the validation seminar for the NEAP, currently scheduled for June, 1997.

Concurrently, nine multidisciplinary "Groupes de Reflexion Thematique" have evaluated and issued reports on the following themes

- the institutional, legislative land management and development planning framework,
- land management and decentralization policy in the framework of an integrated approach to the environment,
- the problem of urban decay,
- environmental research, education, and communication,
- especially vulnerable ecosystems,
- biodiversity,
- desertification,
- environment and sub-regional cooperation, and
- financial mechanisms for natural resource management and environmental activity

The third source of input to the NEAP is a series of sectorial workshops with various groups of special interest

- the private sector,
- women's groups,
- youth groups,
- NGO'S,
- Civil society associations,
- religious and customary chiefs,
- research and training institutions and
- rural producers

The documents and plans that are the result of this process will form the basis of the NEAP. The principals and strategic orientations of the NEAP will be used to create an Environmental

Charter that will serve as the frame of reference for the definition and the enactment of sectorial policies of management of natural resources and the protection of the environment. In conformity with the strategic orientations of the plan, the enactment of the programs identified will take place in three phases

Three year horizon-Phase 1 (1997-2000) should allow the reinforcement of the institutional and legal framework of the plan's enactment, to test the new partnership approaches in the context of decentralization and to put in place the sustainable finance mechanisms of the natural resource and environmental management activities. The principal actions will be

- the creation of an Environmental Charter,
- an evaluation of the cost of investment programs,
- the evaluation of the cost of degradation of the environment and its impact on the national economy,
- the creation and enactment of pilot demonstration projects,
- the creation of a sustainable NEAP program,
- the establishment of a National Foundation for the Environment,
- the reinforcement of the functional blueprint of the NEAP (officials and partnership mechanisms),
- the establishment of a frame of reference for the EIE,
- the execution of studies concerning perspectives on the formulation of plans in the context of regionalization, and
- the initiation of priority projects

Five year horizon-The activities envisioned during phase 2 (2001-2006) should contribute to the consolidation of the improvements achieved in natural resource and environmental management. There are two areas of intervention

- establishment of priority projects, and
- impact evaluation of the changes made by the programs enacted under the NEAP framework

Fifteen year horizon-Phase 3 (2007-2022) will integrate the environmental dimension into the daily management of development policy. The actions envisioned will concern

- the establishment of a global programmatic framework,
- the articulation of NEAP, sectoral plans, and an economic development strategy, and
- the mechanisms for undertaking the plan

2.6 INSTITUTIONS

2.6.1 Ministry of the Environment and Protection of Nature (MEPN)

The MEPN was created in 1993 by regrouping the agencies concerned with natural resource management and the environment and the creation of a new agency named the Conseil Supérieur Des Ressources Naturelles Et De L'Environnement (CONSERE), which is discussed at length

in the next section In addition to various administrative bureaux, the MEPN has three Directions

- Direction de l'Environnement-responsible for monitoring and coordinating environmental activities, writing legislation and regulations concerning the environment, and combating pollution and nuisances,
- Direction des Eaux et Forêts-responsible for implementing the national forestry policy and exercising the prerogatives of the state in the forest domain, soil conservation, wildlife management and continental fisheries, and
- Direction des Parcs Nationaux-responsible for the organization and management of the national parks, protecting the fauna and flora in the national parks and reserves, managing biodiversity in the parks and reserves, creating new parks and reserves, and contributing to tourist development

The major change that is underway is a devolution of the functions that have traditionally been centralized at the national level to the Regions, Communes, and rural communities under the decentralization law

Functions devolving to the Regions include

- Creation, management, protection and maintenance of forests, protected areas and natural sites,
- management of continental waters,
- measures to combat brush fires,
- wildlife protection,
- partitioning the exploitation of forest resources between Communes and Rural Communities,
- regulation of hunting,
- regional planning,
- creation of volunteer brigades for environmental protection, and
- authorizing forest clearance

Powers devolved to the Communes include

- authorizing wood cutting inside the Commune boundaries,
- reforestation and communal reforestation,
- enforcement of the forestry code,
- managing waste, health, pollution and nuisances,
- protection of surface and ground waters, and
- creation of communal environmental action plans

Powers devolved to the rural communities include

- forest management within its borders, based on plans approved by the competent state authorities,
- authorizing wood cutting,
- enforcement of the forestry code,

- operation of vigilance committees against brush fires,
- advising the Regional Councils on forest clearing,
- managing sites of local natural interest,
- creating woods and protected areas,
- creation and management of artificial ponds and retaining dikes for agricultural and other purposes,
- waste management
- combating insanitary conditions, and
- creating and executing of the local environmental action plans

The other recent change that has taken place is the revision of the forestry code to give increased rights to local inhabitants to use forest resources. This code is currently going through a further revision to bring it in line with the decentralization law.

2.6.2 Conseil Supérieur Des Ressources Naturelles Et De L'Environnement (CONSERE)

CONSERE is an agency of the MEPN that was created in 1993 to act as a central body to coordinate the activities of the various government agencies concerned with environmental and natural resource management. Structurally, it consists of three bodies:

- an interministerial council—the decision making body, presided over by the Prime Minister and charged with the supervision and coordination of the action plans for managing the environment and natural resources,
- the permanent committee—the monitoring body, under the presidency of the Minister of the Environment and Protection of Nature monitors the execution of the directives and decisions of the Interministerial Council, and
- the permanent secretariat—with the role of analyzing the coherence of current or proposed policies concerning the management of natural resources and the protection of the environment and analyze the pertinence of the various institutions and legislation relative to natural resources.

The first major task of CONSERE was the formulation of the NEAP, as discussed above. The principals and orientations of the NEAP compose an Environmental charter, that CONSERE proposes to have ratified by the National Assembly, and which will serve as a frame of reference for defining and enacting natural resource and environmental protection management policies. With the first version of the NEAP scheduled for publication in May, 1997, the agency foresees its future mission within the framework of the plan as:

- better defining the environmental responsibilities to guarantee that environmental concerns are harmoniously integrated in the sectoral policies and programs from their conception, planning and execution at all levels, from the central to the decentralized,
- monitoring the conformity of development programs with the Environmental Charter. It will assure compatibility of socio-economic activities with the maintenance of ecologic equilibrium,
- assuring the coordination of environmental sector policies and development. From the frameworks and mechanisms already in place, this coordination will take into account the

- new regionalization context in regard to the different roles devolving to the state and to the local collectives respectively,
- contributing to the creation and the management of a National Foundation for the Environment in view of mobilizing sustainable resources to aid natural resource and environmental management initiatives,
 - aiding in the identification of partnership structures and mechanisms in the natural resource and environmental management domain (environmental management execution networks, articulation of mechanisms located at the public and private levels, integration of the execution structures that intervene at local, regional and national scales, etc)
 - setting up a responsive environmental information system capable of permanently serving the various actors and clarifying the environmental decision making process, CONSERE should establish an information interchange system between the institutions concerned with executing the plan
 - conceiving the planning and decision making tools for natural resource and environmental management,
 - contributing to environmental impact studies (establishing procedures, directives, measurement instruments and monitoring indicators, and measures for public participation in the decision making process), and
 - establishing a system of annual reports on the state of the environment permitting the evaluation of the results obtained by the plan's execution

2 6 3 Centre de Suivi Ecologique (CSE)

CONSERE has identified the CSE as the center of excellence and the focal point of environmental information [CONSERE, 1995, p 145) CSE defines itself as a public interest association under the MEPN Its purpose is to collect, enter, treat, analyze and disseminate data and information about the country, the natural resources and the infrastructure for the purpose of improving the management of natural resources and the environment To achieve this purpose the CSE has established the following objectives

- to offer services and most advanced geographic products to all its members and interested organizations and people,
- transfer technology,
- assist the processes of
 - 1) planning resource management,
 - 2) reinforcing development structures,
 - 3) formulating projects and mobilizing resources, and
- assist the development of the private sector [CSE, 1994]

The World Bank [1994, p 29] comments that CSE has developed a staff and technical capacity are "exceptional for Sahelian Africa " CSE has certainly proved itself responsive to the needs of this report, having provided the data on which all of the maps have been based Continued development of the CSE's capabilities, as recommended by CONSERE, will be a major step in the solution of the information management problems identified at the beginning of this chapter

2 7 CONSTRAINTS, OPTIONS AND ALTERNATIVES

2 7 1 Constraints

There are many constraints to efficient natural resources and environmental management. A number of them are listed below, organized into three categories: physical, institutional and human.

2 7 1 1 Physical constraints

Rainfall

- Rainfall has been decreasing since the 1960's and the trend shows no indication of reversing. This has led to a lowering of aquifers, decrease in river flows, degradation of the natural vegetation, salt water incursions into river drainage basins, and acidification of soils.
- Rainfall is exceedingly variable, both from year to year and within the rainy season of any given year. This variability makes planning at all levels extremely problematic.
- The rain that does fall is concentrated in a few large rainfall events, that mostly runs off the land rather than soaking in to become available for plant growth. The runoff causes soil erosion, especially at the beginning of the rainy season, before the ground is protected by vegetation.

Surface Water

- There is a strong seasonal and annual variation in flows of rivers.
- Surface water is subject to chemical pollution from agricultural runoff.
- The lower basins of many rivers are subject to salinization from sea water.

Ground Water

- There is insufficient knowledge of aquifer capacities.
- There is a problem over exploitation of certain aquifers.
- Aquifers suffer from weak recharge capacities.
- There is excessive mineral content of some aquifers which makes them unusable.

Soils

- No soils have been identified as having 'high potential'.
- Only 19% of the country has soils considered suitable for agriculture.
- Soils are suffering degradation from erosion and overuse.
- Unsuitable soils are being used for agriculture, leading to their degradation.

2 7 1 2 Institutional constraints

Natural Resource information, while relatively abundant, is too poorly organized and managed to give an adequate picture of the natural resource situation.

Land tenure

- The current system favors agriculture over forestry & grazing
- Agriculture and tree planting justify exclusive use, pastoralism and natural forest management have non-exclusive use status, favoring agriculture in agriculture vs non-agriculture conflict situations
- Land left fallow for prolonged periods lose exclusive rights of use, reverting to protected status

The economic incentive structure favors agriculture over fuelwood production, including

- forestry permits and fees,
- price controls on charcoal,
- free access to agricultural lands, and
- subsidies on imported bottled gas

Institutional structures and research are sector oriented, concentrating on particular aspects of the puzzle, neglecting the tradeoffs in the overall scheme

Sectoral policies, plans, programs and projects often conflict with overall orientation of the state and it's ability to sustain them

2 7 1 3 Human constraints

Population is increasing rapidly with no possibility of reversing the trend in the short term

There is a tradition of "command and control" mentality that permeates all levels of the government

There is a lack of involvement by "stake holders" that limits the collection and use of indigenous knowledge and the cooperation of the people most closely involved and affected by the natural resource

There is a lack of an "environmental ethic" in the decision making process at all levels

There is a lack of management skills at all levels

2 7 2 Options and Alternatives

The physical resources of Senegal are a given. Not much can be done to provide more water or increase the capacity of the soil, which are the major constraints to the land's ability to produce vegetation. Nor is it likely that any major deposits of minerals or fossil fuels remain to be discovered to provide the basis for new processing industries. Senegal's population, on the other hand, is increasing rapidly, and will continue to do so for the foreseeable future. The question is "How can a fixed quantity of resources be managed to provide for the needs of an ever increasing number of people, while, at the same time increasing their quality of life

without destroying the productive capacity of the resource base?" The answer is not in the resources themselves, but in the use that the people make of the resources. That is to say in economics and sociology

There is a general consensus that the top down, command and control system of social organization which until very recently has characterized Senegal's approach to natural resource management has had very limited success, not just in Senegal, but world wide. Large technical infrastructure projects have seldom achieved their promised results and have often led to unintended negative consequences. Centrally mandated projects and programs have met with suspicion and resistance on the part of the people they are meant to help, undermining their effectiveness. Thirty five years of experience since the first wave of independence in Africa have proven that centralized natural resource management is not the answer

The alternative is to decentralize. Turn control over the land and natural resources and return it to the local populations who are most closely concerned. Under this alternative free market forces will allow local populations to decide on the tradeoffs that determine land and natural resource use and production

This is not to say that government has no role. On the contrary, government has a very important part to play in at least three areas. First, the government must establish the framework of policies, institutions, physical infrastructure and services that will facilitate the activities of the free market. Second the government needs to protect the common interest by determining the limits to which resources can be sustainably exploited and regulate their use within these limits. Finally, government has a responsibility to ensure that disenfranchised, disadvantaged, and powerless social groups are not excluded from receiving a share of the benefits derived from the exploitation of nation's the natural resources

The Senegalese government is currently in the midst of a restructuring process which is intended to conform to this alternative strategy. The process revolves around two major themes. The first of these is the Decentralization Law which went into effect on December 31 1996 and is intended to devolve responsibility in all aspects of government, natural resource and environmental management included, from the center to the local and regional levels. The second theme is the National Environmental Action Plan which is currently being finalized and is scheduled for adoption at a National Validation Seminar to be held at the end of June, 1997. The NEAP is intended to provide an overall, unified framework upon which the necessary institutions, regulations and policies for rationally managing natural resources and the environment can be constructed

This restructuring process is a very fundamental change in paradigm. Such changes take time and are likely to have false starts, blind alleys and unforeseen difficulties that need to be encountered and overcome as the process unfolds. Although it is important to move forward as quickly as possible, caution and balance are also required. Humans and their institutions require time to adapt to new circumstances, and rushing the process can be very destructive to the outcomes. Developing options and alternatives for activities in natural resource management

in advance of the finalization of the NEAP is therefore somewhat problematic as they may be contrary to the priorities that eventually emerge. Some areas of activity are, however, fairly straightforward, including

- strengthening the capacities of Regional, Rural and Commune Counsels to carry out the new responsibilities that now fall within their purview through training and structuring activities in a manner that aligns them with these administrative bodies rather than creating distinct project management arrangements for administrative convenience,
- improving the government's ability to provide technical support to the local bodies by improving the capacities of the extension services,
- ensuring that all rural development projects take an holistic, integrated natural resource management approach, and do not simply focus on one single production factor or constraint,
- directing research programs towards systematic aspects of the environment rather than concentrating on specific, individual resources,
- continuing to work with the Centre de Suivi Ecologique (CSE) to strengthen the environmental database and the institutional capacities to collect, store, disseminate and use natural resource information,
- continuing to support the overall effort to rationalize and coordinate natural resource and environmental management activities across administrative department boundaries through further development of the role of the Conseil Supérieur Des Ressources Naturelles Et De L'Environnement (CONSERE) or a similar, cross cutting agency

CHAPTER 3 MARKETING, PRICES AND POLICIES

The following chapter will examine the impact of structural adjustment and devaluation on the production, marketing and pricing of Senegal's principal commodities. Emphasis is placed on changes in production choices, marketing decisions and consumption patterns for rice, groundnuts, horticultural products and cereals, in response to the new policy environment. Will the chapter does not pretend to offer a comprehensive analysis of sub-sectoral changes, it does provide an overview of the effect of the Government's redefined role on major production systems.

3.1 THE LIBERALIZATION OF THE RICE TRADE

The rice sector has historically been at the center of the food policy debate in Senegal for four inter-related reasons: its importance in the balance of payments equation, the size of the Government of Senegal's investments to promote local rice production in the Senegal River Valley, its central place in the Senegalese diet and the consequent potential social and political volatility surrounding questions of policy and prices.

Since the publication of the USAID Agricultural Sector Assessment in 1991, the rice sector has undergone a complete transformation. The January 1994 devaluation and the implementation of the GOS Rice Sector Adjustment Program has had profound (but not yet fully appreciated) impacts on consumers and rice producers. This section will provide a historical overview of policy changes and their effects on market organization, consumers and producers [RSAP/APAP/UPA, 1997].

3.1.1 Historical Overview

From independence until 1987, the rice sector was essentially under complete management by the GOS. The government had a monopoly on rice imports and established authorized wholesale and retail margins. The GOS insulated the consumer from world market price fluctuations but also generated substantial profits by selling the imported rice to wholesalers at healthy profit margins.

With the creation of the Societe d'Amenagement et d'Exploitation des Terres du Delta du Fleuve Sénégal (SAED) in 1965, the GOS began a massive investment program along the Senegal River, aimed at assuring food self-sufficiency through the production of irrigated rice. SAED acted as a "total service" regional development agency, providing heavily subsidized inputs, machinery, mechanical farming services and extension. They purchased paddy from the farmers at a mandated price, processed the paddy and marketed the product. Enormous inefficiencies throughout the production and marketing process resulted in astronomically high production costs, among the most expensive in the world. Production was sold at the same price as imported rice, the GOS subsidizing the difference between consumer and producer prices.

The steady deterioration of the country's economy obliged the government to radically revise the policy of heavy government involvement in the agricultural sector. The Nouvelle Politique Agricole, promulgated in 1984, signaled a determination by the GOS to dramatically reduce its involvement (and non-productive investment) in agriculture, opening the door to a progressively greater role for the private sector.

In terms of the rice sector, the new policy began to manifest itself in 1987 with the reorganization and down-sizing of SAED's mandate and corresponding personnel requirements and operating budget. Major changes involved

- Transferring perimeter management authority to farmers,
- Discontinuing the provision of credit and the sale of inputs to farmers, and
- Suspending the provision of mechanical tilling and harvesting services

In 1990, two additional initiatives were implemented which further decreased GOS financial investment in locally produced rice

- Stopping construction and maintenance of irrigation earthworks and
- Withdrawing from the production and marketing of rice seed

By the end of 1990, GOS involvement in local rice production was restricted to the purchase of paddy at a fixed price, product transformation and marketing.

The year of 1994 saw the promulgation of the GOS Declaration de Politique de Développement Agricole (DPDA) and the signing of agreements with donors pertaining to the financing of the new liberalized sectoral policy. In conformance with the schedule outlined in the DPDA, the GOS continued its disengagement from local rice production, and in June eliminated fixed producer paddy prices, sold off SAED rice mills to former employees and ended the Caisse de Péréquation et de Stabilisation des Prix (CPSP) collection and processing of paddy and the distribution of local rice.

On January 11 of the same year, the CFA franc was devalued by 50%, overnight doubling the Cost Insurance Freight (CIF) local currency costs for imports with a view to promoting local production, import substitution and export marketing.

The majority of rice sector reforms were implemented in 1995. On March 3, the GOS eliminated all fixed wholesale and retail price margins, although the CPSP still maintained its monopoly on broken rice imports. This measure, in conjunction with an increase in the CPSP wholesale price to reflect world market levels, saw the retail price of rice jump at least 60 CFA francs/kilo over the next four months.

From March until the end of 1995, the national rice market became very unstable, with steep price rises in the regions, reflecting scarcity. Much of this instability can be imputed to disorderly and precipitous manner in which the CPSP retreated from regional distribution. In

June, the CPSP, with almost no warning to private rice traders, closed their regional warehouse facilities, selling off their stocks and ending transport subsidies to the regions. Henceforth, wholesale supplies could be obtained only from CPSP's Dakar warehouses.

Due to the massive liquidation of CPSP's regional stocks, the impact of the changed distribution system was not felt at the regional level for the first six weeks. By August, bottlenecks in the CPSP wholesale distribution system began to create shortages in certain regions and consequent dramatic price increases. This situation prompted the GOS to permit private firms to begin importing broken rice, five months ahead of their scheduled market entry.

The arrival of the private sector did not immediately result in price decreases. On the contrary, the chaotic situation in the Dakar wholesale market, coupled with high world market prices and opportunities to realize substantial profits, spiked prices during the month of September.

Prices, however, rapidly fell in the following month, as substantial quantities of inexpensive Indian rice came on the market. Over the past year, prices have continued to decrease slightly as the market has matured, world prices have dropped and importers have shifted supply sources from the more expensive but better quality Thai A-1 Special to cheaper, lower quality sources dominated by India.

In February of 1996, the CPSP ceased importing broken rice, ending 30 years of GOS involvement in rice marketing.

3.1.2 Impact on Market Organization

Prior to the enactment of the liberalization measures, there was substantial concern by both the GOS and certain donors regarding the ability of the market to function in an economically efficient manner. Major unanswered questions concerned: Would private sector importers have the financial resources and organization to assure adequate supplies of rice on a sustained basis? Would market share concentration, either among importers, exporters or both, result in oligopolistic market behavior? Would collusion among regional wholesale and retail distributors result in price fixing and "inflated" margins?

The private sector soon laid to rest concerns about their ability to replace the CPSP. During the brief period in early 1996, when both the CPSP, prior to its withdrawal, and the private sector were importing broken rice, private sector imports accounted for 77% of broken rice imports. According to the previously referenced RSAP report, post-liberalization rice stocks have assured, at a minimum, 1.8 months of coverage, based on an average consumption of 30,000 tons. In fact, there has been criticism that stocks are too high, limiting marketing opportunities for locally produced rice.

There is no evidence of dangerous levels of market concentration, either among exporters or importers. Between October 1995 and May of 1996, rice was purchased from 15 different

exporters, with the top four providing approximately 60% of the market. Similarly, during this time, 20 importers purchased rice, with a four firm concentration ratio of a relatively modest 53%. If continued, these trends bode well for structural concerns of the market.

3.1.3 Impact on Consumers

The impact on consumers of the rice liberalization program obviously varies according to income level and consumption habits. According to a 1994/95 household consumption survey, there is little variability in the quantity of rice consumed across urban income groups. The poorest 25% of the urban population consumed 66 kilograms per capita per year, compared to 71 kilograms for the wealthiest 25% of the urban population.

The liberalization policy and the consequent 23% average nominal price increase since the elimination of mandated retail prices has had a severe impact on the nation's poorest income group. Prior to liberalization, expenditures on rice represented a very substantial 29% of income. This figure has increased to an estimated 37%, or 10,032 fcfa per month for the poorest 25% of the population. [RSAP/APAP/UPA, 1997]

Price increases have had no discernable effect on consumption patterns for rice. Preliminary data indicate that there has been virtually no substitution of millet for rice, as had been hoped. According to Diagne [?date], increases in millet consumption in certain rural areas has not occurred at the expense of rice purchases, it is, rather, attributable to increased income from groundnuts, as a result of devaluation and the consequent higher local currency equivalent of world market prices.

In fact, consumption data brings into question whether other cereals can be considered as viable substitutes, particularly for the mid-day meal. This is due to two main reasons. Rice consumption has steadily increased during the last thirty years, both in urban and rural areas, obtaining a nearly unshakable position in the Senegalese noontime diet. [RSAP, ?date] Its ease of preparation contrasts sharply with requirements for cooking millet. Moreover, when comparing the price of rice with commercially pre-prepared millet, rice is 50% less expensive.

3.1.4 Impact of Devaluation and Liberalization on Producers

For the last 30 years, irrigated rice production along the Senegal River has been a center piece of the GOS's policy of attaining food self-sufficiency, absorbing a large share of the investment budget in agriculture, considering that rice production in the valley represents only 3% to 5% of the country's total cereal consumption. This section deals exclusively with the impacts on irrigated production along the Senegal River as rainfed production in the southern part of the country is destined almost exclusively for auto-consumption.

Despite devaluation which has doubled local currency import costs, local rice at current yields and quality level has remained uncompetitive. Recent changes in the rice import tariff system,

aimed at increasing protection (and obviously increasing the burden on the Senegalese consumer) were implemented at the end of January 1997. It is still too early to determine the impact on the marketing of local rice. This issue will be explored in greater detail in a following paragraph.

3.1.5 Production Trends

Between 1989 and 1993, production along the Senegal River rose steadily from 70,600 tons to 120,200 tons but has since declined to 87,615 tons during the 1996/97 season. Increased production during the 89-93 period was largely due to the entry of new private investors into production activities, the completion of the Manatali Dam which improved water access and the easy availability of credit from the Caisse Nationale de Credit Agricole du Senegal (CNCAS).

Rainy season cropped area reached a high point of 25,900 hectares in 1991/92 but fell to 19,470 hectares during the 1996/1997 season. The decline in hot season planting was even more pronounced, descending from a peak of 7,300 hectares in 1992/1993 to 2,700 hectares in 1995/96.

Yields progressed on a regular basis until 1995/96 to 5 tons per hectare but slipped by 10% during the following season. Reasons generally advanced for the declines in production concern the scarcity of quality, certified seed, decrease in the use of inputs and, with the arrival of cheap Indian rice in regional markets, substantial price uncertainty, prompting farmers to diversify into other crops. Area planted, production and yield data are presented in the following graphs [MDRH/DA/DSA, *?* date].

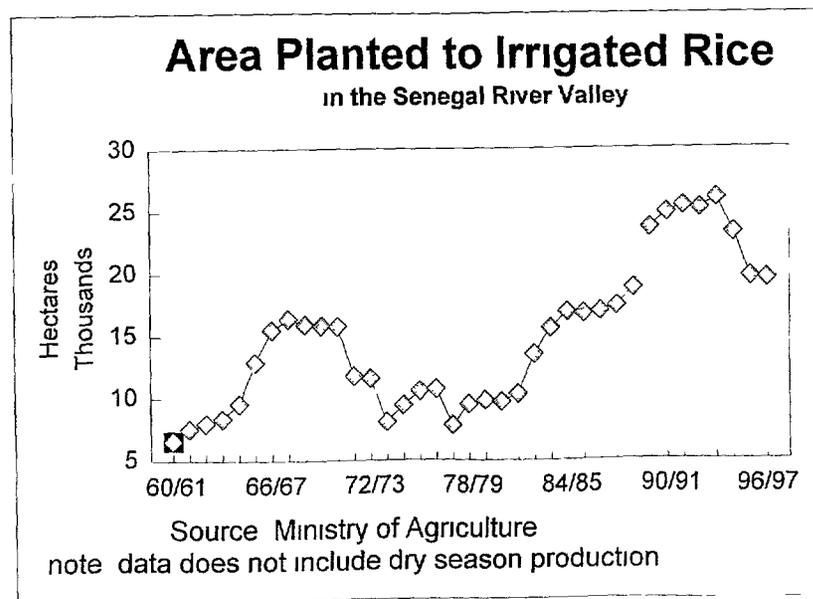


Figure 3.1 Area Planted to Irrigated Rice

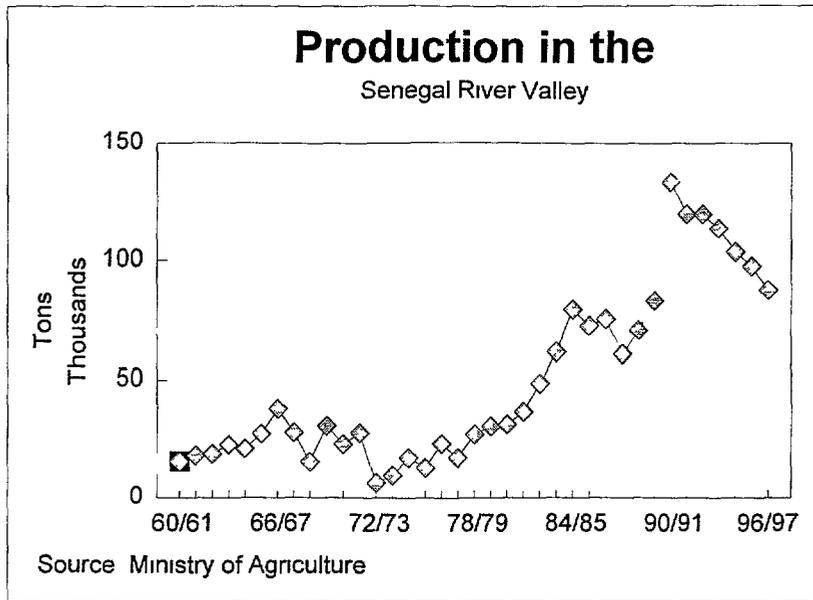


Figure 3 2 Rice Production in the Senegal River Valley

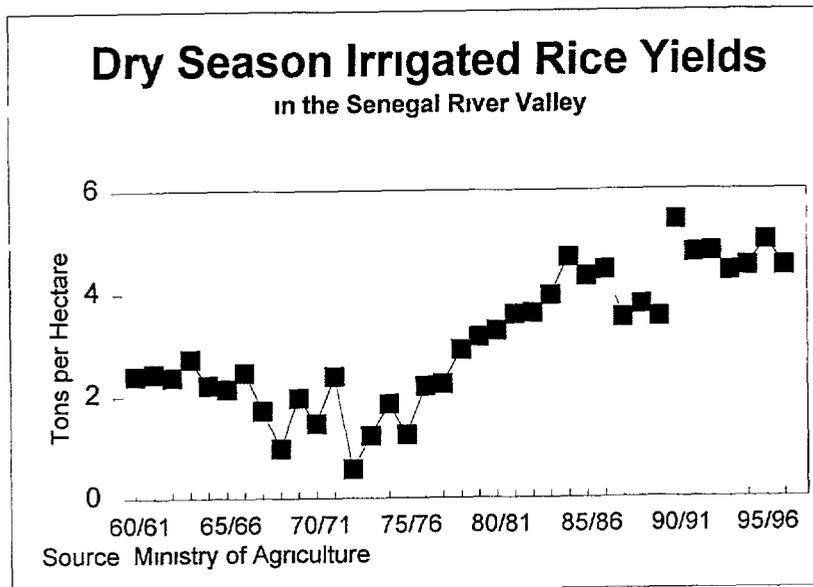


Figure 3 3 Dry Season Irrigated Rice Yields in the Senegal River Valley

3 1 6 Reasons for the Decline in Production

The above graphs clearly illustrate that the concurrent devaluation and liberalization of the rice market has had a very negative impact on rice production in the Senegal River Valley. The reasons for this decline in production span the entire spectrum of the production and marketing streams.

3 1 6 1 Changes in the Relative Costs of Inputs and Paddy

Between 1989 and 1995, per hectare costs of purchased inputs (excluding machine services) at recommended levels increased by 79% whereas the average producer price for paddy increased only 26%. The following table [** author, 1996] exposes the price changes.

Table 3 1 Changes in Purchased Inputs Costs for Rice After Devaluation

	Quantity/ha	1989	1995	% Change
Seed	120	21,600	31,200	44%
DAP	150	13,050	24,000	83%
Urea	250	17,500	45,000	157%
Propanil	10	16,500	32,750	98%
2-4-D	2	5,000	10,400	108%
Furadan	10	15,000	24,000	60%
Diesel fuel	120	25,200	36,000	43%
Total cost		113,850	203,350	79%
Paddy price		85	107	26%

Source: Structure des Prix et des Coûts de Production et de Transformation du Riz dans la Vallée du Fleuve Sénégal, 1996

In concrete terms, a producer in 1995 needed to sell 1.92 tons of paddy to cover his consumable input costs, versus 1.36 tons in 1989. Machine services have increased only by 2% as of the 1996/97 cropping season, [** author, 1997] but these costs will certainly rise as most equipment currently in use was purchased prior to devaluation. As equipment is renewed at post-devaluation prices, its repercussions on production costs will be felt immediately and these will be substantial, given that farming services and amortized motor pump costs are among the highest in the production process.

Anecdotal information suggests that, due to increased competition among input retailers, prices have decreased slightly during the last year. Nevertheless, the impact of devaluation on input costs has been great. Although no detailed studies are yet available, one can safely assume that farmers have substantially decreased application of inputs in the face of increased costs and have experienced a 500 kg/ha decrease in average yields during the 1996/97 cropping season.

3 1 6 2 Credit

The Caisse Nationale de Credit Agricole (CNCAS) is the major credit provider in the valley. As can be seen from the following graph, the amount of credit extended to producers and millers rose rapidly at the start of the decade, as did the default rate.

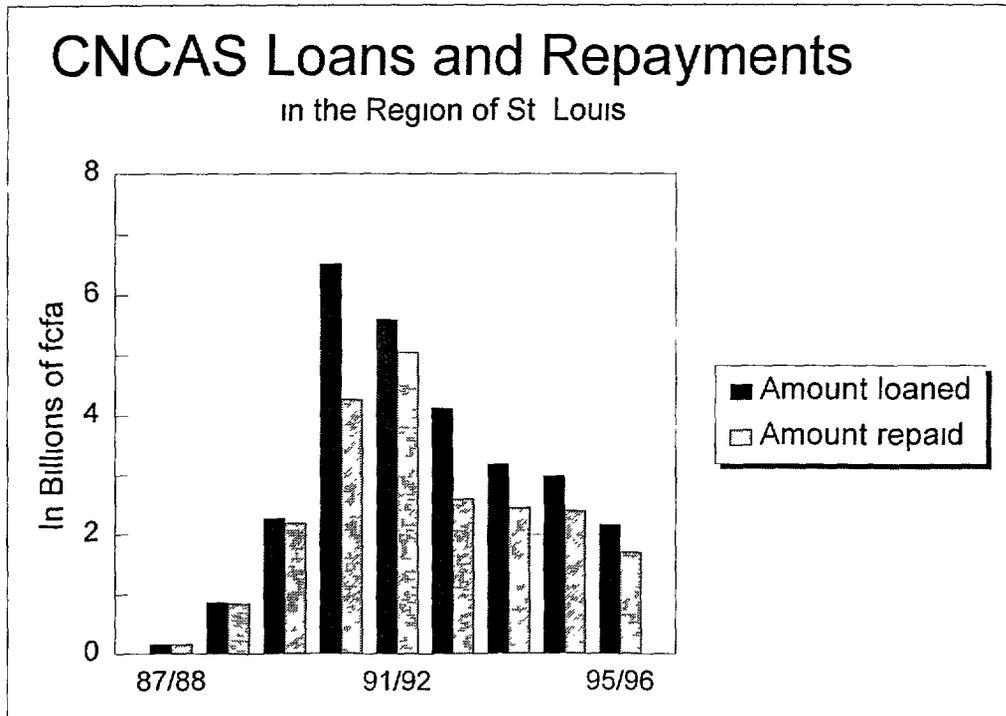


Figure 3 4 CNCAS Loans and Repayments in the Region of St. Louis

This was essentially due to a lack of vigilance and rigor on the part of the loan administrators. Loans were fixed in function of need rather than in relation to the ability of the borrower to repay. Frequently, producer groups who were in default would simply reconstitute another group with the same members to secure an additional loan. One recent study noted that the village of Ronkh, with an active population of 1000 was home to 140 producer associations [** author, date]

During the last three years the CNCAS has radically tightened its loan requirements and has consequently reduced its loan portfolio and default rate. It has recently changed certain lending provisions to better adapt to production requirements: repayment periods for certain loans have been expanded from 3 to 7 years, loans are now available to purchase previously owned agricultural equipment. At the present time, however, loans can not be obtained to finance second crops as farmers do not have sufficient time to pay off the outstanding loan prior to the beginning of the second production cycle. This is probably a major reason why there is not much double cropping in the irrigated perimeters.

3 1 6 3 Product Quality

With the use of proper milling techniques, the Senegal River Valley can produce high quality rice but it never has, and, until recently, it has never had to. Previously, the CPSP, the GOS parastatal, bought SAED milled rice and obliged wholesalers to purchase it, as a condition for obtaining the more desired Thai A-1 broken rice. According to a recent consumer survey [Baudouin and Simantov, 1996], commercially milled local rice has a very good flavor but non-uniformity of grain size (and the presence of impurities) makes it exceedingly difficult to cook. Non-homogeneous grain size means that a portion of the rice is either overcooked or undercooked. Satisfactory preparation of local rice requires time-consuming sorting by the preparer, who, generally is also the purchaser. Despite its appreciated flavor, housewives prefer to purchase imported rice of more homogeneous size. Improved milling and sorting is critical to the viability of local rice production in Senegal.

3 1 6 4 Distribution Networks for Locally Produced Rice

The distribution networks for local rice are not well developed. In large measure, this is due to quality problems which make locally produced rice less attractive to the consumer and, by extension, to the distributor. Additional factors play an important role: the traditional wholesale distribution network (authorized wholesalers who purchased rice from the parastatal importer CPSP, prior to liberalization) is located in Dakar, the entry port for imported rice, making commercial communications far easier, wholesaling rice requires substantial capital, most of which is concentrated in Dakar.

3 1 6 5 Ineffective Tariff Protection

The tariff protection system adopted by the GOS to "assist" local producers in making the transformation to a liberalized economic environment used a reference price which was based on prevailing prices for Thai A-1 broken grains, the historical (and practically sole) source of broken rice imports. Thai A-1 is the only broken rice quoted on international markets and, because of its high quality, is also the most expensive. The liberalization of rice imports in mid-1995 coincided with an accelerated marketing effort by the Indian government to clear out stocks accumulated during eight bumper crop years which were sold to exporters at below prevailing market prices. Inexpensive Indian rice flooded into Senegal, the tariff system which was based on the more expensive Thai rice did not provide the anticipated level of protection for local rice. Poor quality Indian rice was sold in major markets in Northern Senegal for less than the production and processing costs for the local commodity. Demand for local rice dried up, bringing many of the recently created milling firms to the brink of bankruptcy and eliminating marketing outlets for producers. The inability to move product resulted in rising loan default rates and a subsequent decision by producers to decrease hectareage by 25%. Local rice stocks have continued to accumulate, awaiting price increases engendered by the implementation of the revised tariff system.

On December 31, 1996, the National Assembly approved Law 96-35 for a period of two years which established import duties on 100% broken rice, varying from 15% to 45%, in function of the CIF per ton cost of imported rice. The system will guarantee an import price of around 181,000 fcfa per ton which should make it competitive with local rice whose production, processing and local marketing costs are estimated to be 188,590/ton [Kane, 1996]

The law was implemented four months prior to the drafting of this report so it is too early to judge its effectiveness. Anecdotal evidence suggests, however, that its impact will be delayed, as importers, anticipating the increase in taxes, purchased large quantities just before the law was enacted.

3 1 7 The Future of Local Rice Production

The GOS has given the local rice sub-sector two years to "adapt" to the changed market conditions. One can expect that local production will continue to decline steeply as producers switch to other less input intensive crops or cease farming on irrigated perimeters. The most productive rice farmers will probably have improved access to credit as demand decreases with crop diversification.

Financial analyses conducted by West African Rice Development Agency (WARDA) and the RSAP have concluded that, under plausible price scenarios, Senegal cannot compete with low cost broken rice producers without substantial tariff protection. Both studies, however, conclude that the country can be very competitive in the quality, whole grain market. Although this market at around 20,000 tons per year is, for the time being, only a fraction of the size of that for broken rice, there exists significant demand in neighboring countries. A handful of rice mills

in the valley have begun producing high quality whole rice. One miller, Delta 2000, recently sold 500 tons of rice to Mali. Quality improvement and export initiatives need to be encouraged as competing on the broken rice market will cease to be an alternative with the expiration of the two year tariff protection measures.

3.2 THE GROUNDNUT SUB-SECTOR

If one can characterize rice as being at the center of the food policy debate, one can speak of groundnut production as being at the center of both the rural income and balance of payments debates. Approximately 50% of the country's population are groundnut producers and, historically, Senegal has been one of the largest exporters of unrefined groundnut oil in the world. Simply put, as groundnuts go, so goes rural incomes and the country's balance of payments.

Since 1989, the last production year analyzed in the USAID Agricultural Sector Analysis, production and yields have decreased substantially, never approaching 1989 levels. In fact, excepting area planted, production and yields have decreased at accelerated rates compared to the previous 20 year period.

Table 3.2 Average Annual Growth Rates for Groundnuts

	Area Planted	Production	Yields
1967-1988	(1.5%)	(0.6%)	0.9%
1988-1996	0.1%	(2.3%)	(2.4%)
1967-1996	(1.4%)	(0.7%)	0.6%

Source: Duruflé 1996

These calculations are particularly disquieting as they are based on official statistics which are widely believed by knowledgeable observers to have substantially overestimated groundnut production and yield data [CIRAD, 1997].

It was anticipated that the higher local currency producer prices resulting from devaluation would provide a powerful incentive to farmers to increase their productivity and production. The official price paid by SONAGRAINES, the GOS parastatal responsible for sales of seed and fertilizer and the collection of the harvest progressed steadily during this time: 70 fcfa in 1992/93, 100 fcfa in 1993/94, 120 fcfa in 1994/95, 130 fcfa in 1995/96. As the following graphs clearly demonstrate, the awaited supply stimulus has not occurred.

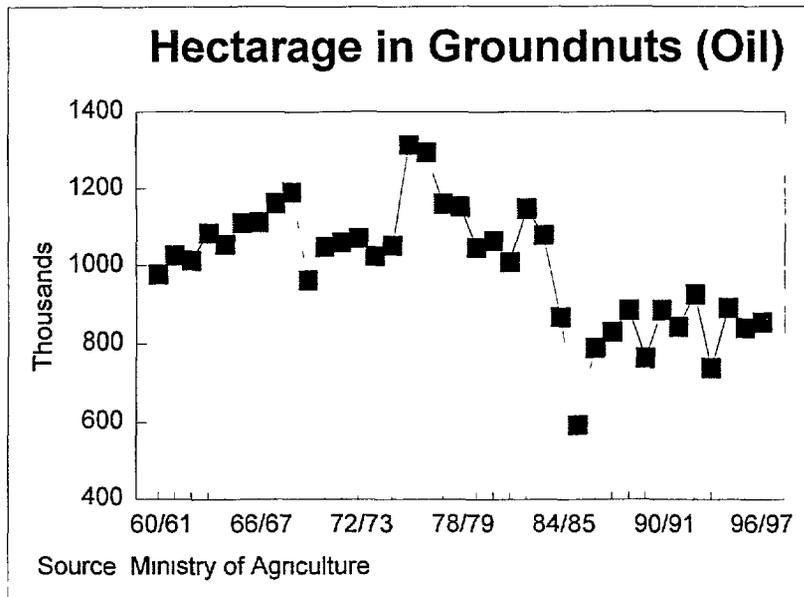


Figure 3 5 Hectarage in Groundnuts (Oil)

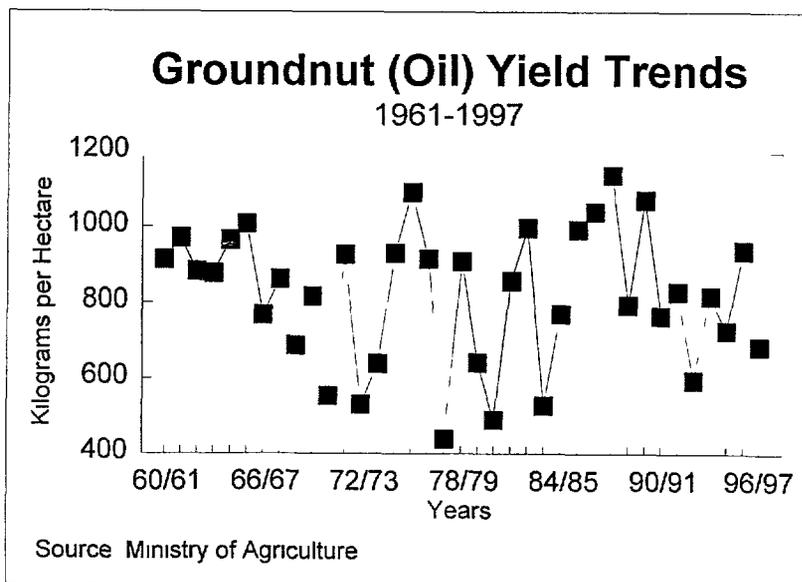


Figure 3 6 Groundnut (Oil) Yield Trends

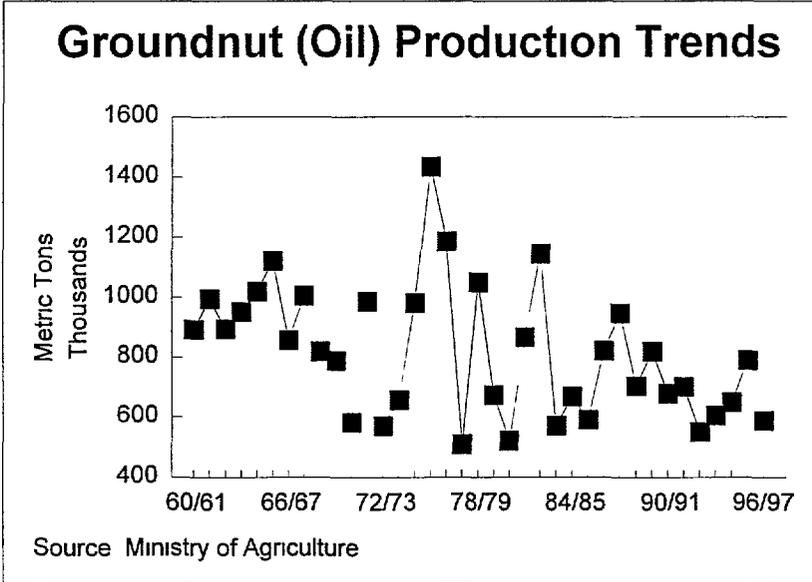


Figure 3 7 Groundnut for Oil Production Trends

80a

3 2 1 Reasons for the Decline

Reasons for the decline are of course interrelated and may be categorized by factors related to lower input use and food insecurity

3 2 1 1 Input Use

The decreasing use of certified seed has been cited in numerous studies as the principal constraint to improved yields ISRA, the National Agricultural Research Institute, recommends that 33% of farmers seed stock be renewed annually but renewal rates are thought to be around 10%-15% Major reasons evoked for non-renewal are access to credit, poorly developed distribution networks and lack of year-round availability of seed

The decrease in the use of commercial fertilizers is clearly due, in part, to credit constraints SONAGRAINES requires that producers provide a 30% down payment on purchases and charges seasonal interest rates of 25% With the continued decrease in rural incomes and the variability of inter-seasonal harvests, the down payment is beyond the reach of most farmers and the risk of a poor harvest resulting in non-payment of the loan is too great to chance It is interesting to note that the increase in consumption in the 1992/93 crop year is directly attributable to the GOS's election year initiative whereby they offered fertilizer at no interest and no money down The repayment rate was 35%

The development of an energetic private sector fertilizer distribution network on which the GOS and donors had founded hope in the mid-1980s has not occurred as farmer demand has not been sufficient to warrant interest from commercial operators

Farmers evaluate the cost of inputs by their price relative to outputs According to Kelly, [Kelly et al, 1996] farmers consider commercial fertilizer to be too expensive, relative to the producer price of groundnuts The following table illustrates the ratio of groundnuts to fertilizer

Table 3 3 Groundnut/Fertilizer Price Ratio (in fcfa/kilogram)

Year	Groundnut Producer Price	Fertilizer Price in fcfa/kg	% of Subsidy	Groundnut/ Fertilizer Ratio
1983-84	50	50	63%	1 00
1984-85	50	100	0%	0 50
1985-86	90	52	32%	1 73
1986-87	90	60	21%	1 50
1987-88	90	78	20%	1 15
1988-89	70	80	9%	0 87

1989-90	70	89	0%	0 79
1990-91	70	89	0%	0 79
1991-92	80	89	0%	0 90
1992-93	80	89	0%	0 90
1993-94	70	90	0%	0 78
1994-95	120	130	0%	0 92
1995-96	125	138	0%	0 92

Source Adapted from Cash Crop and Foodgrain Productivity in Senegal, 1996

The data indicate that since the GOS fertilizer subsidy has been abolished, the per kilo price of groundnuts has not equaled the price of fertilizer. The ratio is highly correlated with fertilizer use and would suggest that either raising the official price of groundnuts and/or decreasing the price for fertilizer would provide impetus for many farmers (who had available resources) to increase fertilizer use.

The producer price of groundnuts on the parallel market is substantially higher than that offered by SONAGRAINES but the unavailability of credit for fertilizer acquisition effectively eliminates procurement on the open market.

3 2 1 2 Food Insecurity

Food security concerns play a large role in the allocation of resources to the production of cash crops. Historically, yields of groundnuts have varied significantly more than yields of millet and sorghum. This has held true for the period since 1989. As groundnut yields have significantly trended downward, the relative risks involved in inter-seasonal variation have become more acute. Thus, despite detailed farm-level studies which affirm that groundnut production is more profitable than millet/sorghum cultivation in the Peanut Basin, farmers are inclined to reduce risk by planting food crops which are subject to less yield variability. It should be noted that a recent in depth study of the groundnut sub-sector CIRAD [1997] reached the exact opposite conclusion while working in mostly the same geographic zone.

Food security concerns also have an effect on the quality of groundnut seed. With the adoption of the GOS's policy in the late 1980s to have individual farmers store 75% of their seeds, producers have not generally applied pesticides to their seed stocks as this precludes subsequent consumption. With the decrease in rural incomes, seed stock has become a principal source of liquidity (and also a reserve food source) after proceeds from the harvest have been exhausted. The absence of pesticide applications has further decreased the quality of seed stock resulting in lower germination rates and less robust kernels.

3 2 2 Groundnut Oil Production

As would be expected, the significant decline in groundnut production has had an adverse impact on the amount of raw material entering the SONACOS oil crushing facilities. As one can see

from the following graph, however, the decline in delivered raw material has far outstripped the decrease in groundnut production

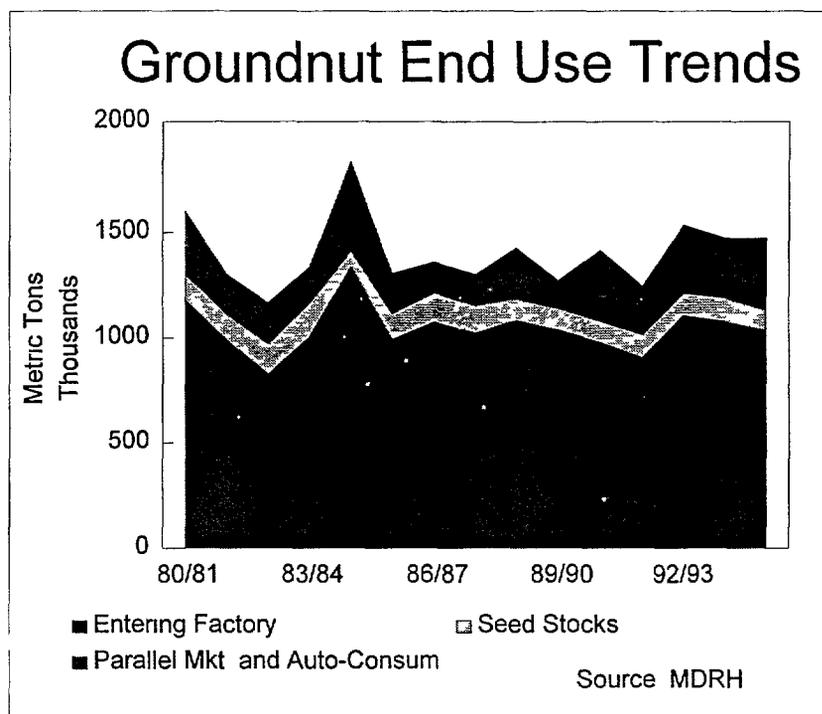


Figure 3 8 Groundnut End Use Trends

This is clearly attributable to the continued development of the parallel market. The sale of groundnuts through un-official channels was authorized in ??? but prior to authorization, it had a long history as a thriving commerce, originally centered in Touba, the headquarters of the Mouride Brotherhood where it benefited from the protection of the Mouride leadership. The main motivation for selling on the un-authorized market was to avoid reimbursing the GOS groundnut parastatal for seed and fertilizer loaned during the previous cropping season.

The decline in the availability and use of credit to purchase inputs has not, as would be expected, had a dampening effect on the un-official market. On the contrary, the market has grown despite decreased motivation to avoid loan repayment. There are several reasons for this. The producer price on the parallel market is approximately 20 fcfa per kilo more than that offered by SONAGRAINES. The high fixed processing and administrative costs of the GOS' parastatal limits its ability to compete with the parallel market on price. The product assembly functions of the parallel market are much more "producer friendly". The parallel market has many more assembly points, often purchasing groundnuts in small rural markets and remote villages and does not require that sellers clean and bag their product. SONAGRAINES and its authorized agents have far fewer purchasing points, which in 1991 were reduced from 1750 to 750, and demands

that farmers clean and bag their merchandise prior to the transaction. The parallel market purchases shelled and unshelled groundnuts of different qualities (and corresponding prices) whereas the official market only purchases shelled nuts, thus eliminating the possibility of farmer families to add value by shelling their product. Perhaps most importantly of all, the parallel market pays cash on delivery whereas SONAGRAINES delays payment for several months after reception.

The reasons cited above amply illustrate why Senegal's 920,000 metric ton annual processing potential has been running over the decade of the 1990's at around 30% capacity.

Paradoxically, the decline in SONACOS' oil production has coincided with its return to financial health. The parastatal greatly reduced its costs. More significantly, it began to import increasing quantities of unrefined vegetable oil which was subsequently refined and bottled and then sold at a healthy profit while exporting an increasing percentage of raw groundnut oil to take advantage of rising world market prices.

During the 1990s, one has seen the State and SONACOS return to sub-sectoral financial profitability while groundnut producers have seen their revenues plunge in both real and nominal terms. The balance of payments which averaged 20,512 million fcfa in constant francs tumbled to an average 4,148 million fcfa between 1991 and 1995 [CIRAD, 1997, pg 87].

Although the future privatization of SONACOS and the suppression of SONAGRAINES should help reduce production costs thereby creating the opportunity to raise producer prices, the refineries will have to provide additional incentives to producers and/or private sector intermediaries if it to obtain insufficient raw material to profit from the post-devaluation environment and maintain a positive commercial balance.

3.3 THE HORTICULTURAL SUB-SECTOR

Since 1989, horticulture has been one of the more dynamic productive activities within the agriculture sector. Prior to devaluation, production trends were already on the rise. This was accentuated after the currency realignment. Devaluation did indeed have the anticipated consequence: import substitution. Exports, however, to both European and regional markets declined slightly. The following graphs illustrate the sub-sectoral trends.

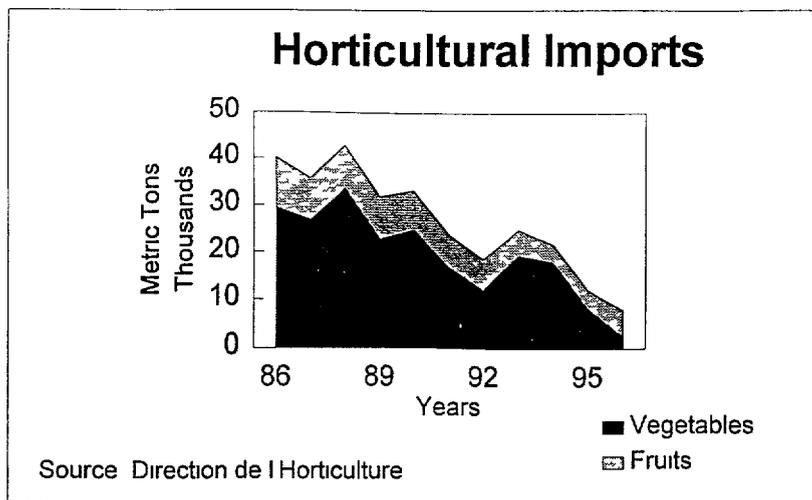


Figure 3 9 Horticultural Imports

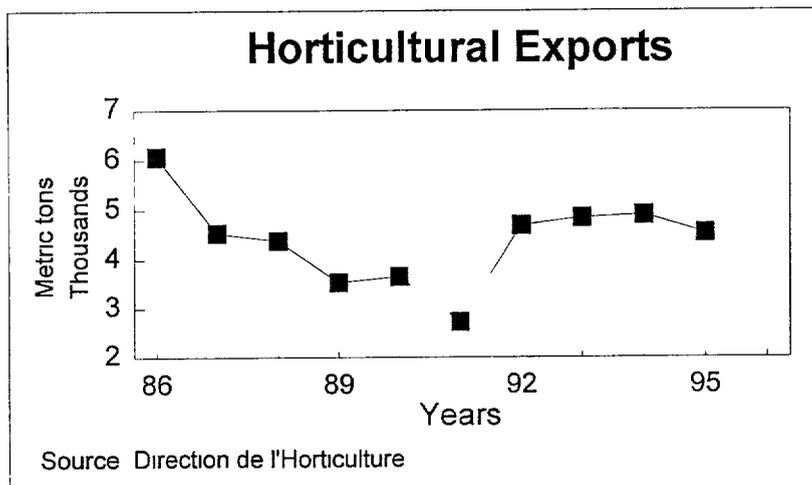


Figure 3 10 Horticultural Exports

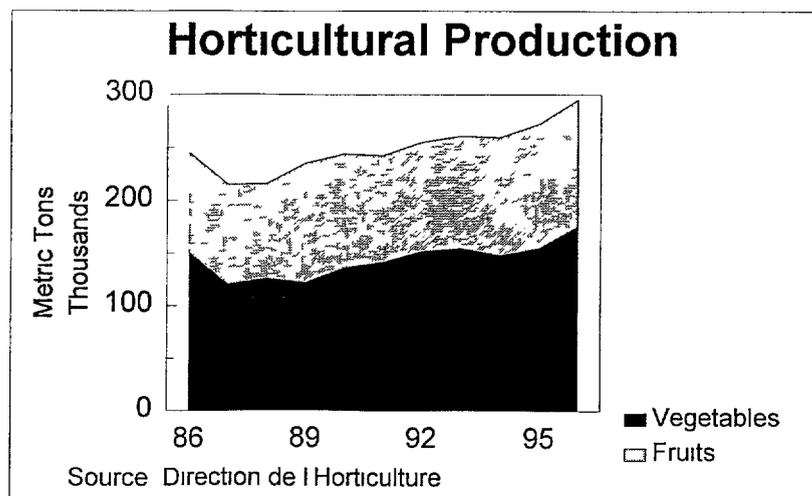


Figure 3 11 Horticulture Production

It is important to note that the official statistics almost certainly underestimate the level of exports to Mauritania, as most of the horticultural exports are produced in proximity to the Senegal River and are transported by pirogue, thus not entering into the national statistics

The positive impact of devaluation can be seen clearly by comparing imports and exports before and after devaluation

Table 3 4 Change in Principal Horticultural Imports After Devaluation

	1993 (in metric tons)	1995 (in metric tons)	% Change
Potatoes	8596	3394	- 60%
Onions	6897	5470	- 20%
Apples	1764	890	- 49%
Citrus	1265	412	- 67%

Source Etude de Diversification et de Modernisation de la Filiere Horticole au Senegal

Table 3 5 Change in Principal Horticultural Exports After Devaluation

	1994 (in metric tons)	1995 (in metric tons)	% Change
Green Beans (extra thin)	187	309	+ 65%
Green Beans (Bobby)	2838	4408	+ 55%
Cherry Tomatoes	492	616	+ 25%
Bissap	2	9	+ 450%
Spring Potatoes	0	112	
Onions	0	28	
Mangos	0	200	

Source Etude de Diversification et de Modernisation de la Filiere Horticole au Senegal

3 3 1 The Domestic Market Current Situation and Prospects

Domestic production, storage and marketing techniques are, almost exclusively, rudimentary in nature With the exception of a handful of commercial sized growers, production is typically on plots of less than half a hectare Yields and quality are generally low due to the use of inappropriate seed varieties, low fertilizer and insecticide use and frequent problems with saline irrigation water Regrettably, producers and intermediaries are currently able to

realize only a small part of the potential benefits from domestic demand. Lack of vehicular access to many production areas and the poor condition of roads and trucks provoke enormous post harvest losses. The lack of cold storage facilities in major urban centers means that production is marketed at the same time with predictable negative impacts on producer and wholesale prices.

Nevertheless, prospects for continued expansion of small scale horticultural production are promising. With increasing population trends, decreasing imports and positive macro-economic responses to recent GOS policies, local demand should continue to rise. The European Union has long provided assistance to the sub-sector, principally through technical and managerial training. In the near future they will fund the construction of additional cold storage facilities, an improved information system and a wholesale market in the environs of Dakar. This should result in substantially increased revenues for market participants.

Small scale horticultural production merits encouragement. In addition to providing good returns on a per hectare basis, its potential impact is far larger. It provides farmers with an economic activity during the dry season, improves nutrition and is a source of revenue for rural women. Perhaps most importantly, it has the potential to slow the rural exodus and can provide capital to permit cereal and cash crop producers to finance inputs to increase their productivity.

3.3.2 The Regional Market: Current Situation and Prospects

It is difficult to estimate, with any degree of certitude, the volume of horticultural products exported to neighboring countries. Anecdotal information suggests, however, the exports to Mauritania have increased substantially over the last three years. Statistics for 1994 from EUROSTAT, the statistical office of the European Union, indicate that Mauritania imports considerable quantities of horticultural products from the EU.

Table 3.6 Mauritanian Horticultural Imports (1994)

Potatoes (Holland)	5,576 tons
Onions (Holland)	3,548 tons
Cabbage (France)	786 tons
Tomatoes (Spain)	163 tons
Carrots & Turnips (France)	238 tons
Cucumbers (Spain)	163 tons

Source: Direction de l'Horticulture

The liberalization of the national rice market necessitates a diversification of crop production along the Senegal River Valley. The increased price competitiveness of Senegalese products

relative to European imports should provide good opportunities to expand market share. Small quantities of vegetables and fruits are exported to Guinea Bissau and the Gambia but weak consumer purchasing power and the small size of the markets do not hold promise for expanding exports. Although the size of the market is small, Senegal has an opportunity to displace Portugal as the primary supplier to the Cape Verde Islands. Portuguese produce is expensive and of mediocre quality. At present, however, no refrigerated maritime transport exists on a regular basis between Dakar and Cape Verde. Among West African coastal nations, Senegal's relatively mild and dry climate provides a great advantage for vegetable production. Its southern neighbors, particularly the Ivory Coast, import large quantities of vegetables from Europe. The total absence of refrigerated maritime transport in the sub-region precludes expansion south.

3.3.3 European Market: Current Situation and Prospects

Senegal is a marginal player in the European market. Green beans, melons and lantern peppers account for over 80% of the country's horticultural exports, primarily to France. An examination of Senegal's market share and its direct competitors is instructive.

Table 3.7 Volume and Market Share of Senegalese Horticultural Exports to the EU (1994)

Product	E U Imports 1994 (tons)	Exporter	Tonnage	Market Share
Green Beans	44,077			
		Kenya	12,665	28.7%
		Egypt	11,042	25.1%
		Morocco	5,364	12.2%
		Senegal	3,155	7.2%
Melons	101,572			
		Brazil	49,634	48.9%
		Israel	13,900	13.7%
		Costa Rica	8,353	8.2%
		Senegal	933	0.9%
Tomatoes (incl. cherry)	157,522			
		Morocco	148,297	94.1%
		Israel	4,073	2.6%

Source: Etude de Diversification et de Modernisation de la Filière Horticole au Sénégal

Senegal's market share is insignificant and its direct competitors during Senegal's growing season are mostly countries who have a long-standing and highly developed agricultural export sector.

Since the 1970s the potential to export horticultural products to European and North American markets has been vaunted. Several unsuccessful attempts have been made to capitalize on Senegal's inherent advantages: proximity to major markets, adequate infrastructure and favorable climate. In the 1970s, a Dutch-American firm exported large quantities of fruits and vegetables to Europe and North America by boat. High costs of production, notably water, and inefficient customs services forced them out of business. More recently, green beans were exported to the USA but an inability to conform to USDA pesticide application norms resulted in the withdrawal of Senegalese exporters' import licenses. In the late 1980s, cashew nut exports held promise but shipments of poor quality product (unacceptable levels of foreign matter, unripe nuts which break during roasting) effectively closed off market opportunities in Great Britain and France.

The devaluation of the CFA franc has once again brought discussions of exports to Europe to the fore. Successful export marketing requires a mastery of production techniques, adequate storage facilities near production areas and at embarkment points, good transport infrastructure (roads, refrigerated trucks), an experienced corps of exporters, an effective quality control agency and a bureaucracy which facilitates timely expedition of product, all of which are currently lacking in Senegal.

Even if some of the above mentioned constraints are overcome, the absence of large production volumes greatly increases maritime and air transport costs. Moreover, export marketing opportunities to Europe have significantly decreased, with the entry of Spain and Portugal into the E.U., the adoption of more stringent quality requirements and the recent increase in import duties for Lomé Convention members. Clearly, European export marketing is destined to remain a footnote in the country's agricultural development.

3.4 CEREALS

3.5 SUMMARY AND CONCLUSIONS

In the short term, devaluation and the concurrent liberalization of the rice market has increased the retail price of rice by an average of 23%, placing an additional financial burden on Senegal's most financially vulnerable groups. Despite the price increase, anticipated import substitution has not occurred, principally for two reasons: prices for millet meal have also risen, keeping it more expensive on a per kilo basis than the imported alternative, consumption habits appear to be so deeply ingrained that the price elasticity for rice is extremely low. The withdrawal of the GOS from the purchase of locally produced rice, combined with the increase in input prices, decreased availability of credit, ineffective tariff protection and continuing mediocre product quality has had a severe impact on production. Rice producers in the Senegal Valley are beginning to diversify into whole grain rice and alternative crops. This is to be promoted as there is little hope for developing a competitive broken rice sub-sector after the expiration of tariff protection.

Devaluation has not stimulated groundnut production, as anticipated, despite higher producer prices. Production and yields have trended downward while area planted during the last seven years has remained stable. Critical factors accounting for this trend are the continuing

deterioration of seed stocks both in terms of quality and quantity and the decrease in use of fertilizers, pesticides and fungicides as a result of tightened credit restrictions. Farmers have tried to compensate by increasing seeding rates. While this may present a short term solution it will have a severe medium-term impact on soil fertility. The development of the parallel market, while assuring producers higher prices and greater convenience, has had a strong negative effect on the production of groundnut oil by the GOS parastatal. With plant capacity currently at 30% SONACOS will need to align its producer prices more closely with those of alternative marketing outlets to avoid a continued decline in oil production.

Devaluation has had a beneficial effect on local horticultural production stimulating substantial import substitution. However, exports have not increased to European markets. This is due to tighter European Union import requirements, stiff competition from countries possessing developed export markets and, with the inclusion of Spain and Portugal, an increased capacity among EU members to produce tropical and off-season products. Although European export prospects are limited, the potential for continued import substitution and increasing exports to neighboring countries is encouraging.

Production and yields of millet have risen slightly over the last seven years but not to levels anticipated by the expected import substitution following devaluation. This is because groundnut production in most regions of Senegal continues to be more profitable. In addition, the high relative cost of millet meal to imported rice has translated into slack consumer demand. In the absence of high yielding varieties and the continued increased profitability of groundnuts compared to millet, production may decrease in the coming years. If so, this will negatively effect soil fertility, as farmers forgo essential crop rotation.

The reform of the agricultural sector is still continuing. The establishment of a new extension agency, decentralization and the reform of the Ministry of Agriculture are now being implemented. Many major structural reforms have occurred recently and their impacts have not yet been fully appreciated. It would seem, however, that the changed sectoral environment has increased potential economic opportunities for Senegal's farmers. To take advantage of these opportunities, much must be done to increase farmer access to certified seed, fertilizer, extension services and stable markets, without recourse to the failed subsidy, pricing and credit policies employed in the past.

CHAPTER 4 AGRICULTURAL CROP PRODUCTION

The purpose of this chapter is to highlight changes since 1989 and to propose possible options and alternatives for increasing agricultural production. In addition, the different types of Senegalese farming practices along with such agricultural supporting institutions as agricultural research and extension and related services are discussed.

4.1 RAINFED AGRICULTURE

4.1.1 Description of Farming System

Senegalese farmers, long ago evolved agricultural systems that successfully used and conserved natural vegetation, soils and landscapes as well as responded to climatic variances and uncertainty. This is evidenced by the **slash and burn**, shifting form of farming which protects trees in newly cleared fields and forests. New fields are usually prepared, first by cutting down most of the trees and shrubs with a machete, followed by burning. Farmers then proceed to till the land and sow the seeds in the beginning of the rains around June/July. Large trees are left in tact while the remaining stumps from bushes cut down regenerate new trees.

For crop production, many of the positive effects of field trees are negated by the shading effect of the crown of the trees. Yet even though crop yields may be somewhat less, farmers often find that the overall greater productivity of crops and fruit trees, nuts, leaves and other benefits of the field trees greatly offset the higher yields of the treeless fields.

The diversification of production systems with field trees and the relative resistance of field tree productivity to drought also increases the farmers' food security and nutrition. Agro-forestry has a link to livestock as a good source of feed during the dry season. During periods of celebrations like Tabaski, the sale of sheep in Senegal represents a valuable source of capital gain and cash income. This helps to stabilize farm income during periods of short climatic fluctuations which have little or no effect on the animals. The animals consume crop by-products while oxen and donkeys in turn provide transportation and animal traction (AT). It also adds to the soil organic and mineral matter as well as minimizing soil erosion. Such a practice is especially relevant in the northern less rainfall zones in Senegal.

Unfortunately, relatively little research has been done to quantify the overall benefits of production systems that incorporate field trees. Generally, the farmers themselves are the most accurate judges of the types and numbers of trees that best fit into their cropping systems.

Today, population, economic and other pressures have altered this pattern. Fallows have either shortened or have been abandoned altogether in some areas of the Peanut Basin. Shortfalls in seasonal precipitation since the late 1960s have resulted in an apparent change in the way agriculture is practised. Not only is the amount of rainfall less than pre-1960 levels, but the duration of the rainy season and hence the growing cycle is shorter. Table 4.1 shows this general

trend Successfully intensifying land use to adapt to these conditions requires an adjustment of cropping practices, and types of crop varieties grown to reflect the realities of a persistent dry cycle in the agricultural climate

Table 4 1 Average Rainfall (mm) for Selected Regions in Senegal

Year	Louga	Dioubel	S Saloum	Tamba	Casamance
1990	287	402	511	656	1111
1991	250	354	394	671	1211
1992	203	146	415	551	923
1993	342	263	443	401	1320
1994	220	428	672	904	1120
1995	265	693	595	578	926
1996	316	293	467	712	998
1960-89	341	491	621	805	1129

Source USAID Statistical Annex for 1990-4, DMN for 1995&96

In Senegal, there are three main bioclimatic regimes running from south to north exist They are Guinea, Sudan and Sahel It is within these regimes that farmers pursue two main agricultural production systems -- rainfed and irrigated A minor form of flood recessional farming referred to as **decrue** is also practised in parts of the Senegal River (herein referred to as the "valley") Upper Valley While most farmers only pursue rainfed agriculture due to limited irrigated areas, others in the Bakel area practice all three types A detailed description of these farming practices and their characteristics follows

Rainfed agriculture depends directly and entirely on rainfall In Senegal, it is referred to as **diern** It is dominant and comprises several crops in a mixture, except in the case of cash crops, and is often practised in association with some form of livestock raising particularly small ruminants (goats and sheep) and chickens The practice has benefits that include

- Improving soil structure, stability and fertility due to the incorporation of animal manure in cropped fields, thereby minimizing erosion and conserving natural resources,
- Improving soil structure, fertility and water holding capacity, and
- Improving farmers' nutritional, health and economic well being

The main crops grown under rained agriculture in Senegal are sorghum millet maize rice peanuts, cotton, cowpeas and cassava. Minor crops include tomato pigeon peas and bissap. There are also tree and horticultural crops but these will be discussed in a later section of this report.

The rice crop will be discussed separately because of its political importance but more importantly rice is one of the rare field crops that can be grown from dryland to 3 or more meters of standing water, and from fresh water to saline conditions. Each regime, however, requires the appropriate variety and complementary agronomic/cultural practices in order to obtain optimum yields.

4.1.1.1 Rice Crop

Prior to the on-set of frequent droughts in West Africa in the late sixties, rice was only a staple food crop in the following West African countries: Liberia, Sierra Leone, Guinea and Guinea-Bissau. For countries such as Senegal, the staples were sorghum and millet. Senegal only started importing large quantities of rice, to make up for cereal deficits caused mainly by recurrent droughts. Moreover, the imported rice is mainly to meet the requirements of urban dwellers. Farmers generally prefer to eat their coarse grains which they generally produce in adequate amounts in years of normal and evenly distributed rainfall over the growing season. Other reasons for the increased rice consumption include:

- Dietary shifts connected with migration to urban centers,
- Food aid provided by the international donors was mainly rice,
- Low producer prices for locally grown rice,
- Its ease of availability in the international market, and
- Difficulties involved in processing coarse grains and roots and tuber crops.

In Senegal, rice is grown in five different conditions/regimes as follows:

- a Upland (plateau),
- b Shallow-flooded freshwater (bas-fonds),
- c Deep-flooded,
- d Mangrove swamp, and
- e Irrigated

Irrigated rice will be discussed in the section on irrigated agriculture in this report.

Upland Rice Upland rice is that type which is grown like any other cereal crop. It receives moisture entirely from rainfall and requires about 400-700 mm of rain during the growing season. Soils range from sandy loams to loams of various depths. The crop duration for the appropriate varieties ranges between 90-120 days with the improved varieties tending to be on the lower spectrum of the scale. The Senegalese Institute for Agricultural Research (ISRA) station at Sefa in the Casamance and in collaboration with the West Africa Rice Development Association (WARDA) have identified higher yielding varieties than the local ones grown by farmers.

Shallow-flooded Freshwater Rice (Bas-fonds) This type of rice cultivation is limited to shallow-flooded swamps or valley bottoms that derive their moisture from a combination of rainfall, streams and run-off from the upland areas. They are found mainly in the Casamance area. A FAO report (1981) stated that these areas are the most productive or suitable for rice and vegetable crops' production. Their agricultural potential is derived from a combination of their

- Native clay loam and hydromorphic soils,
- Year-round inundation in some cases thereby ensuring the crop of moisture and certain plant nutrients usually not available under upland conditions, and
- Fertility brought in by flooding from streams and erosion from the uplands,

Deepflooded Freshwater Rice This type of rice cultivation is done in bowl-shaped depressions along streams and is limited to the Ziguinchor area. The rice is sown by broadcasting the grains on moist ground or is transplanted when farmers are late in sowing the seed. Moisture is derived from streams and run-off from the higher uplands. The depth of water gradually increases to about 90 cm.

Mangrove Swamp Rice Mangrove swamp rice is grown mainly along coastal estuaries in the Casamance. Transplanting, of about 30 days old seedlings, is the exclusive means of growing the rice. It is essential that the soil be continuously flooded except for brief periods of low tide and the rice be able to withstand some degree of salinity and acidity. Farmers usually transplant a few seedlings randomly in different parts of the fields periodically to determine if it is safe to transplant the crop. This type of rice cultivation has been decreasing in Senegal due mainly to decreased rainfall (Table 4.1).

The USAID Southern Zone Water Management Project (SZWMP) under a contract with Louis Berger International was conceived to minimize salt water intrusion and to expand freshwater rice cultivation through the construction of

- Anti-salt dikes,
- Water retention dikes, and
- Contour bunds

By 1995 SZWMP had recovered 22 valleys covering 10,200 ha and trained local nationals and farmers on how to maintain the structures. The SZWMP plans to recover 15,000 ha by 1999. The presence of this project has helped to minimize the intrusion of salt water in the areas above the anti-salt dikes. Both ISRA and WARDA have identified improved varieties for this regime.

4.1.1.2 Cash Crops

Groundnut and cotton are the two main cash crops grown in Senegal. The introduction of mechanization for groundnut production led to excessive land and tree clearing. This clearing of trees is in sharp contrast to the traditional mixed-type of farming adopted by farmers in the production of traditional food crops and that helped to maintain a balance on the natural resource base. The removal of crop residues for animal feed/firewood from harvested fields has been a common practice following the excessive tree clearing. This has continued in the past 7 years as

rainfall has not improved (Table 4 1) Adequate residue to share between peanut fields and homestead maize plots and vegetables gardens is, however, not available Farmers are aware of the fact that this practice diminishes the organic matter content of the soil They try to tackle the problem to some extent by the applications of manure when available or organic and inorganic fertilizers if economic conditions permit They also use crop rotations, etc

Cotton was introduced at a later period and is grown mainly in the more favorable climate and soils in the Casamance and Southeastern Senegal It is grown in rotation with maize and millet and the practice has continued during the past 7 years By adopting this practice, the cereal crops benefit from the residual effect of the fertilizers applied on the cotton

4 1 1 3 Other Rainfed Crops

Sorghum and millet are the two major coarse grains grown under rainfed conditions Cowpeas, maize, fonio, cassava, yams, pigeon peas and bissap are also grown, usually in a mixture with a few exceptions like fonio Mixed farming is a risk avoidance strategy from the unpredictable uncertainties of climate associated with rainfed agriculture Maize is generally grow around the homestead where manure is abundant and moisture not as limiting as in the upland "fields proper" Table 4 2 shows the characteristics of the important cereals grown in Senegal

Table 4 2 Physiological and Related Similarities and Differences of Maize, Sorghum and Millet

Maize	Sorghum	Millet
Rooting System		
Superficial in upper 50 cm	Stronger and deeper than maize	Stronger and deeper than sorghum
Water Requirement (mm) in Growing Period		
500-600	400	300-350
Yields (kg/ha) at low & high inputs		
1000 4000-5000	750-1000 3000	500-750 1000-1500

Source FAO (1983) modified

The Casamance and Southeastern Senegal (Central Tambacounda) are the most suitable areas for growing a wider variety of rainfed crops in the country and also have most of the currently unused arable land (USAID, 1991) These areas also have a better potential than the Peanut Basin for the use of higher/improved technologies, which is consistent with their better rainfall

and soils. They are also not densely populated as in the Groundnut Basin even though there has been some movement of people from the Basin to the Casamance during the last few years.

4.1.2 Trends in Production

Table 4.3 shows average areas and productions of the main crops grown in Senegal for the 1990-95 period. Total area for all crops planted was 2.22 million hectares and is slightly

Table 4.3 Areas and Production of Major Crops in Senegal, (1990/91-1995/96)

Crop	St Louis	Loug	Thies	Dioub	Sine Saloum			Casamance			Tam	Seneg
					Fat	Kao	Tot	Zig	Kol	Tot		
Areas (000ha)												
Mil/Sor	25.3	97.2	124.8	121.4	139.0	332.5	471.5	18.7	94.7	113	67.3	1020
Maze	0.8		0.6		2.2	35.1	37.3	2.0	35.9	37.9	27.1	104
Rice	22.7				0.5	0.4	0.9	19.4	27.3	46.7	3.7	74
Cowp	6.4	29.7	16.6	17.1	4.9	2.9	7.8	0.4	0.6	1.1	0.3	79
Cassav			17.1	0.2	0.6	0.9	1.5	0.3	0.5	0.8		19
Grdnut					4.9	27.2	32.1					32
Oil Nut	8.3	95.4	91.8	85.0	113.9	298.3	412.2	16.3	76.1	92.4	68.5	854
Cotton							4.9		20.9	20.9	13.7	39
Tot	63.5	222.3	250.9	223.7	266.0	697.3	968.2	57.1	256	313	181	2220
Production (000mt)												
Mil/Sor	6.8	32.3	64.4	71.0	87.6	267.7	255.3	12.0	89.2	101	54.1	685.1
Maze	1.5		0.2		2.2	37.1	39.3	2.1	40.7	42.8	33.3	117.1
Rice	106.2				0.8	0.8	1.6	23.8	30.2	54.0	7.4	169.0
Cowp	0.8	9.9	4.8	7.8	2.1	1.3	3.4	0.2	0.3	0.5	0.2	27.3
Cassav			43.8		1.4	4.0	5.4	2.1	3.1	5.1		50.8
Grdnut		-			4.7	25.9	30.7		-			30.7
Oil Nut	2.7	51.1	43.5	51.5	86.6	286.5	370.1	16.8	79.9	96.7	67.3	681.6
Cotton		-			-		3.6		20.9	20.9	13.7	38.4

Source: Data abstracted from USAID Statistical Annex

higher than 1985-89 period which was 2.20 million hectares (Table 4.4). Millet/sorghum and oil groundnuts are the most crops produced in Senegal in 1990-95. They account for approximately 84% of total area planted, with the food staples accounting for 46% and oil peanuts 38 percent. Area devoted to sorghum/millet during the last 6 years is less than that for 1985-89 by about 82 thousand hectares. Both productions and yields are also lower. This can be partly attributed to the difficulty in obtaining credit from the Caisse Nationale de Credit Agricole au Sénégal (CNCAS) for the purchase of such inputs as fertilizer and seeds. The problem of credit was mentioned in most of the discussions with Senegalese officials and farmers' groups as a major constraint following the withdrawal of the Sociétés Régionales de Développement Rurals (SRDR) from providing this critical service.

Table 4 4 Average Areas and Production of Major Crops Grown in Senegal 1985-89

Crop	St Louis	Louga	Thies	Diou	Sine Salm	Casam	Tamb	Sen
Area (1000 ha)								
Mil/Sorghum	21 1	153 3	131 3	146 2	450 6	98 9	100 3	1 102
Maize	2 9	-	-	-	30 0	40 2	28 4	102
Rice	15 5	-	-	-	0 5	56 5	3 8	76
Cowp	4 4	38 8	19 1	19 6	5 2	1 6	1 4	90
Cassava	-	-	11 8	0 4	1 6	1 8	-	16
Oil Nut	1 5	71 9	82 3	81 3	358 9	111 4	65 2	772
Grdnut	-	-	-	-	14 9	2 4	0 8	16
Cotton	-	-	-	-	3 0	17 8	10 3	31
Total	45 5	264 0	244 5	247 4	864 6	330 6	210 2	2,205
Production (1000 mt)								
Mil/Sorghum	11 7	62 5	74 5	88 1	336 8	89 0	85 4	748 0
Maize	6 3	-	0 1	-	42 4	48 9	30 9	128 4
Rice	71 7	-	-	-	1 0	67 2	7 6	147 6
Cowp	1 0	18 5	8 0	9 7	2 4	0 9	0 6	41 0
Cassava	-	-	37 1	-	5 3	11 4	0 4	54 2
Oil nut	0 8	60 6	60 4	63 6	386 8	135 3	71 0	778 5
Grdnut	-	-	-	-	17 2	2 6	0 8	18 2
Cotton	-	-	-	-	2 8	20 7	10 8	34 4

Source USAID Annexes

Maize, cowpeas, and rice respectively are next in importance in area planted (Table 4 3) Area under maize production is increasing In most West Africa countries including Senegal, maize is usually grown around the homesteads where household manure is abundant and moisture not so limiting partly due to the manure that contains some moisture With the introduction of improved varieties, however, the production of maize is moved to the "farm proper" This is now the practice in the SODEFITEX region in Senegal (Personal communications) and may, therefore, partly account for the increase in area planted in maize In that SRDA, maize and sorghum are grown in rotation with cotton The cereal crops benefit from the residual fertilizer applied on the cotton crop Between 1960-89 and 1990-95, maize shows a marked upward yield trend from 907 kg/ha to 1128 kg/ha (Table 3 5) Sorghum and millet, and cowpeas and table groundnut show a slight upward trend in yield whereas cassava shows a downward trend

Cotton yield is slightly lower in the last 6 years than the previous years. Some of the farmers in the SODEFITEX region are reported selling their fertilizer to others who may apply it on the cotton crop (Personal communications)

Table 4 5 Average Yields for Major Crops Grown in Senegal

Crop	St Louis	Louga	Thies	Diou	Sine Sal *	Casam [~]	Tamba	Sen
1960/61-1989/90								
Mil/Sor	401	312	458	496	661	853	674	544
Maize	970	-	-	-	1296	1165	844	907
Rice	2769	-	-	-	1778	1185	1220	
Cowp	291	305	299	327	398	537	342	312
Cassava	-	2854	3485	2473	4652	5781	2915	3698
Grdnut	-	-	-	-	1112	925	779	792
Oil Nut	463	700	778	732	871	1046	908	836
Cotton	-	-	-	-	819	1218	971	1026
1990/91-95/96								
Mil/Sor	256	330	522	582	753	892	804	670
Maize	1843	-	465	-	1054	1116	1226	1128
Rice	4687	-	-	-	1691	1158	2045	NA
Cowp	118	294	268	440	392	457	416	323
Cassava	-	-	2582	-	3665	5444	-	2748
Grdnut	-	-	-	-	954	-	-	954
Oil Nut	377	531	490	603	902	1052	983	803
Cotton	-	-	-	-	716	1040	928	960

Source Data from USAID Statistical Annexes

* Data only available for 1985-89 cropping seasons

Average area planted in oil groundnut in 1985-89 was 772 thousand hectares whereas in 1990-95, it was 854 ha. However, production was lower during the last 6 years (682 thousand mt) compared to 778 thousand mt for 1985-89. The inability of farmers to obtain adequate and good quality seed was frequently mentioned in discussions (Seed Control and Certification division, Associations des Présidents de Conseils Ruraux du Sénégal, etc.) as one important constraint for the decreasing yields of oil groundnuts (Table 4 5). Good quality seed is basic in any "package of practices" designed to increase crops' production. Good seed gives seedlings a vigorous start by providing food and resistance to certain unfavorable soil and climatic conditions such as found in the Groundnut Basin. The inability of farmers to secure good seed is compensated often by

planting more seed and/or replanting. Replanting, however, has the added disadvantage of the seedlings having lost, through leaching, any accumulated nutrients from the dry season or applied fertilizer. Access to credit to purchase such inputs as fertilizer was also mentioned as a constraint during discussions with Senegalese.

Tables 4.6 & 4.7 show the amounts of seed available for the 1997 cropping season and fertilizer

Table 4.6 Amounts (mt) of Seed Available in UNIS for 1997 Cropping Season

Crop	Variety	Amounts	cta/kg
Groundnut	FL 11, * 28206* 55437, GH11920, 69101,7333	52,000	170
Rice	IR1529, I Kong Pao Jaya, Sahel 108 Sahel 202	1,500	250
Maize	GBD, Synthetic C	15	300
Millet	Souna 3, IBV 8001 IBV 8004	20	350
Sorghum	Ce 145	6	400
Cowpeas	IS 275, IS 50439, Nougue TN 88-63, 57-57, 66-35**	-	250

Source: UNIS * Table nuts, ** For forage production

use between 1991-96. Besides the fact that seeds are generally in short supply, those for the staple crops are much less available as compared to the cash crop groundnut (Table 4.6). Part of the explanation is that there is no guarantee on loans requests from the CNCAS for staple crops where in the case of groundnut loans are guaranteed by the European Economic Community (EEC) for the 1997 cropping season, according to discussions with the Permanent Secretary of UNIS. Fertilizer use is also on the decrease and is related to the problem of access to credit and the high interest rate of about 15%. However, the GOS is lowering the rate to 7.5%.

Total sorghum and millet production in 1985-89 was slightly higher (748,000 mt) than for 1990-1995 (685,000 mt) and this may be attributed to differences in cultivated areas and yields in favor of the former period. Crop yield data under rainfed agriculture in Senegal are difficult to assess because of extreme fluctuations caused by rainfall deficiencies (Table 4.1). In years with

high rainfall evenly distributed over the growing season Senegalese farmers tend to produce adequate food crops to feed themselves and with surpluses to sell In bad years, food reserves are greatly reduced if not depleted Decreased rainfall, combined with problems in acquiring credit to purchase such inputs as fertilizer and seeds can be contributing factors to the decreased areas and yields Food staples account for the greater part of planted area and this trend indicates the importance Senegalese farmers attach to the staple food crops

Table 4 7 Fertilizer Use in Senegal

Cropping Season	USAID Estimate of Fertilizer Use	SENCHEM Estimate of Fertilizer Use
1991	26,762	33,086
1992	30,445	41,595
1993	47,020	51,595
1994	38,600	38,600
1995	NA	30,701
1996		32,437

Sources X = USAID, 1996, Y = SENCHEM

It may be possible to increase rainfed crops production in the more favorable rainfall regions through area expansion combined with different cropping practices that will include

- Increased use of improved varieties combined with a complete "package of improved practices" for optimum results,
- Soil and water conservation practices including contour bunding,
- Increased use of animal traction -- land preparation, seeding and weeding,
- Increased use of animal manure -- compost preparation,
- Planting of multi-purpose field trees -- agroforestry-livestock-integration, particularly in the northern regions where these were removed for mechanization,
- Improved forage production and better feeding of draft animals, and
- Improved management of fallow lands

The technologies for most of these activities are already while some practices are already adopted by some farmers to an extent as shown by results in demonstration plots (about 0.5ha) by the USAID SZWMP in Ziguichonzor and Kolder regions for rainfed rice (Table 4 8) The main inputs in these demonstration plots were the recommended rates of fertilizer and seed The 3-year average yield of the upland improved variety IRAT 10 is 2202 kg/ha as compared to 1158 kg/ha 1990-1995 for the Casamance (Table 4 5)

Table 4 8 Rainfed Rice Yields (kg/ha) in Southern Zone Water Management Project

Variety	1992	1993UB	1993B	1994UB	1994B
IRAT 10	2727	995	2633	2454	NA
DJ 12519	3125	789	3242	2908	3495
I Kong Pao	2909	537	2841		
DJ 684D	2250*	472	3211		
ROK 5	2297*	1751	3211	NA	3041

Source Louis Berger Int'l 1996 NA = Cult Practice not done

The Casamance yields comprise both upland and lowland rice (Table 4 5) Lowland rice yields higher than upland The latter has poorer soils and more prone to climatic uncertainties The same IRAT 10 variety and its series (IRAT 109, etc) can produce higher yields when grown in shallow flooded freshwater regimes such as those in which the DJ 12519 (Table 4 8) and its series in WARDA coordinated trials in the region, including Djibelor in Senegal

Using the 2202 kg/ha IRAT 10 yields alone, the production would have been 103 000 mt Assuming a 20% adjustment in the above yield (2202 less 20% = 1762 kg/ha) the production will still be 83,000 mt of paddy rice The adjustment is made since farmers' yields tend to be higher under supervision than when working on their own Annex 4 1 shows rainfed areas that can benefit from soil and water conservation This clearly suggests that improvements in rainfed crops' production can be made using an aggressive technology transfer/dissemination of improved production methods to small-scale farmers, utilizing the national extension system network

The Senegalese extension service is, however, fragmented, constrained by lack of transport and its agents in need of training in different aspects of extension, including proper use of fertilizers Also, availability of seeds and credit are constraints to the adoption of the above package of practices (Louis Berger Int'l 1996) Access to credit (plus high interest rate -- 15%) to purchase fertilizer is more limiting than for purchasing seed Seed is cheaper than fertilizer (Table 3 6) The price of fertilizer almost doubled after the devaluation of the currency (Louis Berger Int'l 1996) A good number of farmers can purchase seed if available Also, in the case of rice, farmers can maintain the seed for up to about 3-4 years since rice is self-pollinated and seed does not deteriorate as fast as maize, for example

The USAID SZWMP has also undertaken a number of activities on which to build possible future programs They include

- Reclamation of 22 valleys covering 10,200 ha in 1995 combined with training and production of a General Water Control Structure Operations Manual and Maintenance for each valley,
- Setting-up 88 contour demonstration plots for rice production in collaboration with ISRA, NGOs and farmers' organizations (Organisations Paysannes),

- Preparation of 560 compost pits and
- Constituting 176 water management committees in 183 villages of which 4 have achieved a (Groupement d'Interet Economique) GIE status

4 2 IRRIGATED AGRICULTURE

4 2 1 Description of Farming System

4 2 1 1 Rice Crop

Irrigated or commercial rice production in Senegal has largely been concentrated in the Senegal River Valley. It was started by the GOS to boost rice production because of the large deficits in local cereals' production brought about mainly by recurring droughts and increased population growth. The Societe' Nationale d'Aménagement et d'Exploitation des Terres du Delta du Fleuve Senegal et des Vallees du Fleuve Senegal et de la Faléme (SAED) was formed in 1965 to promote the organized development of the Valley. Its activities at that time included land and water management, credit provision, input supply, tractor hire services, paddy milling and marketing and technical training of farmers. SAED's current activities are covered in a later section in this report.

Three types of perimeters were developed in the Valley with their corresponding management levels as follows:

1 **Large Perimeters** -- 16,000 hectares comprising 18,000 farm families of which 11,500 ha have recently been rehabilitated by SAED utilizing state funds. Seventy eight percent are located in the Delta while only 22% are in Podor.

2 **Private Perimeters** -- Developed between 1989-93 and managed by private individuals in response to the accessibility to land and credit. They total some 36,000 ha and about 85% are located in the Delta. They were poorly developed in terms of land levelling and drainage provision, resulting in high irrigation water costs (SAED, 1996).

3 **Perimetres Irrigue Villageois (PIV)** -- Totalling 16,000 ha developed by SAED between 1970-80 in the mid-valley primarily as a more secure form of production than rainfed. They were quite heterogenous in terms of land development, soil types and management levels. Many of them were later abandoned by the farmers because of the land development problems combined with the sandy loam soils which have poor water retention. These perimeters were essentially managed by the farmers themselves and management was good (SAED, 1996).

Despite the large investments in irrigated rice production in the valley over the years, yields remained low (averaging less than 3 t/ha up to 1983/84), except for the small farmer-managed plots in the Bakel area. In addition to the low yields in the large centrally managed perimeters'

(PIV) cropping intensities were less than 2, averaging about 1.2 (SAED, 1996). The problems are both technical and management that include the following:

- The numbers rather than the quality of perimeters developed per annum was more of the overriding factor for SAED, perhaps because of pressure from the state. This resulted in large, poorly developed, and unevenly levelled plots that resulted in inadequate water control in the large centrally-managed perimeters,
- Many of the private perimeters were also poorly developed,
- The direct seeding method adopted by farmers, rather than transplanting, combined with frequent irrigation pump breakdowns, resulted in dry, weed infested plots whose yields can be reduced by as much as 80% depending on the physiological stage of the crop among other factors,
- Irrigated rice production is a relatively new technology in Senegal (like elsewhere in the region, unlike in Asia) for which neither the majority of SAED extension agents nor the farmers possess the know-how and strict discipline required by irrigated rice culture,
- Several donors intervened in the Valley without adequate coordination of activities nor sustained long-term program that are essential in agriculture, and
- The different rice varieties grown are often all mixed after harvest, grain moisture content and humidity often not at optimum levels prior to milling, resulting in less rice recovered and more broken grains, **this milled rice in turn is sold only as one grade**

4.2.1.2 Other Irrigated Crops

In addition to rice, maize and sorghum are also grown in the irrigated perimeters. Tomatoes, onions, potatoes, cabbage and other vegetables are also grown. And in collaboration with SAED, SODEFITEX is exploring, through demonstration plots, the possibilities of growing cotton under irrigation in the Valley.

4.2.1.3 Vegetable Gardens and Horticultural Crops

Vegetable gardens and horticultural crops production are quite common and important in the Niayes (Dakar, Thies and Louga) and in large towns and certain villages close to large centers like Ziguinchor and Tambacounda. There are essentially three different types of gardens:

- Those located around homesteads and watered from wells,
- Small gardens in lowlying areas (bas-fonds), and
- Those that are situated along the banks of rivers

Joint research efforts by the L'Institut Sénégalais Recherche Agronomique (ISRA) and the Centre de l'Horticulture (CDH) have already identified periods (possible, low and high) by product and region when vegetable production is possible if water was not limiting. The main vegetable periods are between February and June, with some production starting in early January to July/August.

4 2 2 Trends in Production and Considerations

4 2 2 1 Rice and Other Cereals

Rice is the main crop grown in the irrigated perimeters in the Valley and average yields have gradually increased from less than 3 t/ha in 1960 when irrigation was initiated to currently about 4.7 t/ha, and is slightly higher than the 4.6 t/ha for 1985-89 (Table 4.9). This may be due to improved cultural practices.

Table 4.9 Average Areas (000ha), Production (000mt) and Yields

Crop	Area	Prod	Yield	Area	Prod	Yield
	1985-89			1990-95		
Rice	15.5	71.7	4622	22.7	106.2	4687
Maize	2.9	6.3	2158	0.8	1.5	1843
Sor/Mil	21.1	11.7	555	25.3	6.8	256

Source: Extracted from Tables 3.3 & 3.5

Rice and sorghum/millet areas increased from 15.5 to 22.7 and 21.1 to 25.3 thousand hectares. The increase in cultivated areas may be attributed to the development of private irrigated perimeters between 1989-93 in response to the accessibility to land and credit (Table 3.10). Sorghum yields showed a downward trend and is probably because farmers do not generally apply fertilizer on this crop, particularly under irrigated regimes where it is grown more as an insurance against rainfed climatic uncertainties. The decrease in cultivated areas starting in 1994/95 is mainly attributed to farmers' dismay with the CNCAS credit program for inputs (SAED, 1996), that is, its high interest rate and no provision for medium to long-term basis. This might also explain the decreased maize areas and yields (Table 4.9). The credit program is more fully discussed elsewhere in this report.

Table 4.10 Annual Cultivated Areas (Ha) in the Senegal River Valley, 1990-96

Podor						
Period	90/91	91/92	92/93	93/94	94/95	95/96
Rainy	5530	6337	5851	5680	6275	5896
Cold	2803	2538	2549	2429	1821	2307
Hot	1827	1501	2524	3151	557	576
Total	10160	10376	10924	11260	8653	8779
Rice (%)	71	71	70	72	65	61

Valley Left Side						
Rainy	26472	28211	27044	30444	26172	23052
Cold	5835	5687	4890	4923	3428	1389
Hot	7117	7238	7329	6297	4750	3184
Total	39424	41136	39263	41664	34350	30625
Rice (%)	83	82	83	83	82	76

Source SAED

But credit seems to be an impediment to increased crop production, in addition to the not so-obvious inability of extension agents to identify technical problems and communicate them to farmers or supervisors as the case may be. Private irrigation owners, like the majority of Senegalese farmers, are subsistence, have limited resources and would find it difficult to obtain investment loans (equipment for animal traction -- AT--, to replace old or buy new equipment, etc) from the CNCAS on their own as compared to well-organized farmers' groups such as in SODIFETEX where the agency also buys the cotton crop and recovers the credit loan. This point was also raised in discussions with officials at the Société de Commercialisation des Industries Chimique du Sénégal (SENCHEM) and the Societe Industriel Sahelienne de Mecaniques de Matériels Agricoles de Representations (SISMAR).

The general decrease trend in areas under rice production may be largely due to farmers' inability to sell their milled rice because of competition by the imported 100% broken grains (SAED, 1996). Farmers may, therefore, need to grade their rice after milling into whole, 50% and 100% broken. That will help them to increase their profit margins since the different grades will be sold at different prices. The whole grains can even be targeted at the supermarkets in the urban centers or neighboring states. Almost all of Senegal's southern neighboring countries, including The Gambia, prefer whole grain rice and import large quantities of it (Personal experience).

In addition to rice, maize and sorghum are also grown in the Societe de Développement Agricole et Industriel (SODAGRI) zone but rice yields are quite low, 2 t/ha since the crop is produced as a supplementary irrigated crop due to poor land development initially. With a credit from the West African Development Bank to be channelled through farmers Economic Interest Groups (GIEs), the 4,000 ha at SODAGRI will be rehabilitated for the production of two irrigated crops of rice per year. Because of its location in the higher rainfall area (Table 4.1) irrigation pumping costs at SODAGRI will be less than in the Valley since irrigation will only be done on as needed basis.

Table 4.11 shows differences in irrigation perimeters, levels of management, potentials and constraints to obtaining optimum yields in the various perimeters in the Valley. These differences

can be capitalized on first by conducting an in-depth assessment on how certain farmers are able to obtain yields exceeding 6 t/ha per crop (SAED, 1996) and others do not

Table 4 11 Rice Yields (t/ha) by Types of Perimeters in Senegal River Valley

Type perimeter	Sample size, ha	Areas with crop loss problems (%)	Harvested areas ave yields t/ha
Ancient, not rehabilitated	188	44	3 0
Extended large plots	160	13	3 5
Private perimeters	351	12	3 7
Unrehab perimeters	298	18	3 7
Rehab & transferred	278	1	5 0

Source SAED, 1996

Irrigated agriculture has the highest yield potential One major reason is because the crop is assured of moisture However, it is quite labor intensive particularly in the case of rice It requires a number of essential prerequisites that must be in place and at the right time They include

- Proper land development (engineering works),
- Proper construction of irrigation inlet (some may require cementing to reduce water loss through seepage) and drainage canals,
- Proper land preparation, levelling and puddling to provide good water control, thereby suppressing weeds **Note** The cost for irrigation water is one of the most expensive inputs for rice farmers in the Valley, gravity flow of water from the river is much cheaper than pumping,
- Adequate amount of standing water in the paddies (about 15 cm optimum for rice) This presence of water ensures the crop of moisture, the main limiting factor under rainfed agriculture,
- Irrigation technology is relatively new in West Africa, including Senegal, and requires **well trained extensionists and self-disciplined farmers**, there are some in the Valley as demonstrated by the yields of 6 t/ha (SAED, 1996), and
- Reliable input/output marketing arrangements

The Green Revolution in Asia was based mainly on the development of the irrigated rice varieties IR8 and IR36 by the International Rice Research Institute (IRRI) in the Philippines Currently, approximately 3/5 of total areas grown in rice in the U S are cropped in varieties with IRRI ancestry according to a recent study by the International Food Policy Research Institute (IFPRI) in Washington, D C In West Africa likewise, including Senegal, the majority of rice varieties grown in irrigated perimeters are IRRI ancestry and give comparable yields to those in the Philippines, in WARDA trials at Richard-Toll, Senegal This points to the fact that in principal/technically irrigation can work in the Valley as it does elsewhere in the world For one thing, once the paddy soil is flooded as is the case for irrigated rice production, both its chemical

and structural properties are altered. The pH, for example, approaches neutrality (6-6.5). Also certain plant nutrients (Mn, P etc.) and silicon that are otherwise temporarily "tied-up" or "fixed" under upland aerated soils become available when soils are flooded.

Donors/SAED have probably not made enough efforts in testing a "package of practices/technology" (including affordable small types of machinery for individual/small groups of farmers) such as was done by IRRI in Asia using pilot farmers. Crop diversification (rice, horticultural crops, etc.) and double cropping are necessary in optimizing the productivity of irrigated agriculture. Developing an agricultural technology takes time. It requires testing and refining and with participation of agronomists, economists etc. Once the technology is demonstrated to work and cost-effective, it will then be replicated Valley-wise.

4.2.2.2 Horticultural and Fruits

Annual horticultural and fruits production for 1986-96 in Senegal is shown in Table 4.12. Both horticultural and fruit production show an upward trend, from 136-175 thousand mt respectively in 1990-96. In 1989, total vegetables and fruit production were 121 and 114 thousand mt.

Table 4.12 Horticultural and Fruit Production (000mt) in Senegal, 1986-96

1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
Horticultural										
150	120	125	121	136	142	152	154	148	155	175
Fruits										
95	95	90	114	108	101	103	107	112	118	120

Source: CDH

respectively. In Table 4.13 are the types of fruits produced in 1996. Mangoes are the most fruits produced, with more of ordinary (46 thousand mt) than grafted (27 thousand mt) ones. Next are citrus and bananas. Within the regions, Ziguinchor leads in mango (19 thousand mt) and all types of fruits combined (46 thousand mt) in 1996, followed by Thiès (40 thousand mt) and Kolda (19 thousand mt). The production of more ordinary mangoes than grafted ones suggests the need for CDH/ISRA and extensionists to assist Senegalese fruit producers in procuring more improved fruit trees which are generally higher yielding and the fruits more expensive and attractive to consumers in the urban centers.

Table 4.13 Average Fruits Production (000 mt) by Region in Senegal, 1996

Crop	Dakar	Thiès	Fatick	Ziguinchor	Kolda	Tambacounda	St. Louis	Senegal

Ord Mango	1 8	14 2	1 7	19 3	9 5			46
Grafted Mango	1 6	10 0	2 2	12 7	0 7			27
Ord Citrus	-	14 1	0 7	6 8	2 9			12
Grafted Citrus	1 5	12 6	0 6	3 7	1 5			20
Banana	-	-	-	0 7	4 0	3 7		8
Others	0 3	1 8	0 3	2 4	0 8		0 1	6
Total	5 2	40 1	5 6	45 7	19 5	3 7	0 1	120

Source CDH

Horticultural crops production and yields are shown in Table 4 14, and the main ones being onions, tomatoes and water melons. Production for 1995 season is generally higher than for 1988/89. Dakar and Thies regions are the highest producers. The yields can substantially be improved through a combination of a good extension service and cultural practices.

Table 4 14 Average Production and Yields of Horticultural Crops in Senegal, 1995

Crop	Dak	Louga	Thie	Diou	Sine Salm	Cas	Tamb	St Louis	Sen
Production (000mt)									
Tomato	16 3	0 7	10 7	0 2	1 6	1 4	0 1	0 3	31
G Bean	3 6	-	1 4	-	-	-	-	-	5
Okra	5 4	-	1 3	-	-	0 3	-	-	7
I Pot	1 8	0 8	9 0	-	-	0 1	-	0 2	13
Pep	0 5	-	8	-	0 3	0 6	-	-	2
Eg Plt	1 3	-	2 9	-	0 1	0 1	-	-	4
Onion	10 3	21 3	10 6	-	0 6	1 6	0 1	19 2	64
W Mel	6 9	0 6	-	0 2	8 9	1 0	-	2 0	20
Cabag	5 9	0 4	3 8	0 2	0 4	0 6	0 6	2 0	13
B Tom	0 7	-	1 5	-	-	0 7	-	-	3
Other	0 4	3 7	1 2	-	1 7	0 4	1 1	2 3	11
Total	53 8	28 3	44 7	0 6	13 5	6 9	1 5	25 9	175
Tot *	25	13	43	1	5	5	-	28	121
Yields (t/ha)									

Tomato	18 2	19 7	13 0	12 8	19 1	18 8	12 0	18 7	16
G Bean	7 1	-	7 0	-	-	-	-	-	7
Okra	20 0	-	13 9	-	-	9 1	-	-	18
I Pot	11 9	15 0	17 0	-	-	14 2	-	20 0	16
Pep	8 0	7 0	7 0	-	7 7	21 6	10 0	-	9
Eg Plt	14 9	17 0	15 0	-	10 0	13 0	-	-	14
Onion	15 5	19 9	20 0	13 3	16 5	17 9	22 0	23 0	20
W Mel	20 0	20 0	-	12 1	23 6	18 6	-	15 0	20
Cabag	15 0	19 5	5 8	15 4	18 6	17 8	21 0	15 0	10
B Tom	12 9	9 0	7 0	-	-	12 7	-	-	9
Other	5 6	17 3	7 2	-	8 4	2 6	13 4	13 0	10

Source CDH * 1988/89 totals

Production arrangements for vegetables varies depending to a large extent on their destination. Those for export (green beans) are more well organized as compared to those destined for the local market which are exclusively grown by women.

Avocados, plantains, and papayas are all among the fruits whose production can be expanded by way of the CDH/ISRA providing technical assistance to producers.

The Valley has a great potential for the production of a wide range of horticultural crops because of ideal temperatures during the cool season (November-March). Vegetables are a high value crop, and do not require standing water or large areas. They can provide both food and cash for farmers.

Climatic conditions in West African countries south of Senegal and along the coast do not favor the production of vegetables. They, therefore, import most of the vegetables they consume. The possibilities of exporting vegetables to these neighboring countries, should be explored, more so in the interest of regional cooperation and the less quality requirements of these countries as compared to the western markets. Crops such as dried peppers, green beans and bissap can be targeted at the latter market. Bissap has an export potential, particularly with the interest in organically grown foods/drinks in the U S.

Bananas and plantains can be grown around the irrigated perimeters. They produce all-year-round and will also serve as wind breaks, thereby reducing soil erosion and water loss through evapotranspiration. Moreover, some of the dead leaves can be incorporated in the irrigated plots to improve soil structure and fertility. Birds, often major pests in the Valley, do not nest in banana plantations. Crop diversification maximizes the productivity of the irrigated perimeters in which large investments have already been made.

Increased vegetables production in the Niayes through irrigation from wells may require more studies by the ISRA/CDH Farming Systems Research team in terms of environmental impact, etc

4 3 AGRICULTURAL RESEARCH

4 3 1 Institut Sénégalais Recherche Agronomique

ISRA was established in 1974 as a public research institution responsible for all agricultural research in Senegal. Its mandate covers crops, livestock, forestry and fisheries. ISRA's primary function is to conduct adaptive research on production, resource management and on-farm post-harvest problems (USAID, 1991). Food processing technology research is done by the Institut de Technologie Alimentaire (ITA) of ISRA. ISRA also carries out some applied research and produces and supplies breeder seed, vaccines, improved stock as well as technical bulletins and publications of its research findings.

It has a total 120 national researchers in all the sub-sectors above and 30 expatriates and depends largely on external funding for the implementation of its programs. Research itself is implemented in strategic national commodity research centers with each having a multidisciplinary team of scientists. ISRA also collaborates with a number of regional and international research centers of which the main ones are

- 1 West Africa Rice Development Association (WARDA),
- 2 Semi-Arid Food Grains Research and Development (SAFGRAD)
- 3 Comité Inter-état de Lutte Contre la Sécheresse au Sahel (CILSS),
- 4 International Institute of Tropical Agriculture, and
- 5 International Research Center for the Semi-Arid Tropics (ICRISAT)

Such collaboration provides ISRA direct access to current state-of-the-art knowledge on how to structure breeding programs, in particular, in addition to providing it with materials for testing. This has allowed ISRA to make rapid gains in terms of varietal development as shown by the various improved varieties in Table 4.6

Even though ISRA has developed or identified a number of improved varieties, along with viable complementary agricultural technologies that are suitable for adoption by Senegalese farmers, there have been concerns by donors with regards to

- ISRA's financial management of resources,
- Relevance of some of its research programs to farmers,
- Collaboration with extension agencies and farmers, and
- Need to transfer results of its relevant findings to farmers

It is in light of the above that the USAID financed Natural Resource-Based Agricultural Research (NRBAR) project was conceptualized and awarded to the Consortium for International

Development (CID) for the period 1991-98. The NRBAR addresses Senegal's need for low-cost natural resources-based (RRBA) agricultural technologies so as to improve the productivity of agricultural systems, and the need for ISRA to have a viable institutional capacity to carry out NRBA research (ISRA, 1995). The crop focus is cereals-based cropping system in those areas of more than 400 mm of rainfall. The management (financial in particular) of the project is done by CID. ISRA prepares programs and submit to CID for financing, if approved. Among the main accomplishments of the NRBAR are the following:

- Reinforcing the capacity of ISRA/ITA to evaluate programs jointly with extension agencies (PNVA), PVOs and farmers (Conseil National de Concertation et de Cooperation des Ruraux - CNCR),
- On-farm research on compost preparation and use, agroforestry and livestock,
- High-level training (Ph D) for researchers in agricultural economics and engineering, forestry management, livestock sciences and water and soil sciences,
- Training 10 Senegalese at M S level in soil and aquatic sciences, veterinary, agronomy and meteorology, and
- Development of a data base to manage manpower resources at ISRA

Also, a Comité Regionale de Prospection et de Planification Stratégique, comprising members from research, extension and farmers is completing a strategic plan (1997-2003) based on an in-depth analysis of the countries' production constraints. The plan will be submitted to the GOS for consideration and financing.

Another project at ISRA, financed by the World Bank is the Agricultural Research II and is also working on prioritization of projects, strengthening of research-extension linkage, research planing, financial management and testing of various technologies developed by ISRA in Phase I of the project, at farm-level. ISRA's current organization is shown in Annex 4.2

ISRA is, therefore, working more closely with the extension agencies and farmers more than ever before. However, there are still a number of constraints that limit ISRA's effectiveness (Personal communications) and they include:

- 1 Piece-meal remission of World Bank funds to ISRA, making project implementation difficult,
- 2 ISRA's heavy dependence on outside funding, leads to unsustainable programs,
- 3 ISRA's heavy civil-service administration which provides no mechanism for attracting, rewarding or maintaining productive personnel (this matter is under consideration), and
- 4 The need for ISRA, the Universities and training schools in the country to work harmoniously in solving Senegalese problems as a whole

4.3.2 Centre Développement de l'Horticulture

The CDH is under the Ministry of Agriculture and was created for the purpose of developing the production of fruits, vegetables and flowers in Senegal. The Horticulture Directorate coordinates

these activities and works with the various growers ISRA, the DA and the PNVA in defining programs, and providing technical and extension assistance to the growers. A variety of training programs are conducted for both the extensionists and the farmers/horticultural and fruit growers with joint participation of ISRA/DA/CDH. For instance a training seminar, sponsored by private growers, was recently organized on dealing with the problem of nematodes. These private growers have also sponsored similar training programs which they themselves identify as problem areas. They also frequently provide fuel for extensionists for field visits when there are cases of disease and insect outbreak. In some instances, the growers even finance all the cost of services provided for them by the extensionists. And there are already a number of different groups involved in horticultural crops production and marketing. However, they will be discussed under the section on private farmers' groups. Both the CDH and ISRA hold weekly meetings with the growers to discuss and try to resolve problems.

A master plan covering the period 1995-2015, was prepared with joint participation of the institutions mentioned above for future programs for that period. Also, Taiwan has provided a one year credit program for horticultural production.

Constraints Accessibility of credit from CNCA, the need for more training of growers in the use of pesticides and ability to recognize diseases, storage facilities for produce, quality control, increased water depth of irrigation wells especially in Louga and Thies, and mobility problems for extensionists for field trips. Some growers also depend on Dakar drinking water for irrigating their crops.

4 4 AGRICULTURAL EXTENSION

Introduction

In Senegal like in many other countries, at the center of the agricultural technology and information transfer to the farmers, and is in two broad categories: pure agricultural information (cultural and production techniques, farm management, marketing and processing information, and community development) and agricultural inventions or technologies (inputs to farm production, agricultural implements, marketing and processing equipment) (World Bank, 1994). The agricultural extension service in Senegal is both fragmented and compartmentalized, thereby leaving a large number of farmers with little or no extension assistance what-so-ever. There are several suppliers of agricultural services, including the Directorate of Agriculture, Rural Development Agencies, the National Agricultural Extension Program and non-governmental organizations. They are discussed below.

4 4 1 Directeur de L'Agriculture

The DA, under the Ministry of Agriculture (MA), is more-or-less the main national agricultural extension service in Senegal, and is headed by a Director with the following five divisions:

- Actions and Programming,

- Seed Control and Certification
- Agricultural Statistics,
- Soils and
- Administration and Finance

The Actions and Programming is the main division that is in charge of extension, and has the following sections project monitoring and evaluation, training, and equipment and infrastructure. It is this division that works closely with the Work Bank financed National Agricultural Extension Program (PNVA), provides early warning indications for possible food deficits based on crop assessments. Training is conducted by the training division for both extensionists and farmers while the Projects' Monitoring Division follows-up on the execution of extension related projects. Each division has only one vehicle and were purchased by the GOS except for one bought by the PNVA. The Seed Control and Certification division is responsible for the control and certification of all seeds in the country, including those for vegetables. While the Agricultural Statistics is in charge of collecting agricultural production statistics. The Soil division classifies soils according to types and usefulness.

The field structure of the extension service is shown in Table 4.15. The five administrative divisions set-up at head office are also found at the Regional level. The PNVA helped to alleviate the mobility problem of the Regional Agricultural Inspectors by providing them with 4-wheel drive vehicles plus personal and fuel allowance.

Administratively, the DA is supposed to prepare the annual reports of the Rural Development Agencies (RDAs). Due to their higher recognition, however, the latter communicate this information directly to the MA (Cabinet) and only send copies of their annual program and report to the DA.

Table 4.15 Field Extension Service Set-up in the Directorate of Agriculture, Senegal

	Region	Department	Arroind
Title	Regional Agric Inspector	Agric Sector	Agric Technical Agent
Qualification	MS	BS	Agric Certificate
Number	10	30	90
Transport Means	4-wheel Vehicle	Motocy/vehicle	Motorcycle

Source: Directorate of Agriculture

The DA's relationship with the Senegalese Institute for Agricultural Research (ISRA) is said to have improved since the commencement of the PNVA in 1990 (Personal communications). Since then, both services jointly participate in the annual planning of programs. Regional Committees

with representatives from ISRA, DA, RDAs Forestry, Livestock and farmers meet about twice per annum in a designated region to evaluate the previous season's program and plan the incoming season's one

The DA is constrained by a number of factors that have limited its effectiveness in delivering agricultural information to the farmers They include

- Limited transportation at all levels, making field visits difficult This includes the Technical Specialists who are in the regions and serve as research-extension linkage but only have motorcycles,
- DA depends essentially on the good-will of the PNVA for financing, etc , and
- The Seed Control and Certification division is limited in manpower, infrastructure and mobility to fulfil its vital function of ascertaining that farmers receive good quality seeds for both field and horticultural crops

4 4 2 Regional Development Agencies

These parastatal agencies were created to cater for specific regions and crops but with a wide range of activities that included land development, provision of credit, input supply, tractor hire services, marketing and technical training of farmers However, many of those functions have been passed on to the private sector in-line with the structural adjustment of the GOS

4 4 2 1 SAED

SAED was created in 1965 as a public enterprise to promote the organized development of the Valley Its activities at the time included land and water management, provision of credit, input supply, tractor hire services, paddy milling, and marketing and technical training of farmers Since 1981, the role of SAED and commitment of the GOS to SAED have been defined in three year contracts by Mission Letters (Lettre de Mission) The GOS provides financing, mainly from external sources, to SAED to enable it to perform its functions, mainly planning and coordination of the integrated rural development activities in the Valley, in consultation with the beneficiaries This includes

- Monitoring of production -- provides advice and training sessions for farmers, including water management, and
- Collection of agricultural statistics and carrying out surveys

SAED also assists farmers in the formation and strengthening of farmers' groups for the purpose of carrying out agriculture related activities such as credit and input/output marketing The ultimate objective here is for attain a level that will enable selected members to perform extension activities within their groups

The stream-lining of SAED was completed in 1994, resulting in a personnel reduction to 307 Seventy percent are technicians in the following fields agronomy, zootechnic, food nutrition, engineering and topography, economics and sociology,documentation and training

SAED is headed by a Director and then a deputy Director in charge of technical coordination and operational activities. Next are three directions as follows:

- Administration and Finance
- Land Development and Water Management, and
- Planning and Rural Development

At field level operations are 4 departments (delegations) -- Dagana (Delta), Podor, Matam and Bakel, each headed by an Ingenier Delegeue. The actual implementation of extension services at farmers' level is done by Extension Agents who only advise farmers and farmers' groups involved in irrigated agriculture. SAED extension lacks extension specialists that link research and extension and that can deliver appropriate "packages of practices" that make irrigated agriculture along the Valley economically viable (USAID, 1991). Although SAED collaborates with other RDAs, the relationship is probably closest with WARDA, the regional organization that is the main source of improved irrigated rice varieties in West Africa.

The withdrawal of SAED from the provision of credit has constrained increased irrigated crops production and the full consequences will take time to stabilize.

4 4 2 2 Societe Développement des Fibres Textiles

SODEFITEX was created in 1974 and charged with the production and marketing of cotton in the southern part of Tambacounda, all of Kolda and part of Kaolack. This RDA has about 200 extensionists and 100,000 farm families comprising 300 production associations that are relatively well organized. SODEFITEX enjoys French technical assistance, operates fairly efficiently, and appears to implement an integrated approach to production by combining cotton, cereals, livestock and vegetables production. The latter are grown mainly done by women.

SODEFITEX extension agents (EAs) disseminate "technical packages" and train farmers' producer groups, mainly in agricultural and rural literacy. Some EAs receive training from the Ecole des Agents Techniques d'Agriculture located in Ziguinchor, in addition to in-service training from highly trained section chiefs who upgrade their level of competence.

SODEFITEX plans to substantially increase cotton production through the institution of an intensive cultivation that will combine timely planting through the use of AT, use of organic manure and inorganic fertilizers and adequate planting density. The possibility of producing cotton under irrigation in the Valley is being explored through demonstration plots in collaboration with SAED. Through these combined strategies, productions will be raised from slightly over 46,000 tons in 1997 to 60,000 in 1998 and up-to 100,000 by the year 2000.

Breeder seed for cotton is produced by ISRA with some financing from the Caisse Francais pour le Developpement. In general, the structural adjustment programs have had less effects on SODEFITEX as compared to the other RDAs.

4 4 2 3 Societe de Developpement Agricole et Industriel du Senegal

SODAGRI is also a mixed rural development agency created for the development and management of the Anambe basin in Kolda for irrigated rice production. The objective is to develop 5,000 ha in total. During the phase I period (1982-92) 1355 ha were developed. 2500 ha in phase II, following the consolidation of the Niandoula barrage. Four pumping stations and one rice mill were also installed. Like SAED, SODAGRI's activities were reduced to only land development, extension and training of farmers following the structural adjustment program.

ISRA and SODAGRI have recently signed a research-development protocol of understanding for activities on water management and agroforestry.

Constraints The same problem of accessibility to credit for inputs (seeds, agricultural implements, etc.) experienced by other farmers is also impeding increased crop production in the SODAGRI zone.

4 4 2 4 Societe de Developpement et de Vulgarisation Agricole

SODEVA was created in 1968 for improving agricultural production in the Groundnut Basin. However, it currently has no operating budget and activities are at a standstill.

4 4 2 5 SOMIVAC

SOMIVAC was closed in 1992.

4 4 3 Other Extension Organizations

4 4 3 1 Private Voluntary Organizations

There are approximately 181 registered PVOs or NGOs with the Ministry of Social Development and comprise of foreign and local origin with many of the former serving to strengthen the capacity of the latter to function (Wilcock, 1997). The Federation of Senegalese ONGs (FONGS) is the largest of the local ONGs. The foreign PVOs in turn are categorized into American and European. A certain number of these PVOs pursue agricultural development activities. However, the Ministry of Agriculture (MOA) has neither the capacity nor the means to define/coordinate these organizations' programs. This problem sometimes leads to certain NGOs independently setting-up and operating unsustainable programs such as giving out free inputs without consulting the national extension service. This gives the recipients a dependence on hand-outs, making it difficult later to change their mentality (Personal communications). Some may even recruit their own extension agents. However, many of these PVOs are generally quite experienced and skilful in working with and developing community-based type of activities with farmers/villages at low-cost. Some representative PVOs and a brief description of their activities follows.

Africare Africare is a U S based private non-profit organization that seeks to improve the quality of life in Africa, mainly in the areas of agriculture, water resource development environmental management, health and emergency humanitarian aid (Africare 1995)

The USAID financed Kaolack Agricultural Enterprise Development Program (1992-97) is an \$8 million five year activity for food production and revenue generation for rural groups in the Kaolack region of Senegal (Africare 1997) The project incorporates elements of sustainable natural resource management through the setting-up of 4 hectare demonstration plots surrounded by salanes (*Euphoria bassulmifera*) as fencing windbreaks The project also does water management and soil erosion control activities, and accomplishments to-date include

- Planting of 53 live hedges 180 windbreaks, 260 field trees,
- Construction of 18 anti-erosion dikes, 74 compost pits, 22 for nursery and 122 improved housing, and
- Complete organization of 15 out of 56 anticipated microenterprise groups (80% women) and the food produced is used to satisfy family consumption needs

Environment and Development Action ENDA is an international NGO that was founded in 1972 in Stockholm at the first World Conference on environment The Senegal branch has now acquired a local independent status with its head office is located in Dakar Major activities are in the areas of health, energy, education and agriculture The Système Prospective (SYSPRO) is the research department of ENDA and is headed by an agronomist graduate from the University of Minnesota ENDA targets mostly young people as its farmers because of the large number of unemployed youth in Senegal and the fact that most of them can read That makes it easier for them to adopt new innovations such as intensive cultivation, alley cropping, crop diversification, etc Approximately 80% of the vegetables exported from Senegal are produced from ENDA supervised farms (Personnel communications) The NGO has also published two books, one on health, population and development in Africa and another on AIDS ENDA received some publicity during the visit of the World Bank President and Director General of FAO in Senegal

Constraints Inadequate financing, credit acquisition, and difficulty in locating new markets for horticultural produce

4 4 3 2 Programme National Vulgarisation Agricole

The PNVA is a World Bank financed project that commenced in 1990 with two broad objectives as follows

- 1 Instituting the Training & Visit (T&V) method of approach to extension in Senegal, and
- 2 Coordinating and strengthening the field operations and implementation of extension programs by the various RDAs including the DA, Livestock, Forestry, ISRA, etc

The T&V approach to extension implementation was developed in India and is based on the use of contact farmers within a group of farmers by the extension agent (EA). The EA is assigned a given number of groups of farmers (10-20 farmers per group). Each group has a contact farmer that the EA works with regularly. This farmer in turn passes on the information he receives to the rest of the group. The EAs receive training on selected agricultural themes (line sowing, planting density, fertilizer application, etc.) every 15 days from Subject Matter Specialists (SMS). The EAs in turn carry out demonstrations to the farmers' groups. The rationale is that EAs cannot reach all farmers at the same time. Therefore, it is easier to work with groups. This method has not been so successful in Africa as in India. African countries where it has been introduced by the World Bank have, therefore, tried to modify it to suit their needs.

The PNVA has a total of 53 people, is headed by a director and has four divisions: Research-Development -- headed by a Veterinarian from ISRA; Extension, Training and Monitoring and Evaluation.

In implementing its program, the PNVA and the various institutions signed a memorandum of understanding whereby the former basically provided the latter the means to implement agricultural extension field programs (financial & logistics), a major constraint in the implementation of extension programs in Senegal. The PNVA has a national coordinator plus 4 technicians, representing the 4 PNVA divisions in each of the cooperating institutions. At the field level are Regional Coordinators (10, one/region), Technical Specialists, Supervisors (Chief Sectors) and Village Extension Agents (450 in total). All receive a monthly allowance and coordinators are provided a vehicle while the rest only have motorcycles. There are also Centre d'Expansion Rurals who carry out administrative and extension functions in agriculture, livestock and forestry but are placed under the Ministry of the Interior for administrative purposes. The target of the PNVA was to cover 50% of Senegalese villages but only 23% has been achieved, covering 32-33% farm families.

Major Accomplishments of PNVA Improved mobility and strengthening technical capability of RDAs extensionists, improved research-extension linkage through training of extensionists by researchers on management of multilocational trials, creation of an awareness among farmers on availability of extension information by way of farmers field days, rural training programs, use of organic manure and introduction of improved varieties of groundnut and rice.

Constraints PNVA has too many institutions to deal with and has no control over their personnel, has no field staff at regional level so that head office staff have to make frequent field visits, feedback (expense returns) from regions come too slow, causing delayed expense replenishment, extensionists involvement in too many activities -- surveys, collection of statistical data, etc., and farmers adoption of introduced technologies being impeded by lack of affordable credit.

There is, however, a proposal for the formation of a unified National Advisory Agency for Agriculture and Rural Development (ANCAR) under FAO auspices. This agency will define and plan the overall broad national objectives for all extension services in the country.

4 4 4 Farmer and Private Sector Organizations

There are a number of farmers groups and associations in both the urban and rural areas in Senegal. They are united by the different purposes determined by the group. Some of them become well structured for community development activities such as agricultural, management of groundnut seed stores and village stores, production of charcoal etc. These latter groups operate in the form of Groupement d'Interêt Economique (GIE).

4 4 4 1 Service Co-operatives

Service co-operatives are non-political associations comprising 50 or more individual farmers or members. Their main function is to help their members in the acquisition of credit for the purchase of inputs and in the production and marketing of produce.

4 4 4 2 Conseil National de Concertation et de Cooperation des Ruraux

The CNCS is a federation of about nine farmers groups/village associations whose objective is to share problems and present their positions on development issues to the GOS particularly with regards to the importance of the family unit in agricultural production. Membership fee is 1000 cfa, one third of which is ear-marked for credit acquisition. The CNCS has been active in a number of ways including, the PNVA program, elaboration of the ISRA strategic plan, negotiations with the GOS for lowering the credit interest rate from 15 to 7.5% and elaboration of project proposals for funding by international and PVO organizations. Their ultimate objective is to attain a level whereby certain members of the group will be able to perform extension services, including produce marketing for its members. They are concerned about problems such as poor quality seeds, especially the sale of groundnuts not destined as seed to farmers by SONAGRAINES, and the inability of the Seed Control and Certification division of the DA fulfil its vital role due to lack of manpower and financial resources. The CNCS is, therefore, eager to have these problems resolved (Personal communications).

4 4 4 3 President des Conseillers Ruraux

Comités Ruraux (CR) are rural communities or organizations comprising groups of villages with an elected governing body known as Conseiller Rural. Their operating budget depends largely on local tax which is used for planning, natural resource management, health, education, social services, activities of the communities. There are presently about 320 CRs in the country (Personal communications). Although the Sous Prefet is not a member of the Conseiller Rural, he has an influence on the governing body, in that he is authorized to sign their important decisions in order to make them legally binding (Personal Communications). Most of the members are not educated but yet they cannot hire an outside consultant and is an important limitation on their effectiveness to implement certain decisions.

These organizations are important for rural development activities and the members are also concerned about problems inadequate quantities of seed and of good quality, access to credit, soil

fertility, produce storage, and marketing of horticultural crops. They are interested in assistance in areas including training in agriculture, health, rural literacy, etc. so that they will be able to manage their resources more efficiently, including ultimately the provision of extension services for members.

4.4.4.4 Other Farmers' Groups

Other farmers' groups involved in agricultural development include

- Senegal Exportation Produits Agricoles et de Semence (SEPAS)
- Groupement producteurs Horticoles (GPH) -- production and export,
- Federation des Producteurs Maraichere des Niayes,
- Federation des GIE de Thies,
- Regroupement des Producteurs de l'Horticoles Ornamental (REPROH), and
- Comite Nationale Interprofessionnelles de l'Horticoles (CNIH) -- analyze problems of transport, storage and marketing of horticultural produce

4.4.5 Research-Extension Linkages

In Senegal, the relationship between agricultural research and extension was extremely weak (USAID, 1991). This situation is usually the result of the competition for funds, manpower and physical facilities and the notion for each service's performance by the other service. In an endeavor to find a remedy to this situation and bring about closer collaboration between ISRA and the various extension and related institutions, the PNVA was initiated under World Bank financing in 1990. The PNVA has to some extent helped to improve the linkage between research and extension first by providing ISRA with financing, a major constraint, and then by having an ISRA scientist as one of the heads of the four PNVA divisions -- research-development division.

Moreover, ISRA researchers and the various extension agencies jointly evaluate the performance of previous cropping season's programs and plan those of the in-coming season. Additionally, ISRA researchers train the extensionists on conducting the multilocational trials in farmers' fields. ISRA scientists at the station in Djibelor were also involved in the planning and execution of 88 contour demonstration plots in the USAID financed Southern Zone Water Management Project (SZWMP) for rice production in collaboration with NGOs and farmers' organizations (Organisations Paysannes).

However, research and extension institutions are separated physically and the heads may have little contact except during meetings. This poor contact often moves down the line between the personnel of the two services.

The existence of many RDAs in the country still makes coordination difficult, particularly with traffic congestion in the capital. Also, there are development agencies, NGOs mainly, in the country that sometimes set-up and operate unsustainable programs like giving out free inputs (not

even a package of production practices) without consulting the "national extension service" -- DA (Personal communications) But the institution of ANCAR will ultimately improve this set-back

4 4 6 Technologies and Constraints to Adoption

There are a number of viable agricultural production technologies which ISRA researchers in collaboration with regional and international research centers has developed and are suitable for adoption by Senegalese farmers They include the following

- Improved crop varieties for all major crops,
- Appropriate seed dressing and row seeding
- Use of organic manure and chemical fertilizers,
- Animal traction (AT), and
- Soil and water management practices

Many of the technologies, however, remain in the shelves of the research station The normal concept of information flow system is as follows

Research < ===== > Extension < ===== > Farmers

But this flow breaks down due to many reasons that include

- Limited financial resources by ISRA, creating mobility problems, lack of incentives, etc ,
- Fragmentation of extension services creates more problems for ISRA in terms of coordination, setting of priorities, etc ,
- Inadequate supply of inputs -- quality seeds, etc , and
- Availability of affordable credit to purchase inputs

The ideal flow of information within the system would be

- 1 The promising results of ISRA/CDH station research are confirmed in multilocational trials,
- 2 Results that are positive are passed on to the FSR/E team and extension service as a **package**,
- 3 FSR/E carries out surveys in order to identify any problems and obtain a **feedback** to the introduced technology, and
- 4 Technologies found acceptable are recommended for wider adoption while unacceptable ones are refined, and new ones identified with farmers and developed by ISRA

4 4 7 Agricultural Equipment and Other Inputs

4 4 7 1 Agricultural Equipment

The Societe Industriel Sahelienne de Mecaniques de Materièls Agricoles de Representations (SISMAR) is the prime producer and sales company for agricultural equipment in Senegal The

various equipment produced and sold both locally and to neighboring countries, mainly Cote d'Ivoire for cotton production are shown in Table 4.16. Figures for 1994 onwards are estimated. In 1982, the company became a private entity following the structural adjustment program and all sales were on a cash basis. Sales are reported to have been on the decrease since then, particularly in the case of individual farmers (Personal communications). Farmers' groups such as in the SODEFITEX zone, CNCA and those working with NGOs are able to acquire equipment on credit basis through their organization. Individual farmers may acquire small implements from local blacksmiths.

Table 4.16 Capacity and Sales (000) of Agricultural Equipment by SISMAR

Equip	Cap	1991	1992	1993	1994	1995	1996	1997
Seeder	10.0	1.0	1.5	1.5	3.0	3.2	3.5	3.5
Plow	5.0	0.1	0.1	0.1	0.2	0.2	0.5	1.0
P. Tiller	22.0	2.0	2.0	2.8	4.0	5.0	5.5	7.0
Cart	20.0	0.5	0.7	0.8	0.9	1.4	2.2	3.5
Grdnut Sheller	1.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2
Cerl Sheller	0.3	-	0.1	0.7	0.1	0.1	0.1	0.1
Mills	0.5	-	0.1	0.1	0.1	0.1	0.1	0.1

Source: SISMAR

4.4.7.2 Seed Production

Prior to the introduction of structural adjustment programs in Senegal, the Service Semencier in the MA was the primary producer of seeds in the country outside of the RDAs. This service is now essentially the responsibility of the private sector under the auspices of UNIS (Union Nationale Inter-professionnelle des Semenciers). It comprises a mixture of private individual and groups of farmers and there are 32 active such groups at present. ISRA supplies breeder/basic seed to UNIS.

Some UNIS members are both producers and distributors. Up until three years ago, the credit loan for the production, collection and processing of seeds from the CNCAS was guaranteed by Caisse Francaises pour le Developpement. However, groundnuts alone now enjoy that guarantee from the EEC. In the case of cereals, UNIS has to negotiate with the CNCAS which is a lengthy and tedious process. In addition to selling seeds of field crops, certain members of UNIS also sell vegetable seeds and fertilizer and pesticides. UNIS promotes seed to farmers by setting-up demonstration plots.

The Division des Semences (DISEM) in the DA is responsible for quality control and certification of all seeds sold in the country. However, DISEM is severely constrained by lack

of financial, infrastructural and human resources Table 4 6 shows the quantities of seed available for the 1997 cropping season These small quantities of seeds, particularly for cereals partly shows the seriousness of the seed problem Since rice is a self-pollinated crop seed does not require replacing until every 3-5 years depending on how careful the farmer is in avoiding admixtures Nevertheless, the availability of good quality seed at affordable prices at the right place and time are basic in any "package of technology" designed to increase farmers' crop productions

Constraints

- 1 Lack of technical assistance and loan guarantee from CNCAS for cereals, and
- 2 Expenses in processing cereals using the old equipment inherited from the Service Semencier/SAED and located in Richard-Tool (rice), Tambacounda & Diourbel (cereals)

4 4 7 3 Fertilizer

The GOS also disengaged from the distribution of fertilizer as part of the structural adjustment program in the country The latter program included the removal of subsidies on fertilizer

The Societe de Commercialisation des Industries Chimique du Senegal (SENCHEM) became the prime provider of chemical fertilizer distributed in the country SENCHEM is the commercial company of a tripartite merger of SENCHEM with two other companies, SEFICS and CSPT (Compagnie Sénégalais Phosphate de Taiba) to form the ICS (Industrie Chimique du Sénégal) These companies are semi-privately owned SENCHEM produces compound/complete fertilizers and engages in the marketing of fertilizer, plant protection chemicals and production and marketing of vegetable seeds

The completion of the Programme Agricole in 1980 initiated a downward trend in fertilizer use from approximately 75 thousand tons during the 1980 cropping season to a low of 25 thousand in 1982 (USAID, 1991) Subsidy on fertilizer was actually not removed until the end of 1988 but nevertheless, consumption stabilized around 25 thousand, 26 thousand in 1989 cropping season One of the main constraining factors for the low use of fertilizer is accessibility to credit from the CNCAS which replaced the RDAs The credit arrangement is compounded by increases in the prices of imported fertilizers, seeds, etc

Table 4 7 presents the amounts of fertilizer consumed in Senegal between 1991 and 1996 The Table shows the downward trend in fertilizer use The increase in fertilizer consumption in 1993 was due mainly to easy access to credit provided by the GOS to the farmers because of the political elections (Personal communications)

SENCHEM manufactures diammonium phosphate and the following grades of compound fertilizer for local consumption 20-16-20, 15-10-10, 9-23-30, 10-26-26, 18-46-0 and 14-23-14 The latter is mainly for cotton The actual amount of each fertilizer produced depends on market demand Urea is imported

Acid Phosphate is the form of fertilizer exported mainly in West Africa and to India. Most of that exported in West Africa is for cotton production. Although the company has an export capacity of 230 to 300 thousand mt, it only now exports between 120 to 170 thousand mt per annum due partly to transportation problems within the region.

3 4 7 4 Pesticides

SENCHEM also markets plant protection chemicals mainly for cotton production, and the quantities of pesticides produced are shown in Table 4 17. As is the case for fertilizer, Mali is the major client, followed by Guinea, Benin and Cameroon. Togo and The Gambia each imported 134 and 2 thousand liters respectively in 1996 for the first time.

Table 4 17 Liters of Pesticides Exported to Neighboring Countries by SENCHEM, 1991-96

1991	1992	1993	1994	1995	1996
214,000	942,455	961,2600	392,000	582,912	464,604

Source: SENCHEM

Local purchases for pesticides are not well quantified due to the small amounts involved. However, sales for 1994-96 have been on the increase. The main vegetable seeds imported are onions, watermelon, okra, cabbage, carrots and tomatoes.

Constraints Relative to Inputs and Equipment The availability of affordable credit is a problem. There are also land, sea and rail transportation problems that limit the regional export potential. For example, in the case of neighboring Mali, there is always a shortage of rail wagons. These transportation problems often make inputs from overseas company cheaper. This again shows the need for assisting the private sector by way of removing these regional obstacles to market expansion.

4 5 CONSTRAINTS, OPTIONS AND ALTERNATIVES

These are detailed in Annex 4 3.

4 6 CONCLUSIONS AND RECOMMENDATIONS

Senegalese farmers long ago evolved an agricultural "slash and burn shifting" form of farming which successfully used and conserved natural vegetation by protecting trees in newly cleared fields and forests, and soils and landscapes. They also responded to climatic variances and uncertainty by the growing a wide mixture of crops, often in association with some form of livestock raising particularly small ruminants (goats and sheep) and chickens. Senegalese farmers

may find that the overall greater productivity of crops and fruit trees nuts leaves and other benefits of the field trees greatly offset the high yields of the treeless fields

This increases farmers' food security and nutrition as well as linking agroforestry to livestock as a source of feed during the dry season. Also, during periods of celebrations like Tabaski the sale of sheep by farmers represents a valuable source of capital gain and cash income. This helps to stabilize farm income/productivity. The animals consume crop by-products while oxen and donkeys in turn provide transportation and animal traction. Incorporated animal manure in the soil adds to the soil mineral organic and mineral content as well as minimizing soil erosion which is a problem in the northern and Groundnut Basin, where trees were removed for mechanization. This shows that Senegalese traditional farming system and natural resources management, including livestock raising, are intricably linked. Successfully intensifying land use to adapt to these conditions requires an adjustment of cropping practices to reflect the realities of persistent shortfalls in seasonal precipitation since the 1960s

ISRA, in collaboration with regional and international research centers has identified/developed improved varieties, along with viable complementary agricultural techniques that are suitable for adoption by Senegalese farmers and adaptable to the prevailing conditions. The introduction of "packages of technologies" to farmers such as in the USAID Southern Zone Water Management Project rather the "piece-meal" approach to technology transfer is essential in order to optimize the benefits of generated technologies that take so much time and resources to generate

However, there are number of obstacles in the way of farmers' search to increase crop production especially in years when rainfall is evenly distributed over the growing season. The main ones relate to the inability of extension to transfer technologies to farmers due partly to its fragmentation and need to upgrade the level of competence of extension agents through training, access to affordable credit to purchase agricultural inputs and equipment, and the limited size of the Senegalese market

Also, the structural adjustment programs which led to the disengagement of GOS parastatals from the provision of such services as credit, input supply, etc and transferred to the private sector has partly resulted in

- Decreased fertilizer use by farmers,
- Decreased purchases/investment in agricultural equipment,
- Downward trends in cultivated in sorghum/millet and rice areas, and
- Downward trends in yields of oil peanuts and cotton,

The downward trend in cultivated irrigated areas may, however, partly be reversed if farmers are assisted in properly controlling grain moisture content prior to milling and the milled rice in turn is graded so as to increase farmers' profit margins, since the different grades will be targeted at different groups and sold at different prices. One hundred percent broken imported rice grains are even sold in supermarkets in Dakar in 50 kg bags. This can be done for the local rice through a more well organized local market. Equally important is the need to double crop and diversify crop production in the irrigated perimeters so as to optimize their productivity. The

Valley has a great potential for the production of a variety of horticultural crops and SAED needs to assist farmers more in that area in collaboration with private sector groups

Among the initial strategies that can be considered are the carrying out of targeted assessments on out-standing farmers' and their practices with a view to using them as pilot or model farmers for such events as well organized Farmers Field Days, etc and that involve joint GOS private sector, NGOs, researchers, farmers, etc participation. The assessment can be a joint ISRA/extension undertaking

The structural adjustment programs have likewise resulted in greater participation of the private sector groups in agriculture related activities such as in the development of private irrigated perimeters, inputs/out-put marketing, etc. Senegalese farmers will also likely increase their crop productions if the local market's organization is improved and the size expanded beyond the Senegal borders. However, border crossings, poor roads and rail systems and communication, and unavailability of a reliable shipping line along the West African coast are impediments to allowing the private sector to flourish. While western markets can be explored for targeted crops such as bissap, dry hot peppers, etc, the local and regional markets hold a greater potential in the short to medium-term because of their less quality requirements as compared to the western markets

The GOS, USAID, West African policy makers and various international donors can cooperate and develop joint partnerships in assisting the private sector to maximize the existing market potential in the region by facilitating the removal of the above obstacles. The region can be assisted in optimizing various countries' comparative advantages in the production of given crops due to climatic differences between Sahelian and coastal countries. This assistance will not only be in line with national/regional food security but more importantly with global security. Environmental problems will not be solved on empty stomachs and human misery, such is now the case in Senegal

CHAPTER 5 CURRENT CONSTRAINTS AND FUTURE OPTIONS

5.1 INTRODUCTION

Over the past decade, and especially in the past three years, the Government of Senegal has demonstrated courage by liberalizing the economy. Since 1994, the macroeconomy has improved and many of the fundamental prerequisites are in place to permit sustained economic growth. However, the task, of translating an improved macroeconomic environment into increased agricultural productivity has only just begun. Few farmers today would agree that their financial situation is better now than it was three years ago. They have seen little of the benefits of the improved economic picture. This is to be expected as services and industry are usually the first to profit from economic liberalization.

In this chapter we explore some of the factors that have contributed to the lack of success in agricultural development in Senegal over the last 20 years. Then, we identify the constraints that remain in developing the sector. Finally, we provide some thoughts on what USAID might do in the agricultural and natural resource sectors in the coming years.

5.2 PAST DONOR ATTEMPTS AT AGRICULTURAL DEVELOPMENT

There is widespread disappointment among donors with the performance of the agricultural sector in sub-Saharan Africa over the last two decades despite the enormous sums of money that have been invested. What is true for the sub-continent in general is true for Senegal in particular. The following paragraphs identify some of the contributing factors which have led to this disappointment.

The single most important reason for the poor performance of the agriculture sector is the inadequate resource base: soils are poor and deteriorating, water is scarce, and human capital at all levels in agriculture is wanting. This explains why agricultural productivity was low 20 years ago and partially explains why productivity is still low. It does not, however, explain why such little progress has been made in the last 20 years.

The next most important factor which has led to the poor performance of the agricultural sector has been the lack of a coherent long-term Government policy for the sector. This lack of direction on the part of the Government has meant that individual donors have had to develop projects in a policy vacuum. This lack of guidance, coupled with the sometimes conflicting ideologies of the different donors, has led to a public investment program in agriculture which is largely donor financed and driven as much by the internal policies of the individual donors as by the needs of Senegal.

Another factor that has limited the effectiveness of the donor support is that the donors, themselves, have not been consistent in their approach to agricultural development. There is

enormous pressure within the donor community to show success from their interventions. This leads to sound development approaches being abandoned prematurely, often without benefit of sound analysis of the shortcomings and the lessons learned in favor of a new approach.

The history of agricultural development is littered with examples of such approaches: integrated rural development, farming systems, food self sufficiency, food security, institution building, human resource development, agro-forestry, natural resource management, and private sector development to name a few. Many of these approaches have fallen out of favor largely because results were not shown quickly enough. It is rare to find donor-funded projects which have lasted long enough to reach the objectives of the project. Many projects are pre-ordained to failure because the objectives are not realistic and the projects are then discontinued because the objectives are not met. This "trendiness" in approach, coupled with unreasonably high expectations on the part of the donors, has severely hampered success in agricultural development.

A final factor that has hurt agricultural development is a simple lack of data and a misuse of that data which is available. The inherent complexity of policy analysis in Senegal requires viable and accurate statistics. However, a sustained commitment to develop this capacity has been notably lacking. Inaccurate statistics, once entered into the system, regardless of how unrealistic they might be, provide most of the raw information upon which repeated waves of analysis are performed and new programs are developed.

The history of interventions in the agricultural sector in Senegal shows many successes, but in general, has been disappointing. But that is not sufficient reason for donors to pull out of supporting the sector altogether. Constraints still exist which, if not alleviated, will result in a further decline in rural incomes, a further migration out of the country into the cities and, if the cities are unable to absorb this flow, a further decline in life in the cities.

5.3 CURRENT CONSTRAINTS TO AGRICULTURAL DEVELOPMENT

Factors that inhibit agricultural development in Senegal can be found at all levels: the natural resource base, macroeconomic policy, and production and marketing. The following paragraphs summarize some of these problems.

5.3.1 Resource Base and Natural Resource Management

Since the publication of the 1991 USAID Agricultural Sector Analysis little has changed in the physical resource base. The major physical constraint is the combination of poor soils, inadequate water availability, and a relatively large and rapidly growing population.

Soils that are suitable for agriculture are limited. It is estimated that (a) only 19% of the surface area of Senegal has soils that are deemed suitable for agriculture, and (b) some of these limited soils are suffering from degradation from overuse and erosion. The situation with water

supply is equally bad. Rainfall has been decreasing since the 1960s. While the enormous seasonal and annual variations that are typical make trends difficult to detect, this decline shows no signs of reversing. Surface water suffers from (a) strong seasonal and annual variation in flows, (b) chemical pollution from agricultural runoff, and (c) salinization from sea water invasions in the lower Casamance basins. Finally, the ground water situation suffers from (a) insufficient knowledge of aquifer capacities, (b) over exploitation of certain aquifers, (c) weak recharge capacities, and (d) excessive mineral content in some aquifers. Associated with this inadequate and deteriorating natural resource base is a population that is growing rapidly and will reach an estimated 9 million in 2000.

Two major shifts have, however, taken place in the natural resource management paradigm during this period. The first is the evolution of the concept of decentralization, making the people most closely concerned with the resource responsible for its management. The second is integration, coordinating all the functions relating to natural resource management that were previously widely scattered throughout the government through a newly established Ministry of Environment and Protection of Nature under the umbrella of the forthcoming National Environmental Action Plan (NEAP).

Other problems associated with the natural resource base and its management include

- deforestation is decreasing the availability of fuelwood,
- natural resource information is poorly organized,
- the land tenure system favors agriculture over forestry,
- lack of involvement of stakeholders,
- a "command and control" mentality from the center, and
- lack of management skills at all levels.

5.3.2 Macroeconomic and Agricultural Sector Policy

Starting in 1994, the Government, with support from the World Bank and other donors, has undertaken a major restructuring of the economy, the agricultural sector and the natural resource sector. This restructuring includes

- 1 devaluing the CFA in January 1994 to promote primary sector exports and to encourage import substitution,
- 2 liberalizing the agricultural sector international trade regime,
- 3 liberalizing domestic marketing and pricing of all agricultural products,
- 4 privatizing the production, processing and marketing of groundnuts and rice,
- 5 undertaking a structural reform of the Ministry of Agriculture,
- 6 developing a new policy on decentralization,

- 7 developing the National Environment Action Plan, and
- 8 creating the Ministry of the Environment and Protection of Nature

Macroeconomic policy is on the right track, but will require sustained support by the donor community if the benefits of an improved macroeconomy are to be felt by Senegalese farmers

5 3 3 Agricultural Production and Marketing

There have been changes in recent years in (a) the availability and affordability of agricultural inputs (b) production techniques, and (c) the marketing of agricultural products. Some of these changes are described below. There are many agricultural production and input deficiencies that constrain agricultural production including (a) land, (b) credit, (c) seeds, (d) fertilizers & pesticides, and (e) equipment.

The quantity and quality of agricultural land in Senegal is deteriorating over time. This results in a reduction in the per capita land that is available for agricultural production and a further reduction in the amount of land in fallow and soil quality. Finally, the need to use or sell peanut hay, millet stalks and cereals for livestock use rather than incorporating these back into the soil to improve the organic matter content also results in a loss of fertility.

Short-term credit for cash crops was historically provided by parastatals. As these organizations move out of providing credit, the lack of credit has become an increasingly important constraint. The slack in providing credit has not been taken up by suppliers of inputs or purchasers of outputs, partly because of past poor repayment rates. The consequences of this lack of credit is a reduction in the purchase of other inputs such as improved seeds, fertilizers, pesticides and new agricultural equipment. In summary, the lack of credit results in a decline in the purchase of inputs which in turn results in a reduction of agricultural output.

Production techniques have changed somewhat as a result of policy changes, changing rainfall patterns, and changes in relative prices of inputs and outputs. For example, unavailability of good quality seed and late seeding of groundnuts have had a substantial impact on yields. Some of the reasons invoked include (a) untimely distribution of groundnut seed, (b) absence of farmer's own good quality seed stocks, (c) reducing risk of late rains or early droughts by planting later, and (d) competition for use of seeders and tillers which results in favoring food crop production rather than cash crops. Furthermore, imported inputs such as fertilizer and equipment have increased in price more than producer prices. This has resulted in a decline in the use of these imported inputs.

By way of example, devaluation has, in many regions, improved the profitability of groundnuts relative to millet. In the absence of credit for certified seed or fertilizer, many farmers are responding by employing seeding rates well beyond recommended levels to increase productivity. Length of fallows is also decreasing. While this may be an effective short-term solution, this practice will have dire medium-term effects on the already limited soil fertility.

Marketing is also undergoing significant changes which have had an impact on production and the amount of surplus available for off-farm sales. For example, the decrease in outlets for fertilizer sales and collection points has had a substantial negative impact on groundnut production. At present certified groundnut seed is available only at SONAGRAINES collection points two months prior to planting season. Moreover, it is sold only in 50 kilogram sacks. The limited number of commercial outlets and the size of minimum purchases hinder acquisition.

Another important constraint for improving agricultural performance is that the linkages between agricultural research and the development institutions are weak. There is evidence that new packages and practices developed by researchers do not always get transferred to farmers. The national agricultural extension service is itself fragmented.

5.4 POSSIBLE OPTIONS FOR USAID SUPPORT

Senegal is in the midst of a period of tremendous change. During the last four years the Government has devalued its currency, liberalized both domestic and international trade, disbanded many parastatals, privatized others, and reduced the services and subsidies for yet others, embraced the concept of the market economy and an increased role for the private sector, embarked on a process for revamping policy and investment in agriculture, and started a major process of decentralizing the delivery of government services. These changes, in turn, have had an impact on the meso and micro economies of agriculture. Marketing channels for inputs and products have undergone significant transformation, the price and availability of inputs such as fertilizers, improved seeds and pesticides have been altered, and farmers have reacted to these changes by changing the combination of crops and varieties grown and the proportion of inputs used to grow them.

Structural adjustment was essential for macroeconomic and financial reasons. Most of the changes that have taken place at the meso and micro level were required, even though in the short to medium term they will be disruptive at times and will create winners and losers. An important role for the donors, USAID included, is to assist Senegal in making this essential transformation from a centralized, state dominated and dirigiste economy to a decentralized one where individual consumers, producers, free markets and the private sector make most of the day to day decisions in a liberalized economy.

The following options are proposed within USAID's philosophical framework of private sector promotion, fostering of beneficial competition and results-oriented development activities. While all of the activities may not have a direct impact on enhancing productivity, they strive to promote the enabling environment necessary for its accomplishment.

5.4.1 Supporting Continued Liberalization

First, USAID should consider continuing to provide support for market liberalization, privatization and the development of the private sector both at the macroeconomic level and at

the agricultural sector level. Structural adjustment will inevitably result in segments of the economy being hurt and pressure being brought to bear on the Government to provide relief through such means as import restrictions and price controls. These restrictions and controls while making short-term political sense will be harmful to the economy in the longer term. The donors, especially the World Bank and USAID, should provide support to the Government so that it can resist the pressures to the extent possible. This assistance might take the form of a combination of activities such as the RSAP moral support and, perhaps, other forms of financial support.

5.4.2 Decentralization and Natural Resource Management

Secondly, USAID should consider providing support for both decentralization and the National Environmental Action Plan (NEAP). The Government is currently in the process of re-engineering with an aim to fostering greater participation and responsibility by its citizens in governance and defining a cohesive approach to the management of its natural resource base. The process revolves around two major policy changes. The first of these is the Decentralization Law which went into effect on December 31, 1996 and is intended to devolve responsibility for many aspects of governance and natural resource management from the state to regional and local levels. The second initiative is the NEAP which is now being finalized and is scheduled for adoption after validation in June of this year. It is intended to provide an overall, unified foundation upon which the necessary institutions, regulations and policies for rationally managing natural resources and the environment can be constructed.

The emerging decentralized framework and the adoption of the NEAP are bold and promising initiatives which can provide the means for improving the management of the productive resource base. These initiatives, however, will require the coordinated and sustained support of Senegal's partners. Areas for potential USAID attention include:

1. Strengthening the planning, programming and management capacities of regional, communal and local councils in NRM related areas by providing appropriate training and technical assistance, and structuring interventions in a manner that reinforces these agencies rather than bypassing them, as has so frequently happened in the past,
2. Improving the government's ability to provide technical support in agriculture and natural resource management by reinforcing the skills of the future national extension service, particularly in new areas included in their expanded mandate such as marketing and farm-level financial advisory services.
3. Continuing to support key natural resource management agencies involved in monitoring and coordination activities such as the Centre de Suivi Ecologique and the Conseil Supérieur des Ressources Naturelles et de l'Environnement, and

- 4 Taking a broad holistic approach that considers the interrelated nature of environmental factors when planning rural development and research interventions, avoiding a concentration on single isolated production factors

5.4.3 Support to Agriculture

Finally, USAID might consider continuing support for some of the more traditional interventions in the agricultural sector. Devaluation and the partial withdrawal of the state from supplying inputs and purchasing outputs has resulted in a further reduction in both the availability and affordability of agricultural inputs and credit. There is widespread consensus that the availability and affordability of agricultural inputs and agricultural credit are the two most important constraints to increasing agricultural productivity. Next is an effective extension and research-extension-farmer linkage. There are a number of possible interventions in these areas.

First, USAID might wish to consider developing partnerships with private sector seed, fertilizer and agricultural chemical producers whereby USAID would partially finance promotional efforts of these private sector firms. The private sector firms would reimburse USAID out of increased sales. This option would entail investment in updating improved seed, fertilizer and pesticide demonstration response trials but has the advantage of being (a) private sector oriented, (b) relatively easy to quantify and monitor, and (c) directly linked to the desired result of increased productivity.

Second, increasing farmers demand for productivity-enhancing inputs is, of course, only half of the equation. Facilitating access to affordable credit is a prerequisite for purchasing more inputs. However, experience has shown that credit schemes where the state is the sole lender have not been successful. The recent evolution of rural credit unions merits close examination by USAID. There would appear to be significant needs in financial management training, program and policy development and liquidity.

Third, in addition to agricultural input demand constraints which need to be addressed, increasing the supply of quality seed is also critical. ISRA, in collaboration with international research centers, has identified improved varieties for most major crops grown in Senegal. The availability of good quality seed in adequate quantities from UNIS is a major constraint to increased crop production, particularly regarding food crops. During interviews conducted by the team, the Permanent Secretary of UNIS emphasized the need for technical assistance for training in food crop seed production, control and certification.

One final area which might warrant further investigation is in horticultural exports. Although the opportunities for developing significant horticultural export marketing activities are very limited and are, in any case, being supported by the European Union, the non-perishable dried fruit, pulp and herbal tea export market might be examined as demand has increased sharply for nutritional snack foods in health conscious Western markets. The possibility of exporting to the regional market should also be explored.

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