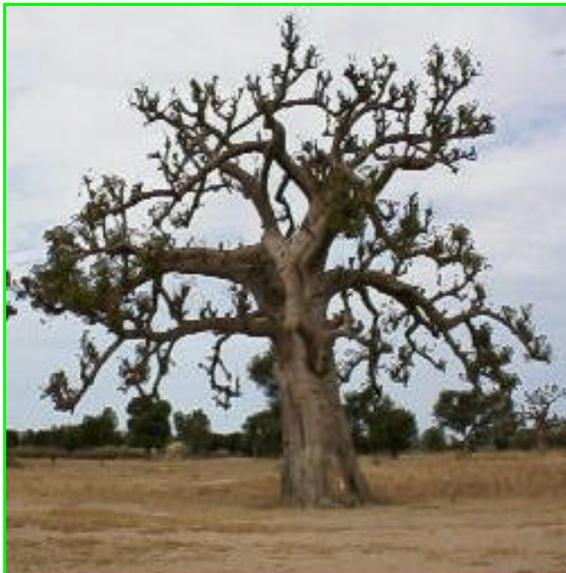


**USAID/SENEGAL**  
*Natural Resources Management*  
*“Limited Scope”*  
*Impact Assessment Report*



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“LIMITED SCOPE”  
IMPACT ASSESSMENT REPORT**

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May 1998

For  
USAID/Senegal  
Rebecca J. Niec, COTR

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# Preface

The NRM assessment team members acknowledge the excellent and much appreciated logistics, administrative, and professional support from USAID/Senegal, in particular from Rebecca Niec (SO2) and the members of the Data Analysis Working Group (DAWG) in the completion of this natural resources management (NRM) assessment. Also acknowledged is the support accorded to the team by the several Activity Centers (SECID CBNRM, Africare KAED, Rodale Institute, Winrock/OFPEP, PVO/NGO Support Program, and CID NRBAR/ISRA) in terms of excellent field trip arrangements and very useful and numerous professional discussions held with Activity staffers. Of particular note here is the assistance and professional contributions provided by Mr. Francios Faye (SO2) and Mr. Mouhamadou Lamine Boucoum from ISRA/NRBAR during the field trips. The Government of Senegal (GOS) also provided invaluable insights into the NRM situation in Senegal through the ISRA research centers in Bambey and Kaolack. Finally, and most importantly, we express our appreciation to the several individuals and associations hosting us in some 22 villages during the field trips, too numerous to list in detail. Without their graciousness and willingness to provide inputs to the assessment process this report could not have been completed. Any errors committed in the report belong to the authors and not to any of the above-mentioned institutions or individuals.

## Acronyms

ABE	Agriculture-Based Enterprises
AHDIS	Action Humaine Pour le Développement Intégré au Sénégal
CERP	Centre d'Expansion Rural Polyvalent
CBNRM	Community-Based Natural Resources Management
CC	Chef de carré
CGRN	Comité de gestion des ressources naturelles
CID	Consortium for International Development
CILSS	Comité Inter-Etat de Lutte Contre la Secheresse au Sahel
CNCAS	Caisse Nationale du Credit Agricole au Sénégal
CONSERE	Conseil Supérieur des Ressources Naturelles et de l'environnement
COTR	Contracting Officer's Technical Representative
CPSP	Country Program Strategy Plan
CR	Communauté Rurale ( rural district, administrative unit of local govt. roughly equal to a US county); not a rural community or village
CSE	Centre de Suivi Ecologique
CSP	Country Strategic Plan
DAWG	Data Architecture working group
EDF	European Development Fund
EPIQ	Environmental Policy and Institutional Strengthening Indefinite Quantity Contract
EROS	Earth Resources Observation System (USGS)
FED	European Development Fund/ <i>Fonds Eueopéen de Développement</i>
GIE	Groupement Intêret Economique
GOS	Government of Senegal
GRN	Gestion des ressources naturelles
HH	Household
IMS	Information management system
ISRA	Institut Sénégalais de Recherches Agricoles
KAED	Kaolack Agricultural Enterprise Development
KAP	Knowledge, Attitudes, and Practices (Survey)
KIR	Key Intermediate Result
LADP	Letter of Agricultural Development Policy
LUMP	Land Use Management Plan
MARP	Methode Accélérée de Recherche Participative (PRA in English)
NEAP	National Environmental Action Plan
NGO	Non-Governmental Organization
NRBAR	Natural Resource-Based Agricultural Research
NRM	Natural resources management
OFPEP	On-Farm Productivity Enhancement Program
ORSTOM	l'Office de la Recherche Scientifique d'Outre Mer
PAGT	Plan d'Aménagement de Gestion de Terroirs
PRA	Participatory rural appraisal (MARF in French)
PVO	Private Voluntary Organization

R4	Results Review and Resource Request
SATEC	Société d'Assistance Technique
SECID	South-Eastern Consortium for International Development
SO	Strategic Objective
SODEVA	Société pour le Développement et la Vulgarisation Agricole
SOW	Scope-of-Work
SRP	Senegal Reforestation Project
SZWM	Southern Zone Water Management
TOR	Terms of Reference
USAID	US Agency for International Development
USGS	US Geological Survey
WID	Women-in-development

# Executive Summary

This report was prepared as a deliverable under the Environmental Policy and Institutional Strengthening IQC Contract to assist USAID/Senegal and its partners in assessing the impact of the past 5 years of investment in natural resources management (NRM) and related programs in Senegal. The report is based on fieldwork completed in January-February 1998.

## Background and Purposes of the Nrm Limited Impact Assessment

The NRM limited impact assessment was organized by USAID/Senegal in cooperation with USAID's Africa Bureau (AFR/SD/PSGE) as an input into the mission's "results review and resource request" (R4) which is submitted annually by USAID/Senegal to USAID/Washington. The current R4 report aims to review the program impacts and other results achieved by USAID-funded activities with respect to the second Strategic Objective (SO2) in the mission's strategic plan—"increased crop productivity through improved natural resources management in zones of reliable rainfall." As part of its ongoing effort to track and report on SO2 impacts and results, the mission has collected household-level data on the adoption of selected NRM practices by rural producers since 1992. Data from the last survey conducted in 1996 was reported in the mission's FY1996-1999 R4. One important task of the assessment team was to provide updated estimates of the rate of adoption of selected NRM practices, based on: a) sites visits, b) informal discussions with activity beneficiaries, c) collection of data from a small sample of households using a limited, structured set of questions based on the 1996 KAP survey questionnaire, and d) a review of progress reports and monitoring and evaluation data from "activity specific KAPs."

In anticipation of the revision of the Country Strategic Plan (CSP) for USAID/Senegal, this assessment report also presents several case studies to document the linkages and synergies among increased use of NRM practices, decentralized decision-making authorities and greater private sector opportunities. Following an initial round of consultations with partners, USAID/Senegal is currently planning to phase out the existing SO2 on September 30, 1998, and reorient selected NRM-related activities to fit under two new Strategic Objectives:

- # SO1: sustainable increases in private sector income-generating activities in selected sectors (the private sector SO), and/or
- # SO2, more effective democratic and accountable local government management of services and resources in targeted areas (the decentralization SO).

The report presents a number of examples of synergistic interactions among past and ongoing NRM activities, and the anticipated outcomes related to the two new proposed SOs. Under the existing SO, the mission has recognized the synergy among NRM and sustainable agriculture, and SO2 is in fact a fusion of two former Strategic Objectives related to support for agriculture and environment. The assessment team prepared several case studies to illustrate that program support for agricultural research, extension and development of private sector agricultural enterprises, reforestation and community-based NRM have in fact contributed significantly to the emergence of

more democratic decision-making processes in rural areas. The case studies further demonstrate the emergence of community-based organizations and agriculturally-based enterprises which collaborate with rural credit institutions and generate greater private sector business opportunities through the improved management and more intensive use of natural resources.

As part of its ongoing strategic planning effort, the mission and its partners seek to capture lessons from past and ongoing NRM activities which can help refine the current development hypothesis and “results framework” for SO2 activities, and improve the implementation of NRM activities in the future. The assessment team was specifically charged with identifying:

- # sites where adoption rates for NRM practices and other NRM changes have occurred within the past five years;
- # the economic, environmental and social outcomes and quantifiable impacts of these changes;
- # the various conditions which have contributed to these changes, or which have constrained the adoption and spread of NRM practices; and
- # the factors or activities which have been or could be supported to establish the “enabling conditions” for positive changes and more widespread impacts.

The limited NRM assessment in Senegal was also organized to review the existing management information system and to make recommendations for improving the capacity to use field-based information to inform decision-making related to the management of NRM programs in Senegal at all levels. In this context, the assessment team considered how to track results more effectively, using better indicators, a broader range of impact assessment tools, and a more integrated monitoring and evaluation system.

## **USAID Investments in Natural Resources Management**

USAID investments in natural resources management (NRM) and related programs in Senegal amount to more than \$125 million for the period 1986-2001. Over the past five years, USAID/Senegal’s NRM investment portfolio has included the following several activities:

- # supporting the construction of salt intrusion dams under the Southern Zone Water Management (SZWM) project;
- # providing grants to Rodale Institute and other private NGOs working with rural communities to encourage the adoption of NRM practices such as composting through the PVO/NGO Support Program;
- # supporting improved seed production and soil fertility management via the On-Farm Productivity Enhancement Program (OFPEP);

- # developing and promoting natural resource-based technologies to increase the productivity of cereals cropping systems through the Natural Resource-Based Agricultural Research (NRBAR) project;
- # establishing demonstration fields and providing infrastructure, training, access to credit and other support for agricultural-based enterprises and natural resource-based income generating activities in the Kaolack region through the Kaolack Agricultural Enterprise Development (KAED) Project;
- # supporting tree-planting through the Senegal Reforestation Project (SRP), and continued support for decentralized, community-based land use planning and the adoption of NRM practices by private sector producers and associations in rural communities through the Community-Based Natural Resources Management (CBNRM) project;
- # collaborating with the US Geological Survey and EROS Program to transfer skills and increase the capacity of the Centre de Suivi Ecologique (CSE) and develop time-series data on longer term environmental changes in Senegal; and
- # providing technical and financial support for revisions of the Forestry Code, preparation of a National Environmental Action Plan (NEAP) and other policy reforms, training workshops, seminars and institutional support to encourage the establishment of more favorable enabling conditions for the adoption of NRM practices.

## Assessment Methodology and Team

The methodology used to collect the necessary information and to complete the tasks assigned to the assessment team included two weeks of field visits to 22 sites in the 200-700 mm rainfall zone in the vicinity of Thies, Bambey, Fatik and Kaolack to observe first-hand the results of USAID-funded program activities as well as several local groups and rural producers which were representative of “non-project” areas. With respect to the range of activities included in USAID/Senegal’s NRM portfolio, during the limited period of time available for this assessment activity (January 12 - February 6, 1998), the team was able to visit a number of KAED and CBNRM sites, as well as several sites which have benefitted from the NRBAR, OFPEP and PVO/NGO programs. Short meetings were also organized with the staff of the CSE and USGS/EROS program. One team member was able to visit several representatives of regional government technical services in the Kaolack region. Travel restrictions in the southern region around Ziguinchor and in parts of the Kolda Regions prevented travel to activities supported in these areas.

The team also spent nearly two weeks meeting with the technical staff of the principal AID-funded SO2 activities, reviewing their activity reports as well as technical literature in order to assess the contributions of NRM program activities to the key intermediate results (KIRs) for SO2. Particular attention was given to KIR B : “Improved NRM techniques mastered and used by farmers.” The NRM techniques targeted by USAID/Senegal include: percentage of farmers (male

and female) using live fencing, compost, improved seed, windbreaks, fallow land, manure and field trees.

The four person assessment team included an economist, a social scientist, a NRM specialist and NRM/Environmental Policy specialist. In addition to site visits, the team took advantage of their experience in the Sahel region dating back to an initial assessment organized in 1988 to identify “Opportunities for Sustained Development”; this effort helped to document a variety of successful NRM activities in the Gambia, Mali, Niger and Senegal. More recently, the team members have been closely involved with the development of participatory, decentralized approaches to community-based land use planning, sustainable agriculture, NRM and local development programs, commonly referred to as “gestion de terroir” programs. This broader background, as well as the field visits and specific experiences of SO2 activities in Senegal served as the basis for the team’s observations about “lessons learned” and suggested refinements in the mission’s development hypothesis.

## Summary of KIR B NRM Practice Results

It is evident from the observations made by the team that there have been significant impacts of five years of investment in promoting improved NRM in Senegal. Quantifying those impacts and comparing them with baseline information from 1992, however, has proved a daunting task. The baseline information used for this assessment is the 1992 KAP. Quantitative results in relation to the seven key indicators for the R4 were taken from activity specific KAP reports done in the zones of program intervention. Though consolidation of disparate data sets was not simple, the following summary results table is presented as a reasonable indication of trends.

### Results of Five Years of NRM Interventions as Measured by KIR B Indicators

Percentage of households using specific NRM practices					
Practice	Baseline (1992)	Results (1997) Household Women		Target (1998) Household Women	
Live Fence	2.7%	10%	7%	30%	15%
Compost	12.1%	21%	11%	12%	5%
Improved Seed	14.0%	24%	18%	50%	25%
Windbreaks	4.5%	13%	6%	20%	10%
Fallow	15.3%	37%	NS	55%	35%
Manure	51.7%	86%	34%	65%	35%
Field Trees	2.4%	51%	43%	60%	40%

From the table, significant increases in the use of NRM practices have occurred since 1992 in the areas where interventions have taken place. In spite of the imperfections in the methodology used to generate these numbers, this assessment would confirm that the trends are realistic estimates. The trends for certain indicators do not, however, attain the 1998 targets. The on-track indicators include compost, manure, and field trees, while the other four, live fencing, improved seed, windbreaks, and fallow appear to be lagging. The following two points are noted:

- # Composting appears to be a much more popular practice in intervention sites than in zones outside of project influence. Composting has been aggressively promoted and often subsidized as part of NRM activities, which most likely accounts for the high rate of adoption in intervention sites. The very real constraints of water and labor, as well as the competing demands for alternate uses of crop residues, would explain the low quality of organic matter obtained and the much lower rates of adoption elsewhere.
  
- # Improved seeds are readily adopted where they are available, but lack of supply is the major constraint. Unless the measures are taken to increase supply to meet demand, this will continue to be a problem. Field trees show a significant increase in use rates, but it is now fairly certain that changes in survey methodology account for the major part of this increase. Cross checking the data with direct questions regarding the use of trees in fields show that field tree use rates are significantly under reported in 1992.

The challenge to deliver a quantitative assessment of the results of five years of NRM interventions is due primarily to the inherent nature of NRM activities. The multitude and creative variety of NRM practices adopted throughout the country (PVO/NGO reports on more than 80) make it extremely difficult to find a common denominator among them. Furthermore, the impact of many NRM interventions is not always realized in the short span of time over which measurement of impact is taken. Nevertheless, results are being achieved, not only in the areas of direct program intervention, but on land and in communities across the country.

## **Economic, Environmental, and Socio/Democratic Impacts**

The environmental impacts attributable to the activities of the USAID/Senegal NRM portfolio would appear to be substantial, although it is difficult to quantify these impacts in a report of this nature. Field visits indicate that there is a reduction in environmental degradation as increasing numbers of farmers adopt different NRM practices such as live fences, windbreaks, rock dikes, and composting. The latter is instrumental in changing the structure of the soils which increases infiltration rates, hence, scarce water is used much more efficiently. Live fences, field trees, and windbreaks reduce wind erosion, increase fertility, and provide much improved micro-climates for the farm fields which, in turn, attracts more rainfall. A little investment in NRM practices apparently goes a long way in terms of restoring the environmental integrity of the areas. More importantly, the efforts to reduce fuelwood consumption by promoting the increased use of improved wood stoves has had a significant impact on the consumption of fuelwood.

In addition to the results observed at the level of KIR B, a number of other significant results were observed at other levels of the results framework, including some highly significant results at the level of the SO. Some of these results include:

- # In the area covered by the Southern Zone Water Management Project, 4,500 hectares of recovered land were farmed in 1997. Average rice yields on this land was 1.45 ton/ha, more than double the pre-project yields of 0.7 ton/ha.
- # The Senegal Reforestation Project (SRP) helped Khassim NDour establish hundreds of meters of windbreaks around his 17 hectare irrigated, export garden operation. In a tightly integrated system that uses tree clippings and bean hay for cattle feed, manure and straw for compost, he makes a yearly application of 30 tons of compost per hectare. His resulting yields that approach 17 tons per crop of green beans per hectare are a record for the country.
- # The adoption of improved varieties of millet seed showed an average yield increase of 117%. By the end of 1996, 695 farmers were using improved varieties in the six villages where demonstrations and interventions were carried out.
- # Through the combined efforts of NRBAR and PVO/NGO Support, over 3,400 rural producers were trained in a variety of NRM practices in 1997.

Over a two-year period, women's groups in the KAED project region who operate grain mills earned a net income of some \$22,500 (13.5 million fCFA). In addition, the women earn substantial incomes from the sale of crops harvested from the demonstration fields, the gardens, the feedlots, the nurseries and woodlots, and the cereal banks. Khassim Ndour generates annual revenues estimated at \$300,000 from his highly successful operation. Other individuals and groups report more modest yet significant economic returns from NRM investments.

Impacts attributable to the activities of the USAID/Senegal NRM portfolio are substantial, although not quantified in this report. There is a reduction in environmental degradation as increasing numbers of farmers adopt different NRM practices such as live fences, windbreaks, rock dikes, and composting. The latter is instrumental in changing the structure of the soils which increases infiltration rates, hence, scarce water is used much more efficiently. Live fences, field trees, and windbreaks reduce wind erosion, increase fertility, and provide much improved micro-climates for the farm fields.

## **Case Studies of Specific NRM Activities and Synergies**

The report presents five case studies to illustrate the specific impacts of representative USAID NRM program investments, as well as the synergies among NRM, decentralization and the promotion of private sector enterprises. Keur Kouthieye is cited as an example of an agricultural based enterprise (ABE) developed with the assistance of the Africare/KAED activity. The team visited the group's demonstration field with windbreaks and live fencing, the vegetable gardening and tree seedling nursery, and discussed the expansion and diversification of economic activities and

corresponding increases in income at the village level which were made possible by the training, equipment and other support provided by the contracted technical specialists and extension agents working with the village associations.

A second case study is based on the village NRM committees supported by the CBNRM project in the Kaolack region as an illustration of the “gestion de terroir” approach. This activity illustrates a participatory, decentralized approach to land use planning and improved natural resources management at the community level which is linked to the empowerment of elected community representatives and strengthened technical support from government extension agents. Small grants are also provided in support of a wide range of micro-projects designed to improve land use and increase the adoption of NRM practices. Ndollor village is presented as a third case study which demonstrates how crop yields can be increased through the use of improved millet seed, composting and live fencing. This activity was supported by the OFPEP/Winrock project with minimal use of credit or grant funds.

Another case study reviews the impacts of collaboration between agricultural researchers and villagers using animal traction, improved seed production and a variety of soil and water conservation practices to control soil erosion. The fifth case study includes several examples of private entrepreneurs who have adopted a variety of NRM practices both with and without external project assistance. Samba Ndao has diversified his agricultural production through the development of a small-scale vegetable garden and fruit tree orchard with little outside assistance. The Samsoun village cooperative has continued to irrigate some 50 hectares to produce regular harvests of beans, maize, poles and other crops for sale over the past 15-20 years. Long after receiving assistance from a rural development NGO to get started, the group has continued to manage its operations, and has even decided to locally recruit and pay for their own technical assistance. Khassim Ndour is another example of a very successful irrigated garden farmer who has taken advantage of his proximity to Dakar to develop a thriving export business. Over the years, this entrepreneur has benefitted from training, and received tree seedlings and other technical support from several USAID funded projects which have helped him to sustainably increase the productivity of his irrigated gardens.

A number of important synergies among NRM, increased income generation and the strengthening of decentralized community-based organizations are discussed. Literacy training and related assistance to improve management and business skills are critically important to the success of these efforts. Improved access to credit and increased capacity to utilize and manage credit and the profits of local enterprises are also especially important to the success of NRM, sustainable agriculture and rural enterprise development activities. The organization, legal recognition and empowerment of village associations, committees and other community-based organizations provides a framework for decentralized decision-making, land use planning and the promotion of the adoption of improved NRM practices while supporting activities which directly benefit local communities by increasing rural incomes, food security, organizational capacity and grass-roots governance. The intensification and diversification of sustainable rural land use and agricultural production systems through the integration of NRM practices sets the stage for the development of small-scale enterprises which directly benefit rural communities, especially women. These improvements in natural resource use and associated enterprise development appear to also be positively linked with improvements in social well-being, such as access to health, education and family planning services.

## Lessons learned, Enabling Conditions and Contributing Factors

Program experience to date indicate that technical assistance, training and other support provided for community organization and improved management capacity is needed as a basis for improving the use and management of natural resources. Improved NRM, in combination with improved local capacity can then serve as a means to sustainably increase the productivity of natural resources so that production and incomes are increased. The resulting intensification and diversification of agricultural and NRM-related production, in turn, sets the stage for the development of a variety of enterprises. The same skills which enabled the community members to organize themselves and to invest their labor in improved NRM are then put to use in managing their increased incomes, which are then invested in a variety of enterprises. And, once an appropriate set of NRM practices has been adopted, a community is able to break out of the cycle of non-sustainable resource use, declining agricultural production and deepening poverty to instead begin the process of restoring the productivity of their cropland, woodlands and pastures.

In the past, building local capacity and increasing incomes in the short term has not always been an explicit and integral part of NRM programs. A participatory approach to the support of NRM interventions, however, often reinforces the linkages and synergies between NRM and private sector program activities. One of the main objectives of private sector interventions is to increase incomes and generate additional sources of economic livelihood. And in rural Senegal, when people are asked how they might increase their incomes, the most common response is to increase the productivity of their farming enterprises. In order to do this, farmers (men and women alike) will typically refer to the need to restore the fertility of cropland. Low fertility is often perceived to be the result of a gradual decrease in the density of trees in and around farm fields, the suppression of fallowing, the elimination of subsidies and declining use of chemical fertilizers, increased competition for crop residues for uses other than as soil amendment, and other factors. Therefore, efforts to increase rural incomes and to promote private sector enterprises which rely on participatory approaches and close integration with local development activities naturally tend to embrace a variety of actions designed to improve the management of natural resources and to sustainably increase the productivity of agricultural production systems.

While reversing environmental degradation is an essential part of a strategy to secure and increase agricultural production and rural incomes in Senegal, it can also be the springboard for a variety of local development activities which feed into the development of private sector enterprises. For example, the need to produce tree seedlings for windbreaks, woodlots and fruit tree orchards has led to the establishment of small-scale nurseries which can produce seedlings for sale. The construction of wells and the installation of more efficient water extraction methods using animal traction has enabled groups to produce vegetables during the dry season. Other groups have established woodlots and used the income from the sale of poles to establish dry season gardens and fruit tree orchards. In each of the 56 communities assisted by the AFRICARE-KAED project, the local groups were able to use the income generated from the demonstration fields to establish a system of revolving credit. As they gained experience in managing these funds generated within the group, they were able to take advantage of additional support provided for the organization of cereal banks, livestock fattening operations, vegetable gardens and other income-generating activities. The management of these ABEs, in turn, has helped to establish their credit worthiness and brought them

into contact with credit organizations such as CNCAS, which are eager to continue to work with the GIE's as business partners.

To reduce dependence on subsidies, it is important to subject proposed NRM practices to farmer-perspective financial analysis to determine whether proposed field interventions will make financial sense from the perspective of the intended beneficiaries. It is also apparent that women are quick to adopt NRM and related practices, especially when these practices help them to save time and quickly generate increases in income. There is a strong effect from demonstrations of NRM practices which are clearly linked to the benefits accruing to successful adopters. The sustainability of NRM practices depends not only on the technical and economic feasibility of the practices, but also on the strength and viability of local institutions.

Among the critical enabling conditions, the report cites: favorable macro-economic policies particularly in the agricultural sector; the adoption and implementation of decentralization policies; a coherent and sustained national environmental planning and policy development process; as well as a host of necessary program support activities related to training and technical support. Important contributing factors have been the program support provided by USAID to CONSERE, CSE, ISRA and other institutions, as well as their concerted efforts to identify, assess and respond to major constraints or potential impediments to the adoption of NRM practices, such as water, capital, labor, risk aversion, tenure, credit, and technical assistance.

## **Review of the Information Management System**

The assessment team was asked to make recommendations for improvements in the existing information management system (IMS) for using field-based information to inform decision-making at all levels. The team looked at the IMS in detail at two levels, data collection and data reporting/analysis. The team also made observations and comments on several larger issues related to NRM information management and results reporting.

The Mission should be commended on the level and scope of data collected from a variety of sources. National KAP surveys are commissioned by USAID/Senegal and performed by a local consulting group. Site-specific KAP surveys and other activity-specific data collection are carried out by implementing partners. Other sources include the Ministry of Agriculture and USGS/EROS through the CSE. Though data quantity is admirable, inconsistent data collection methods make it difficult to compare data sets from year to year and from one activity to another. Furthermore, the KAP survey itself, due to its formal nature and inherent lack of flexibility, does not capture all information necessary for adequate analysis and decision-making.

In order to assess the current status and effectiveness of USAID/Senegal's data reporting and analysis capability, a brief exercise was conducted on the Mission's IMS. The exercise revealed that, in spite of the adequate availability of data, Mission capability for generating reports or doing analysis with these data is severely handicapped. Some of the problems encountered were related to the aforementioned inconsistencies in data collection methodologies, but several technical difficulties were uncovered as well. Incompatibilities in data formats, data table structures, variable names, and data codes make it impossible to do comparative or cumulative analysis on the data in

their present form. The Mission relies on program implementing partners to monitor activities and report results according to a common set of indicators. Partners did not routinely report the necessary information, however, partly because the Mission has not clearly and consistently communicated its requirements.

The current set of indicators used for tracking achievement of KIR B are evaluated in terms of their validity, usefulness, commonality, and practicality. Of the seven indicators currently used, four (live fences, compost, improved seed, and field trees) are judged to be good or better. It is suggested that the other three (windbreaks, manure, and fallow) be dropped or incorporated into existing or proposed indicators. Several new indicators are proposed, including community NRM actions, percentage of land covered by organic amendments, and indicators related to the use and management of water resources and improved cookstoves.

Although information is gathered from the field and passed to the Mission, there is little evidence of any flow in the other direction. Ultimately, information collected from the field should be processed, analyzed, and reported back to the field for confirmation and additional insight. A more participatory process should be pursued in the areas of data collection, data analysis, and setting of indicator targets. The Mission is commended for their support of CSE through the USGS/EROS program and encouraged to strengthen collaboration in the sharing of information of mutual benefit.

## **Conclusions and Recommendations**

Senegal's natural resource base is the basis for the country's economic growth and improved prosperity, particularly in rural areas. Program strategies must continue to address issues of environmental degradation and capitalize on opportunities for improved natural resources management in order to increase incomes and promote private sector enterprises. The elimination of government subsidies for agricultural inputs creates a critical need to empower and assist the private sector and decentralized community-based organizations to support the production of certified improved seed, increased access to credit, the provision of technical information, marketing assistance and other NRM related activities.

The CBNRM approach to the extension of NRM practices may be less effective in the short term but important in the long run in order to strengthen the capacity of government extension agents and democratically elected community-based organizations. Ongoing contract-based extension support should work with local communities to develop greater self-reliance, while the CBNRMP should increase the number and capacity of CERP teams which are able to provide technical support at the level of each arrondissement.

In view of the limited information available about the financial feasibility of various configurations of NRM practices, it is recommended that all NRM practices identified through the participatory approach be subjected to farmer-perspective and site-specific financial analysis to determine the optimal technical configurations of the practices to extend. Such analysis can be assisted by the development and use of user-friendly templates to identify the key variables for each NRM practice.

There is much room for improvement of the information management system used to track and report on the results of USAID NRM investments in Senegal. USAID/Senegal should revisit the recommendations of earlier assessments of this system in conjunction with this more recent assessment, and proceed to implement the specific recommendations provided in the report concerning changes in indicators, integration and improvement of the data sets, clarification of reporting procedures, upgrading of staffing (including designation of a full-time database management specialist), improved management of the reporting process, and sharing of NRM data and analysis.

Given the limitations of the current IMS and the KAP data, an alternative or complementary approach to monitoring and evaluating that makes greater use of information generated by the USGS/EROS activity should be considered. These data can be integrated to generate more useful information through the continued support of a system which includes:

- # Periodic updating and ground truthing of environmental monitoring data collected by USGS/EROS in collaboration with CSE, through a comprehensive sample of all agro-ecological zones.
- # Bi-annual household surveys, with a stratified sample of villages which have and have not directly benefitted from external investments in NRM programs.
- # Periodic compilation and analysis of data from diagnostic PRAs, informal interviews, impact assessments and other community-level surveys associated with NRM investments and related rural development activities.
- # Case studies on specific issues and research topics (e.g. correlation between security of tenure and investments in NRM practices, financial and economic analysis of NRM practices).

# 1. Introduction

## 1.1 Background

This limited natural resources management (NRM) assessment is prepared in collaboration with AFR/SD/PSGE and on behalf of USAID/Senegal as an input to the upcoming presentation of the mission's R4 report (results review and resource request)<sup>1</sup>. The assessment provides estimates of the results achieved over the past year, since the last R4 was submitted, but without the benefit of an updated the Knowledge, Attitudes, and Practices (KAP) survey as a point of reference. The KAP surveys of NRM practices are carried out every two years, beginning in 1992. The next survey is scheduled to take place in September, 1998. The results presented in this report build on the most recent KAP survey conducted in 1996 with information obtained from the individual (mini) KAPs and progress reports prepared by each Activity Center in USAID/Senegal's NRM activity portfolio, complemented with information from informal and formal surveys conducted by the team in the field work. In addition, the assessment team discussed synergies between NRM and the two new SOs: decentralization and private sector in the context of several case studies. The team assessed lessons learned from past and ongoing NRM activities with a view towards refining the current development hypothesis and strategy for SO2 investments. It also carried out an evaluation of the Mission's information management system (IMS). The TOR for the study team is provided in Annex A.

USAID/Senegal has been working closely and effectively with the Government of Senegal (GOS) for several years seeking to promote the adoption of improved NRM practices throughout the country. In the current NRM Activity portfolio (summarized in Annex B), USAID is promoting increased adoption of several different NRM practices, decentralization, improved access to information, NGO support through small grants and training, increased access to credit—all highly prioritized issues by both the GOS and USAID/Senegal. In addition, the Mission has supported policy reforms that affect NRM through the creation and nurture of CONSERE (the Conseil Supérieure des Ressources Naturelles) that led to the preparation of the National Environmental Action Plan (NEAP) adopted in 1997. USAID/Senegal is also providing field-level monitoring of the adoption of NRM practices, and changes that are affected by national policy.

Whereas concrete results from all of these ongoing efforts may sometimes be difficult to discern or measure, it must be recognized that the issues are very complex and time consuming to resolve. There are no quick technical fixes, instead all proposed solutions must be subjected to lengthy and detailed negotiations between different stakeholders. The process of needed policy reform and legislative action is well underway, however, and the partnership between USAID/Senegal and the GOS has fostered substantial progress in consolidating the issues, setting the priorities, and mobilizing resources to address them as effectively as possible.

The challenge at this point is to speed up the process by which Senegal can begin to show solid and sustainable increases in agricultural production and economic growth. For the future, therefore, the most important priority is to link NRM to the new SOs on decentralization and private

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<sup>1</sup> The R4 process is repeated annually in order to help the USAID Missions account for progress in achieving their Strategic Objectives (SOs).

sector to unleash: a) the capacity to increase food production to at least keep pace with a rapidly expanding population, and b) promote the development of micro-enterprises in association with the increases in food (staple and cash crop) production.

### 1.1.1 NRM Strategic Objective 2 (SO2)

The current NRM-SO2, the result of a fusion of two former SOs related to forestry and agriculture, is “to increase crop productivity through improved natural resources management in zones of reliable rainfall in Senegal.” In accordance with the proposed new Mission strategy, the NRM-SO2 will phase out on September 30, 1998 after which all designated-to-continue NRM-related activities will be absorbed under two new SOs: a) SO1, sustainable increases in private sector income-generating activities in selected sectors, and b) SO2, more effective democratic and accountable local government management of services and resources in targeted areas (the decentralization SO). This report provides a limited assessment of the results obtained under the NRM SO2 over the last five years of intervention by the individual Activity Centers listed in Table 1.

**Table 1**  
**USAID/Senegal NRM SO2 Portfolio**

SO2 Activities	\$ Value	Current PACD	In New Strategy
Kaolack Agricultural Enterprise Development (KAED)	\$8 million	Sept. 1998	No
Community-Based Natural Resources Mgmt (CBNRM)	\$35.6 million	Oct. 2001*	Yes
Natural Resource-Based Agricultural Research (NRBAR)	\$23.2 million	Sept. 1998	No
On-Farm Productivity Enhancement Program (OFPEP)	Centrally funded	Dec. 1998	No
Southern Zone Water Management (SZWM)	\$21.5 million	March 1998	No
PVO/NGO Support Project	\$21 million	June 1999	No
Senegal Reforestation Project	\$17.2 million	March 1995	

\* Oct 1, 2001 is the terminal date of the current Cooperative Agreement with SECID.

### 1.1.2 R4 Reporting

The annual R4 exercise provides quantitative facts and figures concerning the Mission’s progress in attaining its SOs. For SO2, the R4 emphasizes those achievements that contributed to attaining certain targeted results measured by a select set of appropriate indicators. The indicators emphasized in this report are related primarily to Key Intermediate Result B (KIR B), “improved NRM techniques mastered and used by farmers.” The key indicators reported in the 1996 R4 were percentage of farmers (male and female) using live fence, compost, improved seed, wind breaks, fallow land, manure, and field trees innovations. Though this report will concentrate on KIR B, it will also include highlights of important results in related KIRs (A, C, and D) which contribute to SO2. Annex C shows the fully elaborated results framework for SO2.

### 1.1.3 “Opportunities” Study

As background to this NRM assessment is the “Opportunities Study” carried out by IRG with funding from the Club du Sahel and USAID’s Energy Initiatives for Africa Project (Shaikh et. al., 1988). This assessment, carried out in Senegal, The Gambia, Mali, and Niger, was instrumental in setting the stage for USAID’s policy on NRM in Africa as it focused on a variety of NRM activities successfully adopted by individual farmers or farming communities in West Africa as a result of initiatives promoted through various donor projects, NGOs, or by farmer groups themselves in the regions. Some 70 highly successful interventions were documented in terms of technical details, enabling conditions and contributing factors, and detailed farmer-perspective financial feasibility analyses. Although the information presented was largely anecdotal, the process of documenting successes in this fashion took hold and led to different approaches to activity design and implementation with a much clearer focus on capitalizing on what works. The lessons learned through this effort were numerous and significant, particularly those signaling the urgent need for adopting a participatory approach to NRM, the decentralization of the management responsibilities and the empowerment of local communities with the necessary skills and authority to sustainably manage the natural resources that they traditionally use. In nearly all of the cases analyzed, participation in the decision-making process by the local communities was the common denominator in the success of the interventions. These lessons were all infused into the design of new NRM projects or activities for USAID missions throughout Africa.

## 1.2 Approach

The purpose of the limited NRM assessment is threefold: a) to provide most up-to-date NRM results for the R4 presentation based on the first KAP survey (1992) as a point of reference, informal and formal surveys carried out by the team (see Table 2 for a schedule of villages visited and the activities observed), and site-specific KAPs conducted by the different Activities in the USAID/Senegal NRM portfolio; b) to provide case studies to clearly illustrate the synergies between NRM and the new SOs (decentralization and private sector); and c) to recommend improvements in the existing information management system, including suggestions as to how the Mission’s KAP survey data could be improved in terms of accessibility, ease of use, analysis, and be harmonized with the kinds of questions asked in the site-specific KAPs. The approach taken to address these points is briefly summarized below.

The methodology used to collect the necessary information and to complete the tasks assigned to the assessment team included two weeks of field visits to 22 sites in the 200-700 mm rainfall zone in the vicinity of Thies, Bambey, Fatik and Kaolack to observe first-hand the results of USAID-funded program activities as well as several local groups and rural producers which were representative of “non-project” areas. ( See table 2). Travel restrictions in the southern region around Ziguinchor and in parts of the Kolda Regions prevented travel to activities supported in these areas. The team also spent nearly two weeks meeting with the technical staff of the principal AID-funded SO2 activities, reviewing their activity reports as well as technical literature in order to assess the contributions of NRM program activities to the key intermediate results (KIRs) for SO2. Particular attention was given to KIR B : “Improved NRM techniques mastered and used by farmers.” The

NRM techniques targeted by USAID/Senegal include: percentage of farmers (male and female) using live fencing, compost, improved seed, windbreaks, fallow land, manure and field trees.

The four person assessment team included an economist, a social scientist, a NRM specialist and NRM/Environmental Policy specialist. In addition to site visits, the team took advantage of their experience in the Sahel region dating back to an initial assessment organized in 1988 to identify “Opportunities for Sustained Development”; this effort helped to document a variety of successful NRM activities in the Gambia, Mali, Niger and Senegal. More recently, the team members have been closely involved with the development of participatory, decentralized approaches to community-based land use planning, sustainable agriculture, NRM and local development programs, commonly referred to as “gestion de terroir” programs. This broader background, as well as the field visits and specific experiences of SO2 activities in Senegal served as the basis for the team’s observations about “lessons learned” and suggested refinements in the mission’s development hypothesis.

**Table 2**  
**Villages/Institutions Visited by Assessment Team, Jan. 19 - 28, 1998**

Village/Region	Activity Affiliation	Dominant NRM Practices	Organizations/Individuals Met
Keur Saïb, Thies	NRBAR/Rodale	Recovery of organic refuse	Agents of the NGO
Ndiouffene, Thies	NRBAR/Rodale	Live fences, cemented compost pits	Women’s group
Tatène Serere, Thies	NRBAR/Rodale	Watershed management, including rock dikes	Interviews with individual farmers (men)
Baback, Thies	NRBAR/Winrock	Composting	Interviews with individual farmers (women and men)
Bambey Serere, Diourbel	NRBAR/ISRA	Composting, millet mill	Women’s group
Darou Mougaguène, Kaolack	KAED	KAED demo site, cashew plantation, nursery, health center, gardening	KAED field agents, women’s group
Keur Layine Gueye, Kaolack	KAED	KAED demonstration site, gardening, cattle fattening	KAED field agents, women’s group
Keur Ali Samba, Kaolack	KAED	Cereal bank, literacy school	KAED field agents, women’s group
Keur Kouthieye, Kaolack	KAED	KAED demonstration site, gardening, improved wood stoves, cereal bank	KAED field agents, women’s group
Keur Katim Diama, Kaolack	KAED	KAED demonstration site, open air composting	Women’s group, millet mill
Keur Mor Selle, Diourbel	PVO/NGO, AHDIS	Nursery, gardening, recovery of bad land with woodlots	Agents of project, members of women’s group
Bambey Serere, Diourbel	PVO/NGO, AHDIS	Protection of <i>Acacia albida</i> , woodlots	Agents of project, members of women’s group
Teug Daara, Diourbel	PVO/NGO, AHDIS	Improved woodstoves	Agents of project, women’s group

Village/Region	Activity Affiliation	Dominant NRM Practices	Organizations/Individuals Met
Medina Sabakh, Kaolack	CBNRM	Rock dikes	Sous prefet, CERPs, Comité de Gestion, individual farmers
Pakane, Kaolack	CBNRM	Eucalyptus plantation, gardening, anti salt dikes	Individual farmers, ARDIS
Thysé Kaymor, Kaolack	CBNRM	Rock dikes, composting	Women farmer, individual farmers
Keur Samba Dié, Kaolack	CBNRM	Composting	Individual farmers, agents of project
Sonkorong, Kaolack	NRBAR/ISRA	Watershed management, rock dikes, vetiver protection, fallow and improved fallow, protection (mis en defens)	Agents of project, individual farmers, meeting in town with villagers
Keur Alpha, Kaolack	Independent	Gardening	Meeting with individual farmers
Sandiara, Thies	Independent (ex-CARITAS)	Gardening	Groupement Interet Economique Samsoum
Sebikotane-Ponty, Dakar	Independent	Modern gardening	Owner of garden, Khassim N'Dour
Ndollor, Fatick	OFPEP Winrock	Improved seeds, live fences, composting, field trees	Agents of project, village farmers, representatives from women/s group

### 1.2.1 Presentation of NRM Results

The results included in this presentation are composed of: a) results obtained in the 1997 site-specific KAP surveys conducted by the different SO2 Activities in the USAID/Senegal NRM portfolio, b) information collected during meetings organized with villagers and through the use of a simple questionnaire for a small number of household sampled while visiting some 22 villages in the 200 - 700 mm rainfall zone in the vicinities of the Thies, Diourbel, Kaolack, and Fatick regions and c) “contextual” results obtained through field visits and informal discussions with villagers and rural producers. Additional information has been compiled from the extensive literature generated by NRM program activities, USGS environmental monitoring project, and site-specific diagnostic surveys using PRA techniques. It is important to recognize that these results reflect progress achieved only in the areas covered by the current NRM project portfolio.

This limited assessment was not intended to provide a comprehensive review of the results of USAID investments in NRM. The team had to rely primarily on existing data from regular reporting and monitoring of ongoing activities as well as information gathered during site visits to identify significant changes in the behavior of rural producers, with particular attention to the major trends in adoption of selected NRM practices by these producers. Because of a shortage of time, only limited use was made of the more in-depth evaluations of the individual activities and program assessments which have been carried out by the mission. One team member did review the data compiled in a series of national household surveys of knowledge, attitudes and practices (KAP) related to natural resources management which were carried out in 1992, 1994 and 1996. The team also reviewed a sample of diagnostic surveys and land use plans which were prepared using

participatory rural appraisal (PRA) techniques, as well as several site-specific KAPs completed by individual projects in 1997. Detailed findings are presented in Chapter 2.

### **1.2.2 Case Studies and Analysis of Synergies and Lessons Learned**

Five case studies based on field observations were prepared to demonstrate the synergies among NRM, private sector, decentralization initiatives, and to illustrate differences between approaches to promote improved NRM practices. The case studies include four elements: a) detailed descriptions and context of the activities observed, b) analysis of the activities in the context of the Mission NRM SO, c) the results, and d) the impacts. A summary of lessons learned is provided after the presentation of the five case studies. The descriptive part follows an approach similar to that adopted in the “Opportunities” Study (1988) described above. The synergies described among the NRM activities and the new SOs are inputs in support of the new Country Strategic Plan (CSP) presentation. The lessons learned from each case study are the “raw materials” for improving the design and implementation of NRM activities in the future and for improved R4 reporting.

### **1.2.3 Information Management System**

The TOR indicated that there were incompatibilities with the Mission’s current IMS (i.e., the KAP survey data bank) that needed to be addressed by the assessment team. The approach taken was to: a) carefully compare the questions asked by the national KAP surveyors and those asked in the site-specific KAPs carried out by the several projects; b) assess the usefulness of the information obtained in the KAP surveys; c) assess the sampling methods used (random vs. stratified sampling); and d) assess the effectiveness and ease of use of the IMS for analysis and results reporting.

## **1.3 Organization of the Report**

The report is organized into six sections and seven annexes. Section 1 provides the background for and approach to the assessment. Section 2 provides quantified results of NRM investments in Senegal in the context of the targets and intermediate results set; i.e., estimated rates of adoption of different NRM practices and their associated economic, environmental, and socio-democratic impacts, and spread effects beyond areas of intervention. Section 3 presents the five detailed case studies complete with descriptions and context of the activities undertaken, analysis, and synergies among the current NRM SO2 and the proposed new SOs on decentralization and private sector initiatives. Section 4 provides the team’s analysis of the impacts of USAID’s NRM portfolio in terms of lessons learned, the enabling conditions, other contributing factors, and constraints to adopting the different NRM practices. The USAID/Senegal information management system, its problems, and possible solutions are discussed in the Section 5. Section 6 provides a summary of the conclusions and recommendations.

## **2. Results of Five Years of NRM Investments**

### **2.1 Introduction**

It is evident from the observations made by the team that there have been significant impacts of five years of investment in promoting improved NRM in Senegal. Quantifying those impacts and comparing them with baseline information from 1992, however, has proved a daunting task. This section begins with a description of sources of baseline information followed by a discussion of targets and indicators. A presentation of both quantitative and qualitative results is then concluded by an assessment of the economic, environmental and socio-democratic impact of those results. A final section assesses impact in qualitative terms of the spread effect of the direct investments.

### **2.2 Baseline Data for NRM SO2 Results Reporting**

#### **2.2.1 Knowledge, Attitudes and Practices Surveys (KAP)**

As part of the process to measure and evaluate the impact of its development strategy, USAID/Senegal instituted a series of surveys known as the KAPs. Three of these surveys have been completed, in 1992, 1994, and 1996. The KAPs are formal surveys that emphasize the gathering of information regarding agricultural activities and NRM practices used by rural producers. The surveys are conducted on a random sample of households drawn from different regions of the country. In 1992, the sample population was the five regions considered to be in the area of reliable rainfall (>400 mm/year). The sample population was expanded to include the entire country for subsequent surveys, though comparable subsets are used for comparisons among the KAPs. Data from the 1992 KAP has been used as the baseline for API and later R4 reporting since 1994. The reliability of the 1992 KAP survey and limitations of using it for baseline information are points that are discussed in later sections of this report.

#### **2.2.2 NRM Practice Inventory**

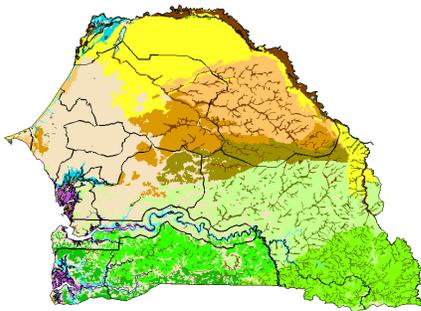
In addition to the KAP, an NRM practice survey was conducted in late 1992 to serve as a point-of-reference for the NRBAR project (NRBAR 1993). The inventory has much useful information regarding the knowledge and use of NRM practices throughout Senegal, but due to its qualitative nature, is unsuitable for use as a quantitative baseline.

#### **2.2.3 Baseline Survey for AFRICARE/KAED Project**

Conducted in 1994, this survey has the potential to be used as a results baseline for the KAED activity, but it lacks any reporting of NRM practice use rates. This is due to a flaw in the original questionnaire that was modeled after the similarly flawed questionnaire used in the 1992 and 1994 KAPs. The data can be quite useful for analysis or reporting on other indicators.

## 2.2.4 USGS/EROS Environmental Monitoring Project

In addition to the periodic KAP surveys, USAID/Senegal has supported a series of environmental monitoring activities that provide another valuable source of information about NRM in Senegal. This information has been collected in the mid 1980's and over the past four years in collaboration with the U.S. Geological Survey - Earth Resources Observation System (USGS/EROS) and the Centre de Suivi Ecologique (CSE) in Dakar. A wide range of data is available through both institutions, and can be used to refine the analysis of the impact of NRM investments.



**Figure 1: Vegetative Cover Map of Senegal.** Vegetation cover map of Senegal, showing distribution of grass and shrub savanna, savanna woodlands, mangroves and open forest

The USGS and CSE database includes information from satellite imagery, aerial photography and airborne videography and ground sites. The satellite imagery includes recently declassified coverage from the 1960's that can be used to compare changes in land use over the past 30 years, as well as low level oblique aerial photography dating from the mid-1990's. Airborne videography transects were flown in 1994 across the entire country, with a spacing of 40 kilometers in the east and 20 kilometers in the western region. In 1984 and again in 1994-96, extensive ground truthing was carried out to obtain ground level photography to compare changes over a 10-year interval. Data was collected from some 600 sites to monitor changes in the vegetative cover between 1984 and 1995. Soil samples were collected from a smaller number of

representative sites in 1995-1996. At this time, socioeconomic data was also collected through informal surveys with populations residing near the sites being monitored.

These data are available for use both in establishing baselines and in monitoring changes in the environment and adoption of certain NRM practices. A more thorough discussion of the USGS/EROS data monitoring system and its relevance to SO<sub>2</sub> results reporting is contained in Section 5.7 below.

## 2.3 Key Intermediate Results (KIR): Indicators and Targets

Indicators and targets have undergone some evolution since the FY92 Assessment of Program Impact (API) Report to USAID/W on the current FY1992-FY1998 Country Program Strategic Plan (CPSP). This evolution came as a result of many factors, including the change in the baseline year (from 1988 to 1992) in the FY94 API and the implementation of a set of recommendations made in a performance audit in 1997. The result of this evolution was the development of a measurable set of indicators that are intended to provide evidence of progress in the realization of the strategic objective. The selected indicators show progress at the level of KIR B, which is stated as "Improved NRM technologies mastered and used by farmers." Indicators reported in the FY1996-FY1999 R4 continue to track the percentage of households that use specific NRM practices, but reduce the number of practices from ten to seven. The seven practices tracked include live fence, compost, improved seeds, windbreaks, fallow, manure, and field trees. The 1998 targets are listed in Table 3. No targets were set for this reporting year (1997).

## 2.4 Results

The challenge to deliver a quantitative assessment of the results of five years of NRM interventions is due primarily to the inherent nature of NRM activities. The multitude and creative variety of NRM practices adopted throughout the country (PVO/NGO reports on more than 80) make it extremely difficult to find a common denominator among them. Furthermore, the impact of many NRM interventions is not always realized in the short span of time over which measurement of impact is taken. Nevertheless, results are being achieved, not only in the areas of direct program intervention, but on land and in communities across the country. The following sections attempt to quantify these results as they relate to achieving the strategic objective.

### 2.4.1 SO2: Increased Crop Productivity Through Improved NRM Practices

Though the content of reporting often focuses on intermediate results, this assessment noted that in many places, results were being achieved at the level of the SO itself. Crop productivity was enhanced in a number of places as a result of the adoption of quick-acting NRM practices such as composting and water management. Longer term impacts are also now being realized at sites where NRM interventions have been practiced for a number of years, such as the recovery of salt-affected soils and windbreak plantations.

The Southern Zone Water Management Project was responsible for installing anti-salt dams and other conservation structures to reclaim, protect or improve 10,000 hectares of land in 22 valleys that were threatened with or had been lost to production. Desalination of agricultural soils is a long-term process that requires numerous cycles of flushing with fresh water and ongoing chemical and biological treatment, but significant results can already be observed. Soil tests conducted in 1992 and



**Figure 2: Windbreaks and irrigated green beans, Dakar Region.** *Leucaena leucocephala* windbreaks and compost are part of Khassim Ndour's cropping system that produces record yields of green beans for export.

clippings and bean hay for cattle feed, manure and straw for compost, he makes a yearly application of 30 tons of compost per hectare. His resulting yields that approach 17 tons per hectare of green beans are the record for the country. More details of Khassim and his accomplishments are described in Case Study 5 (Section 3).

1997 show a reduction of electrical conductivity (a standard measure of the salt content of soils) of over 80 percent in some areas. Most notable is the return of native vegetation in many of the treated areas. Though agricultural production has yet to be resumed on all land undergoing reclamation, more than 4,500 ha were farmed in 1997. Average rice yields on this land were 1.45 tons/ha, more than double the pre-project yields of 0.7 tons/ha.

The Senegal Reforestation Project (SRP) finished in early 1995, but the impact continues. One of the project participants, Khassim NDour, established hundreds of meters of windbreaks around his 17 hectare irrigated farm with project assistance. In a tightly integrated system that uses tree

Sometimes the simple choice of using the appropriate seed can give significant increases in yields with no extra effort. Improved rice seed varieties have been promoted under OFPEP over a four-year period. Demonstration plots in more than 140 villages have led to the adoption of this practice by farmers in every village. The yield increases from this practice differed from village to village, but in no case was less than 20 percent. The adoption of improved varieties of millet seed also pays off. On-farm plot trials in 1995 showed an average yield increase of 117% just by using improved varieties. By the end of 1996, 695 farmers were using improved varieties in the six villages where these trials were conducted.

### 2.4.2 KIR B: Improved NRM Technologies Mastered and Used by Farmers

The SO2 level impacts reported above are significant but not generalized over large areas. In order to capture results on a wider scale, USAID/Senegal has chosen to focus monitoring efforts at the level of adoption of NRM practices by rural producers, KIR B. The targets and indicators of these results were presented in the previous section. Table 3 presents the level of achievement made over the five-year period covered by this report.

**Table 3**  
**Results of Five Years of NRM Interventions as Measured by KIR B Indicators**

Percentage of households using specific NRM practices					
Practice	Baseline KAP (1992)	SO2 Site Results (1997)		Target (1998)	
		Household	Women	Household	Women
Live Fence	2.7%	10%	7%	30%	15%
Compost	12.1%	20%	11%	12%	5%
Improved Seed	14.0%	24%	18%	50%	25%
Windbreaks	4.5%	13%	6%	20%	10%
Fallow	15.3%	37%	NS	55%	35%
Manure	51.7%	85%	34%	65%	35%
Field Trees	2.4%	50%	43%	60%	40%

Sources:

KAED: Connaissances et Pratiques des Techniques de GRN dans la Zone d'Intervention du KAED, 12/97

SZWM: Suivi-Evaluation Phase III, Rapport d'Analyse, 1996/97

CBNRM: Comparative Analysis of CBNRM Strategic Indicators, 9/97 and data tables from site-specific KAP survey

PVO/NGO: Contribution PVO/NGO Support Project a la realisation de l'OS2, 2/98

USAID/ANRO Knowledge, Attitudes and Practices Survey (1992), R. Kite, M. Keita and L. Thiam, ANRO 2/93

R4 FY1996-FY1999, USAID/Senegal, 3/97

The 1997 numbers in the table were derived primarily from surveys performed in the zones of intervention of four of the Mission's NRM activities (KAED, SZWM, CBNRM, and PVO/NGO support). They are complemented and confirmed by formal and informal field surveys during a ten-

day field trip in January 1998. Though consolidating this data is extremely difficult for a variety of reasons, an attempt was made to make appropriate adjustments and come up with averages that are indicative of adoption trends in the sampled zones. See Annex E for more details on the methodology used to arrive at the above reported numbers.

It appears from Table 3 that significant increases in the use of NRM practices have occurred since 1992 in the areas where intervention has taken place. In spite of the imperfections in the methodology used to generate these numbers, this assessment would confirm that these trends are reasonable estimates of reality. The trends for certain indicators do not appear to be of sufficient magnitude to attain the 1998 targets. The indicators that appear to be on track are compost, manure, and field trees, while the other four, live fencing, improved seed, windbreaks, and fallow appear to be lagging. A number of possible explanations for these trends are discussed below:

**Composting** appears to be a much more popular practice in intervention sites than in zones outside of project influence. Composting has been aggressively promoted and often subsidized as part of NRM activities, which most likely accounts for the high rate of adoption in intervention sites. The very real constraints of water and labor would explain the much lower rates of adoption elsewhere.

**Manuring** is a traditional practice it easily adopted and only constrained by lack of organic manuring materials. People are increasingly using whatever is available, especially since chemical fertilizer subsidies were dropped.

**Field trees** show an incredible increase in use rates, but it is now fairly certain that changes in survey methodology account for the major part of this increase. Cross checking the data with direct questions regarding the use of trees in fields show that field tree use rates are grossly under reported in 1992.

**Live fencing** may not be on track to achieve the target, but an almost fourfold increase in five years is an impressive increase. Live fencing use is an excellent indicator to track and will continue to increase along with tenure security and as a way to protect NRM investments.

**Improved seeds** are readily adopted where they are available, but lack of supply is the major constraint. Unless the measures are taken to increase supply to meet demand, this will continue to be a problem.

Use of **windbreaks** is not easy to monitor, as explained in section 2.6, so data on this indicator may not be telling the full story. See also section 5.4.2 for an evaluation of this indicator.

**Fallow** is growing in use, but not necessarily related to good soil management practices. See section 5.4.2 for more information.

Table 3 should only be used for purposes of general estimation of trends in the SO2 zones of intervention. No attempt has been made to measure the confidence interval or level of accuracy. The main reasons for the lack of statistically valid data are due to the differences of methodologies among these surveys. Additional details on this subject are provided in Section 5. A number of

problems with historic data should also be noted. Because of the questionable validity of data from the past KAP surveys, gauging the accuracy of the apparent trends is difficult. Given that targets were established on the basis of these trends, it is no wonder that targets may be out of relation with what can be reasonably expected.

The baseline figures for 1992 were based on questions asked of heads of households regarding practices used on land managed by the household. In 1996, an attempt was made to disaggregate the survey by gender, but with only partial success. Heads of households (mostly male) continue to speak on behalf of all land managed by the household, whereas female leaders are queried about practices that they use on their personal fields. Some have concluded that from the reported data, women have a generally lower adoption rate of NRM practices than do men. Though this may be the case, this conclusion cannot be justified from the data. One would have to ask individuals of both sexes about their personal practices in order to have the information necessary to reach that conclusion. As it stands, personal adoption rates by women are a **subset** of household adoption rates reported by heads of households.

### 2.4.3 Intermediate Results leading to KIR B

**IR B 1.0: Farmer Exposure to Improved NRM Technologies Increased.** Under the auspices of NRBAR, more than 2,200 rural producers were trained in a variety of NRM practices in 1997, more than double the initial target (NRBAR, Nov. 1997). Behind the numbers, of note is the fact that these rural producers were trained in collaboration with local and international NGO partners. Collaborative applied research with NGOs has been one of the themes of NRBAR and it has resulted in some very beneficial relationships. NGOs have benefitted from ISRA's high level of research capability and ISRA has benefitted from the grass roots feedback that only direct contact with rural farmers can provide. Also, under the auspices of CBNRMP, several NRM exchanges and study tours have been and are being undertaken to expose participants to different approaches to solving similar problems.

**IR B 2.1 Institutional Capacity of Organizations Strengthened.** The PVO/NGO Support Project conducted training sessions for institutions involved in the design and implementation of NRM activities. Training sessions included such themes as Participatory Rural Appraisal (PRA), Activity Monitoring and Evaluation, Adult Training Methodologies and Project Design. 19 such training workshops were conducted for 225 participants coming from 24 NGOs, 28 producer organizations, and six technical service groups. Some of the results of these training sessions include the following (PVO/NGO Support Year VI Annual Activity Report, Aug. 1997):

- # 1184 rural producers were trained in NRM technologies and practices by those that attended the Adult Training workshops
- # 27.3 percent of NGOs that followed the Project Design session were able to obtain grants from other donors
- # All NGOs are now contributing to the SO2 monitoring and evaluation system
- # A functional network of PRA trainers is now available

In addition, CBNRMP has sponsored the establishment of numerous NRM committees, trained their members, and assured the support of rural animators to provide technical assistance for

the implementation of the micro-projects. These activities (PVO/NGO Support, CBNRM and others) clearly demonstrate the significant effort and accomplishments achieved by USAID in enhancing the capacity of local Senegalese institutions to address their own problems in their own way.

**IR B 2.2: More NRM Technologies Validated.** Socio-economic analyses of several NRM practices have shown them to have a high rate of return, solidly linking adoption of NRM practices to increased revenues in rural households. The analysis also provides both potential adopters and NRM promoters with objective information to help with the decision-making process regarding promotion/adoption of NRM practices. Some of the practices validated include: composting, animal stabling, windbreaks, improved seeds, and rock dikes (NRBAR/ISRA, Jan. 1998).

#### 2.4.4 Other Significant Results

**KIR A: Land Investments Increased.** Based on site-specific KAP data in the KAED zone of intervention, a strong correlation was noted between security of tenure and adoption of NRM practices. Between 67 and 79 percent of those who adopted tree planting practices (living hedges, windbreaks, and field trees) indicated that they had a high level of tenure security based on purchase, inheritance, gift, or legal affectation (Africare/KAED, Dec. 1997). Also of considerable importance, CBNRMP has been instrumental in promoting, through the NRM committees, the issuance of landholding certificates to farmers adopting improved NRM technologies. In the communities of Diakho and Médina Sabakh these certificates clarify both private access to parcels and public spaces such as cattle trails and pasture lands.

**KIR C: Access to Commodity and Input Markets Increased.** Many participants benefitting from USAID's NRM investments have gained increased access to commodities and input markets, yet not in an easily measured sense. The mere fact that people (particularly the women's groups) who adopt the practices make more money, also means that their access to purchased material inputs has also increased. The real test is if the higher incomes earned are reinvested in additional revenue-generating capital that will cause incomes to increase even further. This phenomenon is clearly evident in the KAED project region. Dynamic women's groups have been taught and are meticulously practicing the basic skills of financial management and reinvesting the proceeds in different economic enterprises such as animal fattening and cereal banks.

**KIR D: Access to Capital Increased.** Money begets more money. Because the participants practice disciplined financial management with the additional income earned, this, in turn, has increased incomes yet further which has resulted in access to credit from the local banks. With access to credit, the women "have arrived" and are in the position to make substantial but safe investments on the road to becoming real and substantial entrepreneurs far removed from the subsistence-level existence to which they have been accustomed.

## 2.5 Economic, Environmental, and Socio-democratic Impacts

### 2.5.1 Economic



**Figure 3: Cash Box of the Darun Mongnagnene Women's Group.** Women are eager to adopt NRM practices that are linked to income-generating activities, and appreciative of their newly acquired skills in financial management

Over a two-year period, women's groups in the KAED project region who operate grain mills earned a net income of some FCFA 13.5 million (after all expenses not including the amortization of the mills). In addition, the women earn substantial incomes from the sale of crops harvested from the demonstration fields, the gardens, the feedlots, the nurseries and woodlots, and the cereal banks. Capitalizing on this new infusion of income, the women established credit systems for the group members lending small amounts of money for up to six months for additional income-generating purposes (not for consumption purposes). The income from the credit system consists of the interest paid (40 percent on an annual basis) which, even though high in absolute terms, is still sufficiently low to generate additional incomes for the borrowers (from small enterprise activities and the like). As

a result of the initial infusion of donor (USAID) inputs in the area, there has been a strong emergence of rural enterprises, particularly among the women, with the important side effect that food security has improved as a result of a diversified income base and lesser dependency on rainfed crops.

## 2.5.2 Environmental

The environmental impacts attributable to the activities of the USAID/Senegal NRM portfolio are substantial, although not quantified in this report. Obviously, there is a reduction in environmental degradation as increasing numbers of farmers adopt different NRM practices such as live fences, windbreaks, rock dikes, and composting. The latter is instrumental in changing the structure of the soils which increases infiltration rates, hence, scarce water is used much more efficiently. Live fences, field trees, and windbreaks reduce wind

### Women's group: Darou Mougnaquene

When asked how their lives have changed over the past several years, the women of Darou Mougnaquene spoke at length about the impacts and results of the KAED interventions. They pointed to the increased number of community-level actions, including the development of a new well and water extraction system, the establishment of their vegetable garden, the access of members to revolving credit which enabled them to engage in profit-making transactions, the purchase of several teams of oxen by the group, the opening of a bank account and access to commercial loans. They were proud of their newly developed skills in reading/writing, financial management, and noted that they no longer had to use separate plastic bags to keep track of their money, but could manage their accounts using a notebook. The group now had a treasurer which looked after their funds, working together with the group's president. They were appreciative of the training which had been provided to help them increase the productivity of their farms. They cited a number of NRM practices which both men and women now use in the village: windbreaks, stone lines, composting, live fencing, regeneration of *Acacia albida* and planting of fruit trees. They said that knowledge imparted from their training activities was a gift which could not be taken back - and which the women were using to train their husbands. They also remarked on the participatory approach adopted by KAED which made them responsible for decision-making—unlike assistance provided in the past.



**Figure 5:** Improved Wood Stove, Teug Daara. Skilled potters can make an improved woodstove in 2 hours at a cost of 1250 CFA. With an improved stoves, fuelwood is used more efficiently, and a woman can cook 7 meals instead of 3 with a bundle of wood.

erosion, increase fertility, and provide much improved micro-climates for the farm fields which, in turn, attracts more rainfall. A little investment in NRM practices will go a long way in terms of restoring the environmental integrity of the areas. More importantly, the efforts to reduce fuelwood consumption by promoting the increased use of improved wood stoves has had a significant impact on the consumption of fuelwood.

### 2.5.3 Socio-Democratic

The socio-democratic impacts are closely linked to the economic impacts as higher incomes begets increased empowerment of women and women's groups. As income-generating possibilities appear on the horizon and the means (appropriate "pump-priming" subsidies) and organizational abilities (literacy training, financial management training, and the like) are present, the women's groups tend to gel socially and economically into dynamic institutions with a momentum of its own. New-found freedoms and opportunities to assume control over their own economic destinies take root and the women often experience a rapid exodus from subsistence-level poverty. Poverty will, more often than not, still persist, however, but be much less severe than before when subsistence was at the mercy of factors not under their control (the weather, farmers are price takers, not price makers, etc.). The initial breaking out of the vicious circle of poverty is crucial in terms of fostering the social dynamic observed so important to further development. Once this initial step is well underway, the women's groups will typically assume much more prominent roles in the GIEs and as participants on NRM committees in their villages.

Equally important to the excellent progress made by the women's groups is the progress made through CBNRMP sponsorship of good governance and democratic procedures in the NRM committees established and functioning in the 15 CRs where the project is operating. This is a significant development, indeed, one which should be aggressively spread and firmly established throughout the entire country as CBNRMP continues and through additional efforts under the auspices of USAID/Senegal's new SO portfolio.

## 2.6 Spread Effects

The spread effects of the NRM practices promoted through USAID/Senegal's NRM activity portfolio are difficult to determine quantitatively, unless what constitutes adoption is clearly defined. The intent of the national KAPs is to estimate knowledge of and the rate of adoption and/or use of

certain NRM practices<sup>2</sup> in the country as a whole based on a random sampling of households in all regions. Yet many impacts are not captured if the definition of adoption is narrow (for example, a windbreak less than X meters in length will not count as adoption). Farmers will adopt new NRM practices if they are convinced that higher yields and higher incomes will be the result, but only within their own time and cash constraints, and the tenure status of their fields<sup>3</sup>. Consequently, adoption is typically spotty and not significant enough to be captured in the national KAP surveys (some, however, would be captured in the site-specific KAPs). The assessment team observed, during the field visits, that farmers were indeed adopting by planting **beginnings** of what may eventually become windbreaks (five to 10 trees), or live fences with five to 10 meters of *Euphorbia* scattered about the landscape, but not yet to the extent where the activities had any significant impact on the productivity of the farm fields. The importance of these observations is that farmers have apparently gained the knowledge of the practices and have begun to adopt in their own ways and in accordance with their own time and cash constraints.

Spread effects are also closely and obviously related to the presence of a donor project or an outside funding source (NGOs) providing technical assistance and demonstrations of the different NRM practices. More often than not, in the areas visited by the team, there are clear differences between the farm fields in a village covered by a project and one not covered. In the case of the former, for example, more biomass would typically be left on the fields as soil protection, including regenerated *Guera senegalensis* after harvest than would be the case for the latter (see comparisons of team fields).



Within the villages covered by a project or an NGO, it is not unreasonable to assume that the **knowledge** of the improved practices extended will be 100 percent; i.e., the project activities will be known to everybody as the villagers participate in defining the priorities. Once the initial participatory step is well underway or completed, the project will then mobilize the resources and begin the physical implementation using different approaches, all associated with different levels and kinds of subsidies and incentives. One approach could be to subsidize the construction of a cement compost pit to use as a training facility on how to do proper composting and not subsidize anything beyond that; another could be to provide low cost credit for the construction of compost pits for participating farmers; and yet another could be a cost-sharing arrangement between the

**Figure 6: Farmer-managed Natural Regeneration, West of Niore, Kaolack Region.** Increasing number of farmers are actively managing the regeneration of shrubs and trees in their farm fields to retain more biomass, to protect the soil from wind and water erosion, and to increase production of fuelwood, poles, fodder, edible fruits and other minor forest products. This NRM practice is more common where farmers have been assisted by CBNRM activities.

<sup>2</sup> There is a clear distinction between the rate of adoption and the rate of use—the latter is reported in the KAPs. The rate of adoption is the number of people who use the technologies vis-a-vis the total number of HHs who **know** about them (i.e., you can only adopt what you know). The rate of use is the number of people who use the technologies vis-a-vis the total population. Thus, the rate of use will always be lower than the rate of adoption.

<sup>3</sup> The likelihood of adopting improved NRM practices on borrowed or rented land, for example, is typically low.

project and participating farmers who agree to construct and use the pits. All of the approaches would involve some level of subsidies for the recipients.

The NRM-practice knowledge quotient will be substantially lower elsewhere in the region, particularly outside the defined project zone, even in neighboring villages, where the presence of the project has not yet been established. Villages without the presence of activities such as KAED, CBNRM, Winrock, Rodale, and PVO/NGO and others will be without the catalyst of women who receive literacy training and then transform into much more dynamic and socially cohesive groups with a stronger orientation and motivation to increase their economic livelihood prospects. Although the groups exist before projects arrive on the scene, they will typically not “gel” without an outside catalyst. This may, in part, be attributable to the phenomenon that recipients may choose to wait for the outsiders (NGOs or donors) to arrive, not sensing the urgency to seize the initiative and learn from the neighboring villages on the off-chance that, should they adopt too early, they may lose out on whatever subsidies and direct financial incentives a donor or NGO typically brings to the villages.

## 3. Case Studies

### 3.1 Introduction

Five short case studies are presented in this section to illustrate how villagers are responding to USAID/Senegal's presence in their areas and to flesh out the synergies among improved NRM and the new decentralization and private sector SOs. Although the case studies are anecdotal, they are representative of NRM needs, constraints, and opportunities in the areas visited, not only based on the observations made by the team, but also on the basis of similar situations in other sub-Saharan countries as witnessed for several years by the team members (most notably from Niger and Burkina Faso).

### 3.2 Case Studies

#### 3.2.1 Case Study 1: Keur Kouthieye, Rural Enterprises

##### # The Context

Keur Kouthieye is a Wolof village located in the Kaolack region (in the Ndiedieng arrondissement, in the CR of Keur Socé, see map showing location of KAED activity sites). The population is composed of 846 individuals of which 458 are males, 388 are females. Significantly, it is the home village of an important marabout who has substantial influence throughout the region. The major crops grown include millet and peanuts, and the farmers also raise livestock—cattle, small ruminants, and chicken. The team visited the 50-member women's group responsible for carrying out the work associated with the KAED activity.

As background, the area around Keur Kouthieye is characterized by the use of animal traction agriculture extended by SATEC—Société d'Assistance Technique, and SODEVA—Société pour le Développement et la Vulgarisation Agricole since 1963. Since 1963, the area cultivated in crops has increased substantially, including the conversion of pasture land to cropping, largely because animal traction made it possible. Another contributing factor for this increase is the demographic pressure, including an influx of immigrants from other areas. Finally, as was the case for the Sonkorong case study (see below), farmers were obliged to practice extensive farming because of the GOS decision in the early to mid 1980's to abandon the policy of subsidizing agricultural inputs, notably chemical fertilizer. As a consequence of this evolution, the area is today characterized by little remaining pasture, with the presence of only few on-farm trees dispersed throughout the farm fields, mostly *Cordyla pinata* (no more than 10 trees per hectare maximum). Water erosion is also intense and the soil is degraded, rainfall is declining as the vegetative cover is decreasing, hence, crop yields are steadily declining over time as well. The population is faced with a dire and worsening situation with respect to food security, health and education.

## **Include Map**

The population of the village developed survival strategies in response to this evolution of dire circumstances, by: a) increasing commerce in the weekly markets to sell dear what they pick up for less in other areas, b) selling livestock (depleting their “savings account”) to compensate for lower crop yields and lower incomes, c) migrating to urban areas; d) increasing the use of manure to offset the lack of (the previously subsidized) chemical fertilizer. All of the above reflects the context in which KAED arrived on the scene in the village of Keur Kouthieye in 1994.

## # The Activities

KAED’s activities in Keur Kouthieye include many of the activities in the “menu” extended by Africare in the 56 ABEs covered by the contract. Briefly summarized, the activities start with the **demonstration site** intended for the production of mostly millet and peanuts. This (roughly) 4-hectare site, typically more degraded than neighboring farm fields, is allocated to the project by the village for the purpose of demonstrating different NRM techniques that will increase millet and peanut yields over and beyond the typical yields obtained on neighboring fields.



**Figure 7: Windbreak around KAED demonstration site.**

Windbreaks reduce wind erosion and increase farm production (crops, wood, fodder). The cash income from the sale of crops produced in the demonstration sites is used by KAED women’s groups to support the expansion of income-generating activities

regenerating naturally inside the 4-hectare plot. Also included as part of the demonstration site is the construction of a large compost pit intended to produce two loads of compost per year to enrich the soils in the demonstration site.

Common to all villages covered by KAED, the demonstration site is first fully enclosed by three rows of different vegetative cover: a) the first row is a live fence—salane (*Euphorbia balsamifera*) which is common and well-known throughout the area, b) row two is another live fence consisting of a mix of *Parkinsonia aculeata* and/or *Prosopis africana* intended to eventually replace the salane, and c) row three is planted in *Acacia holo*, a fast-growing tree established as a temporary windbreak in a third line. The holo quickly establishes itself and thrives in the dry zones, it functions as a windbreak until the trees can be replaced by the 2nd row Parkinsonias and/or Prosopis when they have matured and when they function equally well as windbreaks. The holo is a short-lived tree (approximately eight years) unless managed with occasional branch pruning (in which case it will coppice and stay alive). It could be used as fuelwood although it is not yet known for this purpose in the KAED project region. Another agroforestry activity which is being promoted is the protection of *Acacia albida* trees

**Gardening** (*maraichage*) and a **nursery** are also major activities promoted by KAED. The small garden plot is enclosed by a chain link fence to eventually be replaced by a live fence, including a well and animal traction to draw the water. A well is also provided for the nursery. The purpose of the nursery, of course, is to produce tree seedlings (including fruit trees) for the demonstration site and around the garden plots, and more importantly, to sell to neighboring villages. KAED also supplies **agricultural materials** (shovels, picks, watering cans, etc.) and materials for the construction of a **cereal bank** building to stock cereals bought for a low price at harvest time and

resold when supplies are low. In support of these physical activities brought by the project, KAED also facilitates access to **credit** by way of providing repayment guarantees to the local banks through the Caisse National du Credit Agricole au Sénégal (CNCAS). A key component of the project is to provide **training** in a variety of technical and managerial topics<sup>4</sup>.

## # The Results

The Keur Kouthieye women have benefited considerably from the presence of KAED in the area, probably much more so than may have been anticipated (see discussion on impacts below). The results have been impressive and incomes have indeed increased substantially. In terms of some specific results, production on the initially heavily degraded demonstration site has reached an impressive 1.5 tons of peanuts harvested per hectare, and 760 kg of millet harvested per hectare (1995-96), substantially higher than on the neighboring farm fields because of the work carried out under the guidance of the KAED extension workers plus use of substantial amounts of fertilizer and favorable rains that year. These results are significant in view of the fact that the quality of the demonstration site given to the project was low compared to the rest of the farm fields in the area, and despite the fact that the women were respecting the optimal times for seeding and weeding on



**Figure 8:** Cool season gardening and nursery production in Keur Kouthieye generate income while conserving natural resources. Buyers now come to the village and pay 5000 CFA for a 10 meter plot of lettuce.

their own fields before they carried out the same work on the demonstration site. The total revenue obtained from the demonstration site in the 1995 - 96 season was FCFA 622,830.

On the garden plots, the women produced onions, cabbage, lettuce, potatoes, hot peppers, jaxatu (a Senegalese vegetable), and tomatoes generating a total revenue of an estimated FCFA 175,000 (the exact numbers are not available). The nursery produced 2,920 seedlings during the same season creating an estimated value of nearly FCFA 200,000 (based on FCFA 50 plant for most of the plants up to a value of FCFA 1,000 per fruit tree seedling of high quality), less approximately FCFA 85,000 reflecting the production costs. The women's group also borrowed money from the bank to establish a revolving credit fund whereby members could borrow small amounts to be repaid after six months with a 20-percent interest (40 percent per year). All

transactions (amounts borrowed, reasons for borrowing, and the reimbursement) are meticulously recorded in a notebook. Nearly 100 percent of the loans have been repaid.

## # The Impacts

The observations made by the team indicate that KAED's presence in Keur Kouthieye and other KAED sites has been a major catalyst for mobilizing the women's group into a cohesive and stronger

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<sup>4</sup> Training is provided in several topics, including: nursery techniques, improved woodstoves, gardening, animal fattening, composting techniques, erosion control, soap making, tree planting, small commerce techniques, financial management, and most importantly, literacy training.



**Figure 9: Cereal Bank, Keur Ali Samba.** KAED investment has enabled some groups to establish cereal banks, which provide another means to generate income from agriculturally-based enterprises (ABE's)

social entity than before. The activities promoted by the project and the responses by the women's group have fostered many of the synergies sought, such as: a) a stronger and dynamic private sector, b) a stronger civil society, and c) dynamic group organization. The women, members of fairly weak "association" before, were clearly galvanized into action with the arrival of KAED, even to the point of fining group members who show up late for the communal work to be carried out. The results speak for themselves—many (if not most) of the women in the groups have gained literacy, which begets independence and freedom never before experienced. This, in turn, fostered a collective enthusiasm for pursuing new business ventures such as animal fattening and cereal banks made possible as a result of gaining access to KAED-guaranteed credit through local banks. Higher incomes resulted and a revolving credit fund was established with which the women could engage in a wide variety of

income-generating pursuits. All loans, reasons for the loans, and payback are duly recorded. The social dynamic of the group and its keen focus on capitalizing on economic livelihood opportunities has clearly elevated the economic status of the group to a higher level. Credit worthiness has been firmly established with the local banks and the KAED-guarantees are gradually being lowered. All of the above comprise strong evidence for the synergies between the activities of the project and the empowerment of the local people to assume the responsibility for their own economic development and welfare.

Beyond the Keur Kouthieye women's group, however, the spread effect on the village farm fields is spotty at best. The enthusiasm observed among the women is obviously related to the increased incomes they earn as they care for the KAED **communal** demonstration site (the installation of which was subsidized by the project), collect revenues, and reinvest them in gardening, animal fattening, cereal banks, or other mini-projects to generate yet additional revenues. One obvious problem is related to the fact that women have little or no access to land of their own. Hence, they cannot spread the adoption of the practices on their own fields unless their husbands approve. Although the women say the husbands are adopting, the physical evidence of any significant spread effect of the kind that would be registered in a KAP is missing. What is encouraging, however (as was discussed in Section 2.6 above), is that individual farm households are beginning to adopt very slowly by planting three or four seedlings as the beginning of a windbreak, and/or perhaps five to 10 meters of *Euphorbia balsamifera* (salane) as the beginning of a live fence, or perhaps devise some low-cost method to protect naturally regenerated *Acacia albida* trees, etc. Few such spotty starts will register in any of the KAPs although they are significant with respect to **knowledge** of the practices and **willingness to adopt** them. Universally lacking is the financial means to adopt on a larger scale, and perhaps more importantly, the time. The adoption on

individual farm fields is also hampered because subsidized inputs are not available for individuals, only for the KAED demonstration of and training in the “how-to’s” of the technologies<sup>5</sup>.

### 3.2.2 Case Study 2: NRM Committees (CBNRM)

#### # The Context

Over the past several years, USAID/Senegal has completed periodic surveys of the knowledge and practice or use of NRM techniques by the rural population of Senegal. These surveys indicate that the level of knowledge of selected techniques generally exceeds the frequency of use of those techniques. **With the support of the CBNRM Program, assistance is being provided to reduce the gap between knowledge and practice.** The program also aims to accomplish this in a manner which promotes decentralized and participatory approaches to land-use planning and improved use of natural resources, so as to achieve sustainable increases in agricultural production and rural incomes. The program is organized to provide support in several critical areas, including: community organization and planning, training and improved access to technical information, and co-financing of interventions within targeted rural communities.

Interviews with village leaders and site visits reveal that community-based actions to address environmental degradation and rural poverty are, most often, not constrained by a lack of awareness of the problem. Rural producers are keenly aware of the reduction of tree cover in farm fields and steady expansion of cultivated land. They recognize that even relatively shallow soils in the upper reaches of the watersheds are being converted from pasture to farm land. They are especially concerned about the declining fertility of permanently cultivated soils. With the elimination of fertilizer subsidies and the reduction in the use of chemical fertilizers, they have tried to compensate by using manure and raising the density of seeding their peanut fields. However, they are unable to maintain soil fertility with current farming practices. And, unsustainable farming practices are contributing to sheet and gully erosion. As environmental degradation proceeds, farm production declines and poverty increases. These problems are understood, but as one woman in the village of Djouffeine (Bambey region) explained: “Where there were 10 trees, now only three remain. We need more trees in our fields to reduce the erosion and to protect the soil. We know that our survival depends on our soil. But that problem cannot be addressed by an individual. It must be addressed collectively.”

The reasons behind the gradual reduction in the density of agroforestry species such as *Acacia albida* and *Cordyla pinnata* and associated acceleration of erosion and depletion of soil nutrients are complex. Included among the major reasons are poor management practices such as: a) the elimination of fallow, b) increasing grazing pressure, c) lopping of branches for fodder, d) scraping of bark for medicine, e) systematic cutting back of vegetative reproduction (sprouts of

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<sup>5</sup> “Lack of means” is used by many as an argument for higher project subsidies in order to increase adoption. The other side of the coin, however, is that yet more subsidies will contribute to an already high degree of dependency among the beneficiaries. Once subsidies are common in an area, they are very difficult to undo and the incentive to solve problems without them is reduced. So long as outsiders are always waiting in the wings to step in and solve the problems with yet additional funding infusions, adoption without any subsidies (*mesures d’accompagnements*) will likely remain sluggish. The issue should be resolved at the design stage. Subsidies should only be used only as a pump-priming measure, perhaps only be applied in the context of demonstration activities, and rarely as direct financial incentives to attract participation.

woody plants in cultivated fields), and f) multiple constraints on the increased use of manure and compost. All of these are a direct function of increased population pressures—more people demanding services from a fixed resource base—and a generally declining rainfall pattern. Given these complexities, people often feel constrained in their ability to respond. The community-based land use planning effort supported through CBNRM empowers people to organize both the collective action and changes in individual behavior needed to restore the productivity of the community's natural resources and reverse the downward spiral into poverty. The newly developed intervention strategies supported by CBNRM bring a community together to a point where people can learn from and encourage one another to a much greater degree than possible through the classic approaches to extension. This enabling process and a new participatory approach is now being supported in dozens of *Communautés Rurales* (CRs) in Senegal.

## # The Activities

While development assistance has been provided for many years to the rural sector in Senegal, it is only recently that the approaches have evolved to transfer decision-making to the rural communities. Under the provisions of decentralization legislation adopted in 1997 with the support of the CBNRM program, the elected representatives of the *Communauté Rural* are responsible for decision-making. The CBNRM program provides assistance to the CR to analyze their problems and to develop a 10-15 year Land Use Management Plan (LUMP) to address the critical constraints to reducing environmental degradation and to improving NRM. A, democratically elected NRM Committee (*Comité GRN*) is organized and legally mandated by the elected representatives of the CR to oversee the diagnostic studies and the preparation of the LUMP. After the LUMP is completed and adopted by the CR, the CR then decides on the priority actions to undertake over the next three years to implement the LUMP.

Since the work of the CR and NRM Committee is carried out within the enabling framework of the decentralization legislation, the resulting LUMP is a tool which the CR can use to encourage and guide assistance provided by other development assistance agencies. In fact, the CBNRM program is now organizing training in negotiation skills to help the CR's interact more effectively with other development partners collaborating in the implementation of the LUMP. For example, the European Development Fund (FED) is becoming involved with CR's in the Fatick region, while discussions are underway to mobilize funding from CILSS/FED and NGOs to support NRM plans prepared by rural communities in the Bakel and Kolda regions. To date, participatory planning and preparation of LUMPs have been organized in some 15 CR's in five major regions: Kaolack, Fatick, Kolda, Tambacounda and Bakel.<sup>6</sup>

The NRM plans being prepared with the assistance of CBNRM are taking advantage of the prior experience and lessons learned from earlier NRM activities in Senegal and elsewhere in the Sahel. Program oversight is provided by an interministerial committee and by an Advisory Committee (*Comité de Suivi Technique or comité consultatif*) which brings together the major partners supporting NRM activities in Senegal. This committee has helped the program to share information and to develop a consensus among NRM specialists on the most effective approaches

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<sup>6</sup> Program assistance to the Casamance region will be continued as soon as the security situation improves.

and NRM techniques that merit support. Recognizing that it is better to see with your own eyes than to hear about successes in other areas, CBNRM has also taken the initiative to organize visits to other participatory NRM and community-based land-use planning activities in the Sahel, including a number of successful programs underway in Burkina Faso. Representatives of the CRs, NRM committees and district technical services (*Centre d'Expansion Rurale Polyvalent* or CERP) participated in these field visits, and have returned to their local communities with a renewed sense of enthusiasm and confidence to restore the productivity of their natural resources. Delegations from other countries (Niger and others) have visited the CBNRM project, and have been inspired by the innovative use of elected representatives and NRM committees, and the changed relationships between rural communities and government technical services. In Niger, the government has opted to recruit multidisciplinary teams to provide support to rural communities; the decentralization of rural administrative services is also underway, but not yet linked to the efforts of community-based land use planning. In Senegal, the elected representatives of the CR's are empowered to oversee the work of the government technicians who are now accountable to these decentralized structures.

Over the past two years, the CBNRM program has invested in training in a variety of areas needed to build community-level planning and organizational capacity. This includes familiarity with the use of Participatory Rural Appraisal (PRA), conducting meetings and group decision making techniques<sup>7</sup>, financial management, literacy, and numeracy training, provision of vehicles, equipment and technical support to the fields agents working with the district technical services (CERP), as well as organized field visits to other projects and sites of NRM interventions within and outside of Senegal.

## # The Results

To date, some 146 micro projects are underway under the guidance of the CGRNs (whose role is to review and approve the micro-grant proposals) in the five CRs for which the first tranche of Land-Use Management Plans (LUMPs) have been completed. The 146 projects (representing a full range of activities such as composting, reforestation, nurseries, rock dikes, etc.) were selected from a total of some 600 submissions by individuals or associations. The selection process is rigorous and choices are made on the bases of the NRM priorities established in the LUMP and the abilities of the applicants to share costs. Another 10 LUMPs had been prepared by September 1997 in the second tranche and applications for micro-projects are being solicited.

In all of the CRs for which the LUMPs are completed, the CGRNs are created and functioning, having already received training in several technical and managerial areas, including training in financial management. In addition, CBNRM has established a formal partnership with the CERP in all 15 CRs.

## # The Impacts

It is too early at this stage to measure any significant impacts from the 146 micro-projects already underway. The stage is set, however, for CBNRM to promote the spread effect of the

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<sup>7</sup> PRA is known as *Methode Accélérée de Recherche Participative* or MARP in Senegal.

different activities as soon as results in terms of higher crop yields and higher incomes are manifested. The project is currently at the crossroad between the first and second phases. The first phase consisted of formalizing and streamlining the process of preparing the LUMPs based on the participatory approach. The second phase is now beginning with the implementation of the micro-projects which are intended to demonstrate the benefits of adopting improved NRM techniques. In this process, CBNRM is now changing directions with a view to: a) increasing the involvement at the local community level (with training and other activities) to promote the spread effect of the micro-projects among the communities, and b) begin the process of ensuring the continued role of the CGs after the end of the project, through laying the groundwork for making credit increasingly available in the CRs in lieu of continued donor infusions of subsidies. The importance of CBNRM to USAID's new SOs is long-term in nature, with respect to both the decentralization and private sector SOs. The NRM committees (CGRN) are key actors in this process as they will pave the way for legislative initiatives to bridge the gap between the Decentralization Law and large scale implementation of lessons learned from the CBNRM pilot activities, particularly as the economic welfare of participating local communities improve as a result of the pilot activities.

The most interesting impact question concerns the synergy between using improved millet seeds and the new private sector SO. Increases use of improved seeds is explicitly mentioned in the R4 as one that should be adopted on a large scale as a result of the investments USAID has made in research. For improved peanut and rice seeds, adoption on a large scale may be the case, but for millet seeds this is not the case. When the Government disengaged from the improved millet seed production business, farmers essentially stopped buying seeds in the markets and relied on traditional seed selection methods from their own harvests to provide seeds for next year's production. The result has been an overall and gradual decline in the quality of the millet seeds and an increasing susceptibility of the millet crops to pests and diseases.

Given the now documented large increases in millet production in the Winrock/OFPEP project, therefore, the synergy between the practice and private sector mobilization to make large scale implementation a reality is missing. The question is why the private sector has not stepped in to produce improved seeds. There is a disconnect between farmers who want improved seeds and would be willing to pay high prices to get them, and private sector mobilization to produce them. In a free market, if there is a strong demand for a product, someone will mobilize to produce it, and if they make a profit in the process, others will enter the market, supplies will increase and the prices will fall. This market dynamic is very much absent today, and one that should be prioritized and addressed in the new USAID/Senegal SO for the private sector. Food security is the issue. Based on the few very promising results on crop yield increases already documented as a result of using improved seeds, Senegal stands to make substantial progress on food security if improved seeds were plentiful and inexpensive (as a result of competition in the private sector) all over the country. The private sector has yet to seize the initiative—it should be encouraged to do so by the GOS along with clear measures from the government as to how the process of improved seed certification could be facilitated at little cost to the participating producers. Although the synergy is yet to be established, USAID is very much poised to address it aggressively through the new Soss.

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### **3.2.3 Case Study 3: Ndollor, Spread Effects of NRM Practices**

#### **# The Context**

This case study was carried out in the village of Ndollor in the region of Fatick, one of six villages covered under the OFPEP/Winrock project in the region, working in collaboration with the Christian Children Fund. This small village (46 households) located near Mbour some 17 km inland from the coast is plagued by low annual rainfall (200 mm + per year), low farm productivity because of degraded soils, and subsistence-level poverty. The aim of the program is to improve the economic well-being of farm households through the provision of improved millet seeds to use in conjunction with improved soil fertility practices. Team members traveled to the village with the Dakar Director of Winrock (Alphonse Faye) where they met with the project field people, extension workers, and several members of the village leadership, including members of the women's group.

#### **# The Activities**

The project is extending three basic NRM practices: a) improved millet seeds in association with improved soils resulting from composting, b) composting techniques, and c) live fences, all with the assistance from unpaid village-based extension workers and some minimal investments made by the project to get things started in the farm fields.

The approach taken in this effort is different, particularly with respect to the use of subsidies. In fact, the villagers stated themselves without any prompting from the team, that the value of the project was in providing some credit up front to get things started—subsidies or direct financial incentives were not used, or only sparingly<sup>8</sup>. With respect to the improved millet seeds (Souna 3), for example, the project has negotiated a contract with ISRA/Bambey for the rights to purchase the small amount of improved seeds ISRA can produce per year. The project initially gives these seeds to seven carefully selected seed growers in the region who are contractually mandated to multiply the seeds on manured or composted fields. In turn, these farmers sell back to the project 50 kg of the best seeds for FCFA 275 per kg. This increased supply is then resold on credit to the participating farmers who, at the end of **their** season, are obliged to reimburse the project three times the volume of seeds received (if they receive four kilo—enough to seed one hectare—they are obliged to reimburse 12 kilo of seeds from the crop they harvest).

This process continues for three years before it begins all over again with a fresh supply of improved seeds from ISRA. A maximum 3-year cycle is necessary because the relative quality of the seeds will gradually decline over time and the system must be restarted in order to maintain a high seed quality. Even after three years, however, the quality of the seeds is still considerably higher than the quality of the best millet seeds currently available in the local markets.

A second example, the project used a small fund of some 400,000 FCFA earmarked for the construction of cement compost pits (cement construction is favored because of the sandy soil texture in the area) in the village, each pit costing FCFA 30,000. To begin the process, the project would build some pits and give them to some of the farmers with the contractual provision that the farmers would use them. At the end of the farming season, they would reimburse the project FCFA 15,000 plus another 15,000 FCFA worth of crop (millet, and/or cassava) for the full total of FCFA 30,000. After that the compost pit would be owned free and clear. With the FCFA 15,000 collected from the initial group of participating farmers, the project would now have funds to begin construction on the next tranche of compost pits, and so the system continues until all farm households in the village has a compost pit. The use of compost is strongly recommended by the project as a means to capture the full benefit from the improved seeds.

A third example, the project also extended the use of live fences to fully enclose farm fields and protect them against livestock intrusion and provide some relief from wind erosion. In the enclosed fields (at least 1/4 ha in size) observed by the team, the farmers are obliged to assist the regeneration of naturally-grown tree species. Once the live fences are established, the farmers produce cassava with an initial supply of cuttings provided by the project. When the fields are in full production, the first tranche participating farmers are contractually obligated to give an equal number of quality cuttings to their neighbors—the second tranche of participants—who had also committed to establish the live fences and to grow cassava. The system is perpetuated without any further input from the project other than additional technical assistance where and when needed. Some farmers have expanded their surface area with live fences from the required initial 1/4 ha to one full hectare

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<sup>8</sup> Technically, all of the activities are subsidized in-as-much-as the beneficiaries receive money up front through the project to carry out the on-farm investments without an interest cost charged next year when the reimbursement is due. This OFPEP system, however, represents the lowest subsidy level offered to participants among all of the other Activities in the USAID/Senegal NRM portfolio; and, the results are very encouraging.

to produce more cassava (in addition to value of the cassava itself and the cuttings, the cassava leaves can also be sold in the local market).

## # The Results

The results are impressive. Crop yields from using the improved seeds have increased dramatically, by 181 percent (from 461 kg per hectare using the traditional long-duration varieties, to 1,298 kg per hectare using the improved variety). In other areas the, crop yield differences range between 37 percent increase (minimum) to 365 percent increase (highest). All of the increases are attributable to the combination of improved seeds and the use of compost. In addition, incomes have increased substantially from the increase in sales of cassava and cassava by-products (leaves and cuttings).

## # The Impacts

The impacts from these interventions in terms of adoption elsewhere are difficult to determine, at best. The immediate problem, of course, is that no impact can be expected from the improved millet seed intervention for the simple fact that the improved seeds are not available to buy—improved seeds are only produced in small quantities by ISRA/Bambey in the context of research, not for the entire millet-growing population. The impact, therefore, is only confined to the participating farm households in the project region. With respect to the live fences, the impacts in the project zone is considerable as nearly all farmers have adopted the practice. It is noted, however, that only the saline Euphorbia fence is extended because of its rapid growth, ease of installation, and effectiveness of the protection it offers. Not consciously extended are different kinds of windbreaks, equally efficient with respect to protection, but more valuable in terms of other products that can also be sold in local markets. The compost pits are also adopted and used by the farmers because composted fields are a prerequisite to participation in the improved millet seed program.



**Figure 10: Cemented Compost Pit, Tatène Serere, Thies Region.**

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Composting is an increasingly popular practice associated with NRM interventions designed to restore soil fertility and increase crop production.

Given the now documented large increases in millet production in the Winrock/OFPEP project, therefore, the synergy between the practice and private sector mobilization to make large scale implementation a reality is missing. The question is why the private sector has not stepped in to produce improved seeds. There is a disconnect between farmers who want improved seeds and would be willing to pay high prices to get them, and private sector mobilization to produce them. In a free market, if there is a strong demand for a product, someone will mobilize to produce it, and if they make a profit in the process, others will enter the market, supplies will increase and the prices will fall. This dynamic is very much absent today, and one that should be prioritized and addressed in the new USAID/Senegal SO for the private sector. Food security is the issue. Based on the few very promising results on crop yield increases already documented as a result of using improved seeds, Senegal stands to make substantial progress on food security if improved seeds were plentiful and inexpensive (as a result of competition in the private sector) all over the country. The private sector has yet to seize the initiative—it should be encouraged to do so by the GOS along with clear measures from the government as to how the process of improved seed certification could be facilitated at little cost to the participating producers. Although the synergy is yet to be established, USAID is very much poised to address it aggressively through the new SOs.

### **3.2.4 Case Study 4: Collaborative Research: Sonkorong**

#### **# The Context**

The village Sonkorong in the Kaolack Region (covered by ISRA/NRBAR) is an important research laboratory because of ISRA's strong presence there since 1968. ISRA provided technical assistance and subsidized agricultural inputs for several years in exchange for the right to test research results in a real farm setting. In the beginning, the main research themes included: a) animal traction, b) techniques for soil improvements including fertilizer, manure, and plowing methods; c) studies on improved seed production using different vegetative materials in which to germinate the seeds; and d) several socio-economic studies on a variety of socio-economic topics. The research results were tested by the farmers along with heavy subsidies for tools, agricultural materials (improved seeds, fertilizer, carts, cultivators, etc.), and infrastructure needed in accordance with the research protocol. The test results were encouraging, at least with respect to the biological responses. ISRA also promoted mechanized farming in the area in collaboration with ORSTOM and, in that process, launched a program to restructure fragmented land holdings in order to increase the efficiency with which farmers could work their land; i.e., by reducing the travel time spent between the different farm fields. This was successfully accomplished and the larger contiguous farm fields could be mechanized to a greater extent.

The Sonkorong farmers were, during those years, in close contact with the researchers only in an implementing capacity, not as participants in the process of elaborating priorities in a participatory way. They were, in essence, told what to do in exchange for receiving the materials, buildings, fertilizer, and improved seeds. All was well and the villagers were content with ISRA's presence.

In 1985, however, ISRA's presence in the area had ended and the farmers of Sonkorong were left on their own facing real problems without any of the subsidized inputs, most notably an increasing demographic pressure, and a decision by the GOS to abandon altogether the policy of

subsidizing agricultural inputs, particularly chemical fertilizer. In the beginning of this period, the demographic pressures obliged the villagers to begin clearing new land in order to increase production. This began in the upper watershed where wetlands covered by trees were cleared, areas that formerly would naturally contain all of the water during heavy rainfalls. The result was rapidly increasing water erosion. Then, when GOS no longer subsidized fertilizer or any other agricultural inputs, the problem was substantially aggravated. The price for fertilizer quickly increased from 25 FCFA to 145 FCFA per kilo—a level beyond the reach of the individual farmers. The farmers again had no choice but to continue the practice of extensive farming by clearing the only remaining land available for farming—the water-holding plateaus, gradually ruining its natural function to store water. The result was heavy erosion, often to the point where the entire village became inaccessible because of 4-meter deep ravines on all sides. In addition, all of the downstream farm fields were also heavily degraded because of the water erosion, and the crop yields declined rapidly over time. It was in this context that ISRA/NRBAR returned to the area in 1995 to initiate a program of collaborative research with a view to addressing the more severe erosion problems in the region<sup>9</sup>.

### # The Activities

The activities undertaken in the collaborative research program, launched in 1995, included all NRM practices that could be used to slow the movement of water, such as: live fences, rock dikes in farm fields, rock dams across ravines, heavier rock dams across major ravines and/or to provide road access in and out of the village (*radier*), and plowing along the contours, plus training of the local farmers under contract with CARITAS, an NGO with substantial experience in such matters. The main difference between the new presence of ISRA (now with USAID support through NRBAR) was the added element of local participation in planning and decision-making, as well as in implementation.

### # The Results

The new participatory approach has yielded both qualitative and quantitative results. On the qualitative side, the “free fall” of the Sonkorong farmers from a highly subsidized existence from ISRA through the period of no assistance and rapid extensification of farming in the area with the increasing severity of water erosion problems was a major awakening. When ISRA/NRBAR returned, it was not to resume a period of heavy subsidies, but to work with the farmers in a participatory process, expecting that the farmers would assume much more of the initiative to solve their own problems. This was a major step in the process of weaning the village from a dependence on outside funding, a step the villagers (through the GIE) now recognize and act upon.

On the quantitative side, the new presence of ISRA/NRBAR first yielded a detailed map of the area to pinpoint fragile areas and where to intervene with dikes, gully plugs and other practices intended to slow the movement of water during heavy rainfall. This process clearly increased the villagers’ understanding and comprehension of the process of water erosion—they can now identify fragile areas in their own farm fields and take corrective actions. Physical results accomplished to

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<sup>9</sup> The intent of the NRBAR program is to provide assistance and tools to: a) strengthen the ISRA capacity to do field-oriented research, and b) improve the management of natural resources through the adoption of low cost techniques to promote sustainable NRM.

date include: a) small stone bridge (*radier*) to ensure road access to the village, b) live fences (1.5 km with 2,400 plants), and c) stone ridges (*cordons pierres*) in farm fields carried out by more than 70 farmers. Combined, these activities provided effective protection for some 800 hectares in the area (NRBAR/ISRA 1997, *Revue Annuelle*). In addition, ISRA/NRBAR provided intensive training for three farmer extension workers who, in turn, trained an additional critical mass of 40 trainers to work in the region. The end result of this process was to provide technical training for nearly 2,500 farmers throughout the region.

## # The Impacts

The village of Sonkorong today is less dependent on outside support than before. As a consequence of the severity of the erosion problems, farmers are now eager to adopt new technologies intended to slow or stop the water erosion in the area, without much or any additional subsidy support from ISRA/NRBAR except for technical training. In fact, some of the Sonkorong farmers have assumed a new role—providing technical assistance to neighboring villages requesting help. This new-found expertise is also evidenced by the 70 or some farmers who installed rock ridges in their farm fields (see above) who enjoyed higher crop yields as a result. Not only did this increase the productivity of existing farm fields, it also increased the entire surface area cultivated since land previously abandoned because of erosion was reclaimed to a productive status. These farmers were also eager to adopt because the erosion problem had become critical and posed a serious threat to the entire farming community in the area—in essence a confirmation of the saying that “necessity is the mother of innovation.” This phenomenon has also been observed in other countries, notably in the 5th region of Mali where farmers, on their own, practiced many NRM techniques to preserve the fertility and productivity of their farm fields without any outside support once the situation had become critical.

Collectively, the community also rallied to solve some of their most important erosion problems with their own means and in their own ways. In March 1996, for example, a total of 737 man-days were spent to build the road access to the village using 238 carts (several coming from other neighboring villages) used to haul some 630 loads of stones and other materials, all without any payment or financial incentives from ISRA/NRBAR. The only help offered by ISRA/NRBAR was the use of shovels and picks and the repair of carts on an as needed basis. Furthermore, the Marabout of the Confrérie Mouride in Darou Salame (in the same region as Sonkorong) was conscious of the erosion problems in the village and was instrumental in mobilizing between 600 and 1,000 persons to build other rock dikes across ravines in critical areas of the watershed in May 1997 (NRBAR/ISRA 1997, *Revue Annuelle*).

Although the villagers responded to urgent and critical circumstances (the absence of which would have rendered their farms essentially useless because of the severe erosion problems), there is strong evidence in support of synergies between the activities undertaken by the villagers and the private sector and decentralization SOs. The fact that the severity of the problems galvanized the villagers into collective action without direct financial incentives or subsidies demonstrates their ability to address problems when needed; but more importantly, the ensuing reality of higher crop yields and reclaimed farm areas in an otherwise arable land scarce region, have triggered further developments. As the farmers solved the more urgent problems (erosion control), the quick and dramatic results prompted them to do more to yet further increase the productivity of their farms.

There is a growing realization in the community that they are in control over their own economic destinies and that they can increase the productivity of their farms considerably without relying on subsidies or waiting for new donors to continue where others left off.

### 3.2.5 Case Study 5: Independent Private Entrepreneurs

**Samba Ndao** (farmer). Mr. Ndao has a small (half hectare) garden, woodlot and fruit tree orchard located alongside the main road from Kaolack to Fatick, about 28 kilometers northwest of Kaolack. He is just one among many farmers in this region who have constructed living fences with *Euphorbia balsamifera* to protect small-scale dry season gardens and planted trees. Samba explained that he decided to invest his labor in diversifying his farm production because rainfed crops (peanuts, millet) were not as successful as they had been in the past. Also, the water table was fairly close to the surface (about 5-6 meters) allowing him to draw water by hand to irrigate his crops, and his plot of land located close to the main highway and he could easily market his garden crops.

Samba was growing a variety of crops, including lettuce, tomatoes, watermelon, squash, melons, sorrel (bissap), and manioc. He also had planted numerous trees, including both fruit trees and other economically valuable local and exotic tree species : cashew, lemon, mango, banana, guava, *Ziziphus jujuba*, *Tamarindus*, *Moringa*, *Acacia holo* and Eucalyptus. He used a combination



**Figure 11: Samba Ndao, in His Vegetable Garden, Next to His Fruit Tree Orchard and Private Woodlot.** Increasing number of farmers are eager to intensify and diversify their agricultural production activities; only modest levels of assistance may be required to support such local initiatives.

of live fencing and cut branches for fencing. He had also stockpiled straw for roofing, as well as *Acacia albida* seed pods to feed his goats and sheep. He was actively collecting and spreading manure and crop residues on his garden crops, and had prepared soil pits (much like “zai”<sup>10</sup> holes) for his melon plants.

He knew about compost, but was directly applying the uncomposted manure and crop residues as he had not prepared the compost in advance and was not willing to wait until it was ready to be applied. He had learned about composting, fruit tree grafting techniques and received other technical advice in the past from the CERP agents who had visited him with Japanese volunteers. They had demonstrated gardening techniques and helped him to establish his garden plot several years ago, but no one was continuing to provide him with any technical support or advice. He was not associated with any village organization and did not have any access to commercial credit. He was using the gardens, fruit tree and woodlot production to reduce the risk of dependency on rainfed cereal crops and to increase his income. He would like to expand the scale of his operation, but is currently limited by the labor-intensive production methods which he employs and lack of funds to develop his irrigation system.

<sup>10</sup> Culture zai is the practice of digging small holes in which the seeds are planted along with compost and/or manure as an alternative to plowing the fields. The technique has been successfully adopted in Niger (and other countries) with excellent results.

**Samba Ndao is not alone. He represents thousands of rural producers in Senegal who are well aware of the need to modify their agricultural production techniques.** They have already adopted a range of NRM techniques they use to reduce the risk of crop failure, diversify production and increase the output of their farms. They are currently not well served by the government extension services or private sector providers and may be overlooked by development projects. However, there is a significant opportunity to build upon their local initiative and to further intensify and increase agricultural production and rural incomes by improving their access to technical information and credit. With a modest level of assistance with dry season gardening and the development of perennial tree/fodder crops (channeled through a village organization or association of producers with similar needs and interests), farmers like Samba Ndao could then invest more in improved complementary practices. For example, cattle fattening would produce more manure and compost for his millet and peanut fields. Resulting increases in biomass from these fields would allow him to further expand his cattle fattening operation and invest more in his dry season production activities, and continue to diversify his production system, spreading his risk among multiple crops and increasing his income.

**Samsoun GIE** (*Groupement d'Interet Economique* or Economic Interest Group). The Samsoun GIE is located along the main road from Fatick to Mbour, about 100 kilometers southwest of Dakar. While traveling in the area, the team was attracted to the irrigation piping distributing water from a tubewell, and recently harvested Eucalyptus woodlots. After talking with several members of the GIE, including the treasurer, Serigne Ngom, we learned that the group had originally benefitted from training provided in 1976-1979 through CARITAS. Although not mentioned by the GIE, USAID did provide funding to CARITAS 20 years ago in this area to assist local communities in the establishment of irrigated gardens.

The training provided by CARITAS helped the group to establish irrigated gardens which produce a variety of vegetable crops throughout the dry season. The group has been active for over 20 years, and exploits a large area of some 100 hectares on a rotating basis. There are about 80 members in the GIE, and 2-3 members cooperate to irrigate designated sections of the perimeter each year. They produce green beans, okra, maize, tomatoes and other vegetables, some of which are sold roadside, and some is sold under pre-negotiated contracts with institutional buyers. Each member generates a profit of 100,000 - 200,000 FCFA each season, after paying for the water, seeds, fertilizers and other inputs. The group has also established a small woodlot of Eucalyptus trees periodically harvested to provide additional income for the group. The maize stalks and other crop residues are also used by the members as livestock feed.

**Last year, the group recruited a locally-trained horticultural specialist to provide technical assistance.** To compensate the technician for his services, the GIE has entitled him to the production from one hectare of the irrigated perimeter. This demonstrates an important point that independent producers who have “made it on their own” with perhaps only an early infusion of technical assistance (CARITAS in this case) several years ago, will sense the need from time to time to call on additional technical services as their operations grow and become technically more complex. **When this point is reached the farmers are already capable operators in their own right and the technical services they receive are requested and paid for because they address and solve specific problems.** This is a desired impact, indeed (i.e., the development of a private market for technical agricultural extension services without any dependence on funding from any

outside sources, requested and paid for by the GIE). Another desired result is that vegetables gardens can be a reliable source of additional income which enables farmers to reduce their dependency on rainfed agriculture. Initial project assistance in the form of training, development of a well and irrigation system can be sustained by local organizations without continued dependency on externally provided development assistance.

**Khassim Ndour** (modern gardening). Mr. Khassim N'dour<sup>11</sup> is a very successful irrigated garden farmer living in the village of Sebi-Ponty in the Communauté Rurale (CR) de Yéne, the home of William Ponty College of Education (Ecole Normale William Ponty), located some 35 kilometers from Dakar. The area is famous for its high quality vegetable crops because of excellent soil quality, reasonably abundant water (at least compared to other areas in Senegal), mild climate, and its closeness to the Dakar airport which facilitates exporting perishable products to other countries.

Based on these natural assets, and the proximity to main paved roads and the airport, BUD SENEGAL was created in 1972, a branch of BUD OF CALIFORNIA and BUD OF HOLLAND that grew, packed, and shipped fruits and vegetables to Europe. Khassim was an employee of this company at the time, until 1979 when the premature policy of "Senegalization" of the company staff in 1977 caused BUD SENEGAL to stop operations. When this happened, not only did local incomes decline drastically, but also BUD SENEGAL's 1,000-hectare operation in this area stopped, along with the production of some 17,000 metric tons of fruits and vegetables per year using the latest modern farming methods available, including sprinkler and drip irrigation, aerial and harnessed spray treatment and green fertilizer. Mr. Khassim acquired much of his farming/gardening knowledge from having worked with BUD Senegal.

Once BUD SENEGAL had left, Mr. Khassim was eager to start on his own, in collaboration with former employees. To this end, he followed the advice of and used the subsidies extended by USAID's Senegal Reforestation Project (SRP) in conjunction with 200 grams of *Leucaena leucocephala* seeds given by a Peace Corps volunteer to test as windbreaks by fully enclosing his vegetable fields with trees, receiving cost matching grants from the SRP in the process. Because of his demonstrated drive and enthusiasm, Khassim was asked to participate on a short-term USAID/Human Resources Development Assistance Program agro-business training program in Arizona in 1989. The experience gained under this program enabled him to expand his farm to the 17-hectare size he manages today with the use of modern techniques of water management with drip irrigation system.

**The result: success beyond anybody's expectation. Today his gross income exceeds \$300,000 per year from farming only 17 hectares of drip-irrigated gardens, all fully enclosed by Leucaena trees.** His fields can be triple-cropped every year, producing yields as high as 17 metric tons per crop of green beans per hectare. The bulk (90 percent) of his production is exported (green beans, cherry tomatoes, and melons, etc.) to European partners in Germany and Holland, while the lower quality produce is sold in the local markets. He is currently paid an estimated price (FOB) of \$2.30 per kg for green beans and melons and \$5.00 per kg for the cherry tomatoes. Other crops like okra sells for \$1.00 per kg. All of the citrus production is sold in the local market for

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<sup>11</sup> Much of this case study was prepared by David Diop, Foreign Service National (FSN with the SO2 team), USAID/Senegal.

approximately \$0.50 per kg. A packing station has recently been established (December 1997) which employs some 150 seasonal employees mostly from nearby cities like Bargny and Rufisque—in effect, an urban exodus phenomenon, exactly the opposite of the almost universal phenomenon of rural exodus. Some of the women earn nearly 2,000 FCFA per day and the packing house is also used to process neighboring farmers' harvests. The President of the World Bank, Mr Wolfenshon visited Mr. Khassim last year and promised to make available a credit line of some \$6.5 million in order to develop and expand agriculture for export in the area. If this support materializes, Sebi-Ponty would effectively become a granary of the Sahel as indicated by an article of PANA in the edition of a local daily newspaper (Walfadjri) dated on January 13, 1998.

The multiplication of the *Leucaena* seeds with the support of USAID/Senegal Reforestation Project (SRP) enabled Khassim to plant up to 63,000 trees by 1991. **Presently, some 300,000 trees are planted as windbreaks around his fields.** Not only did Mr. Khassim discover that the *Leucaena* is fast growing and has excellent wind break characteristics, he now also uses the *Leucaena* leaves and young twigs as a major ingredient for his cattle feeding program. In addition, he is an aggressive marketer of *Leucaena* poles having sold thousands of poles fetching prices of between 150 and 800 FCFA per pole and he has developed a brisk market for *Leucaena* seeds among other farmers in the region, which he sells for 10,000 FCFA per kilo. He sells at least 500 kilos of seeds per year harvested from his own plantations. All cattle pens and fences are constructed with thin *Leucaena* poles. The crooked poles are sold as fuelwood or are carbonized and sold as charcoal.

The agroforestry system used in Khassim's operation has favored the development of several compost pits where animal manure, crop residues, and *Leucaena* twigs are mixed with an end result of saving up to 50 percent on the chemical fertilizer that would have been needed to produce the yields he currently enjoys (up to 14 tons of beans per hectare, for example). He estimates adding up to 30 tons of new compost per hectare every year. In addition to the compost, he adds enough chemical fertilizer such as NPK, Potassium Nitrate (KNO<sub>3</sub>) and nitrogen depending to the crop grown in order to complete the fertilizer regime.

Khassim's operation is also a research laboratory as he cooperates with ISRA in testing different cropping rotations and associations. For example, he has adopted the use of lines of corn grown at regular intervals in the bean fields to function as temporary windbreaks. Another approach has been to integrate some 500 fruit trees into the vegetable fields, each tree producing fruit (mandarins) of export quality without compromising the productivity of the fields for vegetable production. Through ISRA's matching grant research program on livestock nutrition and production, a mortality test associated with using *Leucaena* as livestock feed was tested. The results showed that more than 60 percent *Leucaena* mixed with other local biomass would maintain excellent nutritional health for cattle, while 25 percent is the recommended mix for small ruminants. Khassim's work with livestock also garnered him support from the Veterinary Medical College of the University of Dakar. Artificial insemination and embryo transfers of high milk producing Holsteiens using local subjects have provided excellent results.

It is obvious that Mr. Khassim is a shining example of Senegalese farmers to emulate, even though he is blessed with better land and water resources, a better technical preparation with his earlier experience with BUD-SENEGAL, and better access to markets. **When asked, he had no reservation in saying that farmers everywhere in Senegal could succeed if they heeded the**

**advice from the many different projects now underway. He asserts that training is the most important ingredient for success, followed by judicious management of finances and water resources.** A major key to the success of his operation has been the agroforestry activities and water management. The development of the drip irrigation system was time-consuming but essential, and he was obliged to use old or used tubing bought for a low price. Proper water management eliminated the risks of crop failure associated with erratic rainfall. He is open to help out where he can and he has already been in contact with Africare to open his operation to visits from inland farmers **to observe what can be** with only a small initial beginning. If this happens, the visiting farmers should be exposed to the importance and value of the Leucaena, not only as a windbreak, but perhaps more importantly, as a feed supplement for the livestock and as biomass to mix with the compost, and as fuelwood and poles that could be sold and generate some additional incomes. Mr Khassim would also have seeds available to sell to the visiting farmers (one kilo of seeds will be sufficient to enclose one full square hectare of land with tight spacing) if the sponsoring project would agree to extend credit for this purpose. The testing of Leucaena inland would be particularly interesting in association with the KAED support of gardening plots—leucaena could be planted in tightly spaced rows just inside the perimeter fences to provide not only a wind break effect, but also other highly valuable products (fodder, biomass for composting, fuelwood, poles, etc.).

Another impact of Khassim's success is his increased role in the formulation of Senegalese agriculture policy. He plays strong roles in two agricultural associations that promote the interests of producers and exporters. Khassim has no political ambitions of his own, but his advice is eagerly sought by those in legislative and executive bodies of his country. He appeared on a television interview just a few days prior to meeting with the team, speaking out in favor of a rational and equitable implementation of the previously mentioned World Bank program. He says that in the past, the Senegalese farmer had little or no voice in such matters. But due to this personal success he has not only raised his own profile in the Senegal political and economic arena, but has increased the stature of farmers across the country.

### **3.3 Synergy Between NRM and Decentralized Governance**

Villagers who have benefited from the support of the AFRICARE/KAED project, the ISRA/NRBAR project and others enthusiastically describe the impact of the participatory approach on the vitality of their local groups. Previously unorganized villages, or villages with relatively inactive associations, have been transformed by the series of interventions organized to support the increased adoption of NRM practices. As a result of the training and other assistance provided to local "*groupements*," the members often mention the increased frequency of meetings and free debate in which "everyone has a word" as they organize and carry out their activities. Participatory and community-based NRM activities now generally include training in the conduct of meetings, participatory planning and decision-making, literacy and numeracy training, financial management and other skills which establish a firm foundation for democratic governance.

**Functional literacy training** is increasingly associated with participatory NRM practices for a variety of reasons. Literacy training is often based on diagnostic studies which use PRA techniques to identify problems and constraints affecting the village. Villagers are keenly aware of the problem of illiteracy and the limitations imposed by illiteracy on the development of agricultural

and NRM-based enterprises. They are anxious to increase their incomes and to manage their own businesses, and recognize the need to read/write in order to keep their books. In the words of the women of Keur Ali Samba, “*l’alphabétisation, cela nous aide à régler beaucoup de problèmes.*” When given the opportunity to organize development interventions at the community level, rural people are quick to take advantage of literacy training followed by training in financial management, business planning, small enterprise development, value-added processing, etc. Once this training has been completed, the members of the local groupements are well-positioned to assume a greater role in democratic governance. Both KAED and CBNRMP have included literacy training as a fundamental prerequisite to success in any of the areas supported by these Activities.

Transparency, openness and participation in the **management of a group’s financial resources** are critically important to the long-term success of NRM interventions. As these interventions are designed to lead to the adoption of NRM practices which increase the productivity of cultivated soils, woodlands, water resources and other natural resources, the local groups soon find a need to apply their newly acquired organization and management skills in making decisions about the best use of the additional resources which are generated by the NRM interventions. In the case of the AFRICARE-KAED project, the groups were able to reach a consensus on how to use the earnings from their “demonstration field.” Groups which benefitted from the NRBAR on-farm research in the vicinity of Bambey-Serrer also came together to decide how to use the earnings from their composted garden plots. Successful community-based NRM interventions generate funds which need to be managed in a open and participatory manner. In the process, they provide a proving ground for “*democracie authentique*” as local communities debate the alternative uses of the funds which they have generated and agree on their own particular investment priorities.



**Figure 12: Functional Literacy Training, Keur Datin Diana.**

Literacy training has emerged on a critically important and popular activity, among women’s groups engaged in CBNRM activities.

point for more participatory and democratic decision-making.

In some cases, the assisted groups have decided to lend their earnings back to the members, through a **revolving credit fund**, which enables members to develop “*petit commerce*” responsive to the needs of their community and to local market demand. A part of the additional income generated by the individual members is recovered when the credit is reimbursed with interest, and often re-invested in a larger-scale enterprise for the group. In some villages, revenues from the nursery operation, for example, may be used to purchase cattle for fattening and resale (*embouche bovin*). In each case, the NRM activity and associated training and capacity-building interventions were the starting

Working through CBNRM, USAID/Senegal has successfully lobbied for the **legal recognition of NRM committees now associated with more decentralized decision-making**. As the various types of “*collectivités locales*” assume a greater role in managing development assistance activities, the centralized, top down approach to development is giving way to a decentralized approach in which the technical services are more accountable to elected officials within each region, municipality and rural district (*Communauté Rural*). In the past, field agents of government technical

services were answerable to the central ministries, and provided support to local communities in keeping with the priorities of programs conceived by these ministries. Under the provisions of the new decentralization legislation, technical agents working at the *arrondissement* level as part of the *Centre d'Expansion Rurale Polyvalent* (CERP) are now more accountable to the elected officials of the *Communauté Rurale* (CR) and the associated democratically elected NRM committee. Each month, they meet with the members of the CR and the NRM committee to review the activities carried out in support of the local development program, and to agree on priorities for the next period of activity. The NRM committees conduct business in an open and transparent manner as a result of appropriate training in financial, administrative and open-meeting practices. The committees also carefully adhere to these practices and follow-up with appropriate support during the implementation of the decisions taken. Similarly, at the level of each region, the regional supervisor for each of the technical services must henceforth be responsive to regional development priorities identified by the elected members of the Regional Council (*Conseil Régional*). This new governing structure provides an excellent opportunity to focus on the specific environmental challenges and rural development needs of each region, and helps to insure that the development programs are more responsive to local interests.

### 3.4 Synergy Between NRM and Private Sector Interventions

Khassim N'Dour (see case study 5) is perhaps one of the best illustrations of the synergies between successful NRM and the potential for enhanced participation in the democratic process, although (unlike CBNRM and the NRM committees it supports) these were not explicitly sought *ex ante* in the Senegal Reforestation Project (SRP)—they were unintended impacts. The significant lesson learned, nevertheless, is that rural producers will always seek to master the factors of production, starting with the elements within their control. NRM practices that can be practiced by individuals such as agroforestry, water resources management, and compost help increase yields significantly. Once the yields increase and surpluses emerge, farmers have something to sell and the private sector flourishes. Sooner or later, however, farmers face constraints that cannot be addressed at the individual level. Access to markets, land tenure systems, import duties on agricultural inputs, export policies and agricultural input subsidies are all issues that impact farmers like Khassim, find difficult to deal with individually. By participating in interest groups and private sector producer associations, farmers are able to discuss these issues with people with similar concerns, adopt strategies, and make their voices heard by decision-makers at all levels. In the process, farmers learn valuable skills that help to enhance their private sector empowerment as well as in the areas of democracy and governance.

**The intensification and diversification of agricultural and NRM-related production sets the stage for the development of a variety of private sector enterprises.** The same skills which enabled the community members to organize themselves and invest their labor in improved NRM can and are being used in managing the resulting higher incomes, particularly investments in new private sector enterprises intended to increase incomes even further. As observed by the team in all of the case studies, once improved NRM practices have been successfully adopted and higher crop yields are a reality, groups and/or communities will mobilize to break out of the cycle of non-sustainable resource use, declining agricultural production and deepening poverty to begin the process of addressing new (but welcomed) sets of constraints, namely the efficient marketing of

surplus production and re-investment of proceeds in new enterprises or in new capital to increase incomes even further. It all begins with increasing the productivity of the farming enterprises.

While reversing environmental degradation is an essential part of a strategy to secure and increase agricultural production and rural incomes in Senegal, it can also be the springboard for a variety of private sector enterprises. For example, the need to produce tree seedlings for windbreaks, woodlots and fruit tree orchards has led to the establishment of small-scale nurseries producing seedlings for sale. Constructing wells and installing more efficient water extraction methods (animal traction, for example) has led to an increase in dry season vegetable production. Others have established woodlots and used the income from the sale of poles to establish dry season gardens and fruit tree orchards. In each of the 56 communities assisted by the AFRICARE-KAED project, the local groups were able to use the income generated from the demonstration fields to establish a system of revolving credit. As they gained experience in managing these funds generated within the group, they were able to take advantage of additional support provided for the organization of cereal banks, livestock fattening operations, vegetable gardens and other income-generating activities. The management of these ABEs, in turn, has helped to **establish their credit worthiness** and brought them into contact with credit organizations such as CNCAS, all now eager to continue to work with the GIE's as business partners.

In the region of Kaolack, two of the apparently most profitable uses of credit are cereal banks and livestock fattening<sup>12</sup>. Village groups and local entrepreneurs are able to generate quick returns and repay their loans on time when they purchase cereals immediately after the harvest when prices are low, and resell them just before the harvest when prices are high. Young livestock can also be purchased for a relatively low price, and resold at substantially higher prices after being fattened for several months. Both of these income-generating activities are linked to the adoption of NRM practices which sustainably increase millet and fodder production.

Khassim N'Dour's financial success described earlier would not be sustainable if it were not for the variety of NRM practices that he has tightly incorporated into his production system. He claims that without the application of generous amounts of compost in his fields, he would have to rely on increasing amounts of costly chemical fertilizer which would not only reduce profits, but do nothing to maintain the structural quality of his soil.

### 3.5 Synergy Among NRM and Health, Education and Family Planning

#### 3.5.1 Health

In the village of Darou Mougnauguène, KAED-supported NRM practices and related activities enabled women's group to **generate sufficient income to build a "case de santé" (village health care facility)** and to purchase initial medical supplies. With a modest increase in incomes, the group members can now afford to replenish the medical supplies of their health care facility. The

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<sup>12</sup> The emphasis here is on the word "apparently" because the relative financial and/or economic attractiveness from the perspective of the participating farmers of any of the NRM techniques has not yet been confirmed.

AFRICARE health project has benefited considerably from the organizational skills developed through KAED with respect to the delivery of health services to the local communities, particularly in conjunction with the literacy training. This program has enabled the women to take advantage of a wider range of extension materials and “*fiche techniques*” related to health and other topics as well as NRM practices. In addition, the vegetable gardens and fruit tree plantings have not only provided a boost to local incomes, but also helped to improve the diets and nutritional status of the community.

### 3.5.2 Education

Synergies with other development sectors are sometimes direct. In the village of Tatène-Serrer, Christian Children’s Fund is providing support for a school with an enrollment of over 700 students. The parent’s association, anxious to increase incomes to be able to contribute to the costs of school fees and other operating costs of the school, decided to work with Winrock and Rodale in promoting the use of compost. Many parents have since adopted composting and other NRM practices related to soil fertility management which have resulted in higher crop yields and revenues which now also benefit the local school. The team interviewed one farmer and member of the parent’s association who participated in the composting program. His efforts has enabled him to “revitalize” the soil, improving not only the quantity but also the quality of his millet crop and it has reduced the incidence of disease in his crop. He also mentioned that his fields retained more moisture from the early rains and enabled his crop to withstand dry spells during the cropping season better than fields without compost.

### 3.5.3 Family Planning

In other cases, the linkages are indirect. Despite USAID’s best efforts to **increase the demand for and improve the delivery of family planning services**, the results are modest at best. Senegal must reverse the trends of agricultural extensification and declining productivity of natural resources; otherwise rural households have no choice but to expend more labor over larger areas in order to meet minimum food requirements. If soil erosion is not checked, rainfall runoff reduced and infiltration increased, water tables will continue to drop. Deeper wells will increase the labor demands on already overworked girls and women. Similarly, in the absence of efforts to restore and increase tree and shrub cover, firewood supplies will be reduced and more time will be required to collect the wood. All of this means that the strong demand for more children and large families will persist. Smaller families—the desired end of family planning efforts—will remain the exception rather than the rule. As mentioned before, the reversal process of these trends begins with the restoration of the natural resource base to full productivity. Once food is relatively abundant and the

Insert Graphic here

natural resource base is managed sustainably, then people will be prone to adopt family planning and other measures.

As one visits the women's groups benefitting from the support of USAID-funded NRM activities, **the positive linkages to the pre-conditions for adoption of family planning services are evident.** Young women are benefitting from training in literacy, financial management and other educational opportunities; they are contributing to the increased productivity of the natural resource base and earn higher incomes as a result; they combine their newly acquired skills and higher incomes to obtain and manage a variety of labor-saving devices such as cereal threshers, grain mills and peanut hullers, which in turn, contribute to a further diversification of value-added processing and income-generating activities.

In addition, there are other more subtle social changes brought about which are related to the **increase in self-esteem, confidence, problem-solving skills, willingness to take initiatives and other changes in attitude, behavior and capacity.** These groups are no longer living from day to day, resigned to their inability to address socio-economic and environmental constraints that may block their economic development. Instead, they have a new, more dynamic and hopeful outlook, and are better prepared to assume their role in building a better future for themselves and their families. While these changes are difficult to measure, and not easily captured in measurements of the adoption of NRM practices or other indicators which have been tracked to date by USAID/Senegal, the changes are real and provide a solid foundation for continued progress in meeting Senegal's development objectives.

## 4. Analysis

### 4.1 Lessons Learned

#### 4.1.1 Farmer-Perspective Financial Analysis of Individual NRM Practices

It is argued that when farmers choose to adopt certain NRM practices, what they adopt is **assumed** to be financially and economically feasible, otherwise the practices would not be adopted. This assumption is bolstered by the detailed farmer-perspective analyses of individual NRM practices carried out in the 1988 IRG “Opportunities” study where most of the interventions singled out in the R4 presentation were shown to be financially feasible.<sup>13</sup> In addition, NRM practices are also subjected to some economic scrutiny by the ISRA Economics Unit, although the efforts are mostly of a socio-economic nature rather than rigorous benefit/cost feasibility analysis of each intervention and combinations of interventions<sup>14</sup>. If the results of these earlier analyses (and the current ISRA ones) are still valid, then one can assume that the practices promoted through the USAID/Senegal NRM portfolio have increased farmer incomes over and beyond the costs incurred (although these impacts are not quantified).

This is only half the picture, however. There is typically a big difference between the results actually achieved and optimal economic results, again from the farmer’s perspective. Even though the former (i.e., the results generated from implementing the current sets of activities in their present configurations) may be financially feasible, the latter may prove to be much more attractive and associated with much greater positive economic impacts. The conventional wisdom is that windbreaks, live fences, composting, water harvesting techniques, the use of improved seeds, protection of *Acacia albida* and the like are worthy of promotion because they increase crop yields, sometimes to the point where the farmers may have something to sell resulting in higher incomes. Because of this conventional wisdom, donors will typically encourage these practices with subsidies such as free seedlings for tree planting efforts, low cost credit, subsidized fertilizer, free metal baskets used to protect *Acacia albida* regeneration, etc. and other material inputs.

One important point emerges from the above, namely that all NRM practices should be subjected to rigorous farmer-perspective financial analysis in several different configurations before they are included in the packages of NRM interventions to be promoted, as if no subsidies and/or financial incentives were available. None of the current Activities in the USAID NRM portfolio, nor the USAID KAP data base questions have any expressed focus on the need to determine the farmer-perspective financial feasibility of the NRM practices promoted without any subsidies or direct

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<sup>13</sup> Of course, 1988 is a long time ago and changes have occurred in yields, input and output prices, and the FCFA has been devalued. The nature of the interventions may not have changed much, however, hence, there is little reason to assume that the results would be very different today. The point made here is that, although the interventions found to be financially feasible then and probably today, that there may be many other options available today that could generate much more attractive financial results from the farmers’ perspectives. The new options need to be tested and the old ones confirmed.

<sup>14</sup> One notable exception is Monica Fisher’s ISRA report: “The Socio-Economic Impact of Stabling Technology in the Kolda Region,” 1996, which presents detailed benefit - cost analysis of one technology. This kind of analysis should be carried out for all of the technologies.

financial incentives. The absence of an emphasis on defining the optimal technical configurations of the different NRM practices from the economics perspective locks the economic impacts of the interventions into levels probably substantially lower than the returns that could be obtained if the technologies were promoted in accordance with optimal economic configurations.

One example would be to analyze the economic differences between live fences with Salane (*Euphorbia balsamifera*) and live fences with *Parkinsonia aculeata* and/or *Prosopis africana*, each excellent live fences that provide at least two products that have commercial value in addition to protection from livestock intrusion: a) fuelwood (and sometimes some poles), and b) fruits.

#### 4.1.2 Time Saving

One important lesson learned is that NRM interventions tend to be easier to extend to women and women's groups than to men. In all of the villages visited during the field trip, the women, much more so than the men, were actively involved in the activities of the projects on the farm and/or garden fields. In all situations, they exhibited a greater propensity to learn from the activities and adopt them in an organized fashion, always with a clear focus on the income-generating potential of the practices.

The importance of this lesson, however, relates more to time saved than to incomes generated. The women are more prone to adopt, with enthusiasm, all kinds of NRM practices that save time from an already far too heavy workload drawing water for the household daily needs and the gardens, fetching fuelwood, caring for the children, and cooking. For this reason, **millet mills** are very popular because they both generate incomes and save up to four hours of work per day, time that could be profitably spent in other income-earning opportunities. It could also partially explain the rather sluggish adoption of **composting** because the practice is very time-consuming, particularly with respect to the need to water the compost from on a regular basis from wells that are typically located several hundred meters away. Not only must the women draw the water from 30 to 50-meter deep wells, they must also carry the water in head loads to the compost pits because few have carts or donkeys to do this work for them. When the compost is ready to be used on the fields, the women must again empty the pits and carry head loads to the farm fields located far away. Another example is the apparently easy diffusion of **improved wood** stoves in areas where wood is particularly scarce-women will adopt the improved stoves when they save time in collecting fuelwood, and even more so if the wood has become so scarce that fuelwood cash markets begin to appear in the village.



**Figure 13: KAED Nursery and Garden Well.** Animal traction is used to lift well water, thereby reducing the labor demands on women's groups organized to produce tree seedlings and irrigated vegetables.

### 4.1.3 Role of Immediate Revenue Generation

The adoption of NRM cannot be assessed in isolation. In any meeting with local GIEs or women's groups, including the CBNRM Comité de Gestion, the respondents typically indicate that improved NRM is, indeed, very important, but probably less so than the pre-requisites to adopt improved NRM practices, namely other micro-realizations such as gardening, millet mills, animal fattening, and cereal bank installations. The presence of these are very important because they generate almost immediate incomes which can, in turn, be invested in other long-term NRM interventions. The important lesson here is the **order of priority** of activities to undertake. The very first priority is to provide the fundamental enabling capacity through basic literacy and numeracy training, followed closely by implementation of interventions that generate incomes as fast as possible. As the higher incomes become a reality, the focus should then shift to training in financial management of the revenues to encourage investments in a variety of new improved NRM practices and value-added enterprises, all for the purpose of increasing incomes even further.

### 4.1.4 Demonstration Effect

The demonstration effect of certain NRM practices is powerful when they augment dominant revenue-generating activities in the farm landscape. A strong case in point is Khassim Ndour's (see case study 5 above) influence on all neighboring gardening operators who now are beginning to fully enclose their garden plots with *Leucaena* trees, clearly mimicking Khassim's success in creating a much improved micro-climate for the garden fields. Further inland, the situation is the same—farmers mimic one another by enclosing their fields with the saline *Euphorbia* live fence. This is done largely because the practice is traditional and because saline fences are easy and inexpensive to install and provide protection from livestock intrusion. *Leucaena* fences, however, could be easily added just inside the saline fences to improve micro-climates of the garden plots and, more importantly, to provide a substantial boost to the generation of revenues from the additional high quality fodder for the animals and from the sale of fuelwood and poles in nearby local markets.



### 4.1.5 Sustainability and Recurrent Costs

It is of the utmost importance that USAID-funded Activities maintain a strong focus on the sustainability of the activities undertaken, not only the biological sustainability of the NRM practices extended and adopted, but more importantly, the sustainability of the local institutions created and now functioning with USAID's support. Any support, subsidies and incentives offered to the local GIEs by the project, including technical assistance, have recurrent cost

**Figure 14: Khassim Ndour in His Green Bean Field.** Entrepreneurs such as Mr. Ndour have achieved great success by combining a variety of NRM and sustainable agricultural practices, with support from a series of USAID-funded activities.

implications which must be accounted for as the donor prepares to discontinue funding. In far too many cases, local GIEs are ill prepared to take over and often cease to function without a continued infusion from a donor or an NGO, until a new donor arrives on the scene, or the old project is extended. In this respect, USAID/Senegal is well advised to ensure that all Activities in the NRM portfolio include rigorous training in financial management with a view to raise the consciousness of the recurrent cost implications of the services provided with USAID funding. The local institutions must be well aware of the fact that they will eventually be on their own, that they have obtained the requisite skills to carry on, and that they, with proper financial discipline, will be able to cover all recurrent costs associated with the activities they choose to undertake without needing any further outside support. Another important part of this training will be the solidification of the contacts established between the local GIEs and the several outside institutions in their area that could provide considerable benefits in the long run, such as formalizing the relationships with the local banking community, the CERP teams, and other GOS service institutions.

## **4.2 Enabling Conditions**

### **4.2.1 Agricultural Sector Strategy**

As stated in the Senegal Agricultural Sector Analysis Update (ISTI, 1997), the general principles for the strategy were reflected in the Letter of Agricultural Development Policy (LADP) of April, 1995. In this letter, the GOS sets out six main objectives:

- # a target agriculture growth of four percent per year;
- # improved food security through intensified production;
- # the creation of agricultural employment to increase rural purchasing power;
- # improved NRM guided by the NEAP;
- # promotion of private sector investments;
- # improved efficiency in public resource management.

This macro-economic orientation is also in line with the GOS reforms concerning open markets for inputs (the decisions not to subsidize agricultural inputs), decentralized decision-making concerning NRM matters, and the privatization of all marketing activities formerly carried out by the state (i.e., the state was formerly in charge of selling rice in both internal and external markets).

### **4.2.2 Adoption of Decentralization Policy**

If interventions supporting community-based land-use planning and improved NRM are to work, they must be increasingly linked to the achievement of regional and national development objectives. With respect to the physical environment, the absence of an effective program to reduce and eventually reverse environmental degradation will lead to conflicts over land-use and social instability. As economic livelihoods are threatened and pastoralists are pitted against farmers in an effort to secure water rights and pasture lands, ethnic tensions will likely flare. As farm land degrades and people migrate elsewhere, they will likely be resisted by the indigenous population in

the new areas where they try to resettle (this, in fact, has emerged as a contributing factor to the difficulties in the Casamance and also in the Ferlo). With respect to the local communities, if development planning and investment programs ignore local priorities and fail to provide benefits equitably, local participation will be lacking and development benefits may be compromised. Alternatively, **the development of community-based institutions empowered at the community**



**Figure 15: Kaolack Agriculture Enterprise Development (KAED) Project Women's Group.** Improved local-level governance, more democratic decision-making and more social and dynamic women's groups have developed as a result of the group's participation in NRM and agriculturally based enterprise activities.

**level to resolve conflicts and promote sustainable land use and improved NRM practices can contribute to greater social stability and a more equitable and productive use of natural resources.** This empowerment will contribute to a wide range of development and economic outcomes.

The above is largely the aim of two decentralization laws (1972 and 1996). The first, Law 72-25 (April 25, 1972) created the *Communautés Rurales* (CR); geographic administrative units, composed of a few up to several dozens of contiguous villages (roughly equivalent to county administrative units in the US) and gave them the power to resolve tenure problems and conflicts at the local level. This was followed by Law 96-06 of March 22, 1996 (commonly referred to as the Decentralization Law) accompanied by Law 96-07 which transferred several additional responsibilities to regional authorities, communal authorities, down to the CR level. The text of the 1996 law seeks to involve the local population at different levels in the NRM decision-making process regarding what to do, how to do it, when, and how to follow up with new interventions where and when appropriate.

The 1972 law gave the CR the responsibility to deal with all **tenure** questions and conflicts at the CR-level instead of having the State perform these functions. The current system is informal to some extent where, in the villages, the traditional authorities (*chef du village*) are still present to allocate land and to resolve conflicts if and when they appear. By law, however, those engaged in the land-use conflict can appeal directly to the CR for a decision and are not obliged to consult with the village hierarchy (although this rarely happens). The significant change brought about as a result of the 1972 law was that the decision-making responsibilities were moved from the State level to the local CR-level, while not explicitly usurping the traditional role of the village chief in resolving conflicts. The 1993 Forestry code (*Code Forestier*), signed on February 4, 1993 followed by the decree of application on April 11, 1995, allowed the first enabling conditions for decentralized NRM in Senegal in the forms of participative management of the natural forests, including ownership of trees planted, and management of forests by local GIEs. The preparation of this important code was entirely funded by USAID (PL480). The 1996 Decentralization law devolved several other responsibilities (natural resources, health, education, planning, youth, culture, planning, and others) to the regional, communal and CR authorities.

Finally, an important element of the process of decentralization has been for local communities to legally create associations (GIEs) for the purpose of either replacing functions

previously in the domain of the State, or to create GIEs for the purpose of pursuing new and unknown private sector opportunities. In the past, such associations were not formed, simply because the State was responsible for carrying out all kinds of production and commercial activities that the GIE's are now encouraged to take over. In one sense, therefore, the GIEs are encouraged to replace GOS in areas where the private sector can do better, and in another sense, to encourage local GIEs to pursue any and all kinds of commercial and income-generating possibilities as they emerge, regardless of previous GOS involvement.

### 4.2.3 National Environmental Action Plan (NEAP)

The preparation of the National Environmental Action Plan (NEAP) between 1995 and 1997 (validated in a September 1997 seminar) was another important step in the process of facilitating the adoption of NRM practices in farming communities of Senegal, particularly with respect to the preparation of the PAGTs at the CR level under the auspices of CBNRMP. Proper management of the natural resource base must be firmly anchored in an enabling policy framework that recognizes the importance and role of local community participation in the management of the resources. Several regional participatory environmental action plans were prepared as inputs to the NEAP. The NEAP, therefore, is thought to reflect the concerns expressed by the local communities. This is evidenced by the fact that the 2,330 individuals attended community-level meetings to solicit opinions and to collect information for the NEAP preparation and detailed surveys were conducted with another 5,155 individuals from 38 communes and 137 CRs (PNAE, 1997).

### 4.2.4 Other Enabling Conditions

A fundamental enabling condition has been the provision of training in literacy, business skills and financial management, extension services, and technical support designed to build up the capacity of community-based organizations and the human resources of agricultural and NRM-based rural enterprises. Increased access to credit services as well as technical information about NRM practices and marketing information was also critically important to the success of these activities. In most cases, this support was provided by intermediary groups (NGOs, PVOS, government technical services) which were funded by USAID's NRM program. This support enabled the groups to become knowledgeable about and to examine first-hand the demonstration of effective and well-adapted NRM practices which increased production and generated higher incomes for rural producers, while reducing environmental degradation. Frequently, a participatory assessment of constraints and opportunities was required in order to identify the constraints to be overcome and the most well adapted and relevant types of practices to be adopted within a given community. The provision of training, technical support, credit and the participatory planning and implementation of program activities was greatly facilitated in those communities with well organized, dynamic associations



**Figure 16: Stone Check Dams, Keur Katim Diama.** Check dams are constructed by farmers to control runoff and reduce gully erosion. KAED and other CBNRM activities provide support for a participatory process which mobilizes producer groups and rural communities to address problems which may seem overwhelming to an individual farmer.

which were locally recognized and led by local innovators and entrepreneurs. Members typically shared a common motivation and interest in reversing environmental degradation, improving agricultural production, developing small enterprises and diversifying their sources of income and livelihoods. Another common characteristic is exposure to successful NRM ventures which have been undertaken by other groups operating in other areas under similar circumstances (as witnessed by these groups during village-to-village visits facilitated by NRM support programs).

### **4.3 Contributing Factors**

USAID has, for several years, helped set the stage for the evolution of the above and other enabling conditions that have facilitated the increased knowledge and adoption of NRM practices in Senegal (see graphic-interaction of Sos). The funding and support of CONSERE (Conceil Supérieure des Ressources Naturelles et de l'Environnement has been an important contributing factor). This inter-ministerial institution was created in 1993 (Décret 93-885) with the aim to increase the consciousness of environmental and natural resource matters in Senegal's national policy agenda. In addition to being responsible for the preparation of the NEAP (see above), CONSERE is also in charge of the Secretariat de la Commission Nationale pour le Développement Durable. Even though USAID's funding of CONSERE ended on December 31, 1997, some activities are continuing (with synergies emerging as a result of its relocation with CSE). CONSERE is also solidifying its role as the coordinating institution for all policy developments in the environment and natural resource arena.

### **4.4 Assessment of Behavioral Changes**

Over the past several years, the collective impact of all investments made in the NRM sector by the donor community and the GOS has certainly changed the behavior of the farming communities—some beneficial changes are observed and some less so. In a macro sense, the trends still clearly indicate a propensity to practice extensive farming as opposed to intensive farming, despite the efforts of the donor-funded and NGO activities to promote the latter through extending many different NRM practices. The reasons for this behavior is not a failure of the message—people whose economic lives and survival depend on the natural resource base fully know and appreciate the importance of improved NRM, yet there are many real constraints that preclude their adoption of the techniques. These constraints, which in part describe the behavioral changes (or lack thereof) are discussed in detail in the section on constraints below (Section 4.5), in the case studies (Section 3), and in the section on the spread effects (Section 2.6).

### **4.5 Assessment of Constraints**

The KAP surveys contain a rich amount of information that could potentially be used in the assessment of constraints to adoption of NRM practices. Land tenure, access to markets, availability of training opportunities, economic status, level of education, etc. are all issues that are addressed and quantified in the KAPs. But because of the current disarray in the Mission's IMS (detailed in section 5), analysis of the data in regards to these constraints was not possible. Instead, the team

## **Insert Interactive of Sos Graphic**

made its assessment based on visits to some 22 villages covered by the USAID/Senegal NRM portfolio of activities and consulting the large body of reports and other documents directly or indirectly covering the subject. The conclusion is that villagers and rural producers still face a variety of environmental and socio-economic constraints. Some of these are natural, others perhaps reflect conventional wisdom, yet they are still relevant, at least to some extent. The constraints are briefly discussed below.

#### **4.5.1 Most Important: Water**

As the vegetative cover throughout Senegal has decreased over time, largely due to drought and over-use, rainfall has also decreased in absolute terms and the runoff has increased as the degraded soils resist infiltration more so than rich soils. Consequently, the water tables continue to fall and the wells need deepening. In turn, water must be hauled up from greater depths, taking yet more time and effort by the women. Women now spend four to six hours every day just drawing and transporting water, in addition to the time they spend caring for children, collecting fuelwood, cooking, and working in the farm fields and/or the garden plots. Agricultural production is being undermined by a dependency on unreliable / erratic rainfall, depletion of soil nutrients, reduction in density of vegetative cover, and exposure to wind and water erosion. As soil fertility, crop vigor and resistance to drought declines, crops become more susceptible to pests and diseases. The increasing scarcity of water triggers a vicious cycle that cannot be solved with quick fixes such as digging more wells or deepening existing ones.

#### **4.5.2 Risk Aversion, Cash, and Labor Constraints**

Improved NRM is tantamount to producing more with a different combination of labor and other inputs; i.e., doing things more efficiently and differently on the existing area in question without having to clear new land in order to produce more. Hence, NRM and other practices such as composting, stabling, live fences, windbreaks, rock ridges, field trees, improved seeds, the practice of fallowing, and many other techniques are routinely extended by NGOs and donor-funded projects, all associated with different levels of subsidies and incentives to attract participation, and all intended to increase the fertility and productivity of the existing farm fields. Given the current level of rainfall in the region, such intensification will increase crop yields as soil nutrients will gradually restore, erosion and the degradation of cropland soils will decelerate, and the re-emergence of a richer and more diverse vegetative cover will improve micro-climates and attract more rainfall to the area. These are the desired outcomes and they will occur if the local farmers adopt and implement as intended.

A fairly sluggish rate of adoption, however, can be explained by a few, but important constraints, as follows. Farmers already working severely degraded fields are not necessarily prone to adopting new techniques, even though they may be perfectly aware of the benefits of these techniques. The worse off they are, the more risk averse they tend to become as new approaches will invariably be associated with some level of risk, particularly those that will occupy scarce cultivable space. They know that their current (traditional) farming methods will provide enough food for the family if the rains come, but rarely, if ever will they have any surplus to sell. Any “outsider” arriving on the scene with proposals on how to increase crop yields (other than giving chemical fertilizer) will be met with some scepticism if the proposals involve investments of cash and labor, or by occupying

scarce cultivable space with trees, for example. They may be very well aware of the long-term benefits of a windbreak but can ill afford to lose the cultivable space in order to plant the windbreaks. They certainly are aware of the long-term benefits of protecting *Acacia albida* trees and attempt to do so, but usually with limited success, rarely with any purchased inputs such as welded protection baskets around each seedling, such as promoted by AHDIS (PVO/NGO). The loss of cultivable space is perceived by many to be too costly if the time horizon between investment and return is more than just a few days, hence, they will typically not adopt with the scales of operation often envisioned or reflected by project targets.

Instead, adoption will be spotty and erratic—a few trees here and a few trees there, perhaps a small beginning of a wind break or a live fence, a few rocks to divert the flow of water, and so on—always within the limit of the time and other resources they may have at their disposal, but rarely as originally envisioned by targets specified in projects. Farmers are also excited about the dramatic increases in crop yields brought about as a result of the introduced composting techniques, but may not adopt them on their own as extended by a project because of the universal constraint of “*manque de moyens*”—lack of means (funds, tools, manpower, etc.) to build the facilities. Added to the above are the constraints of insufficient development and management of water resources, unclear land rights of women, competition over the use of crop biomass (such as between livestock feeding, housing and fence construction, and composting). As agricultural production declines, food security declines, women are increasingly overworked, poverty increases and households are unable to renew/purchase necessary agricultural equipment (carts, etc.).

The success of any NRM intervention will always also be limited to the availability of labor. Even if all the other constraints are successfully resolved, the labor constraint will remain as a major limiting factor. Under traditional farming systems, the entire farm HH is fully occupied in the fields during the farming season. Extending activities that require additional labor during this busy time period, therefore, will be difficult. Activities requiring additional labor input during the off-season will certainly be easier to extend (such as the planting of saline live fences), dry season composting, and water harvesting techniques.

### 4.5.3 Tenure

Security of tenure is the *sine qua non* of successful NRM investments, and is critical to the success of the proposed interventions. Without it, people will have little incentive to participate in the proposed schemes. Farmers may want to apply fertilizer and other physical inputs, reclaim unproductive land through water harvesting, plant trees etc., but will be reluctant to do so if their tenure is insecure. Local communities and farmers clearly recognize the risk of future dispossession of their rented or borrowed farm fields as was clearly demonstrated by Astou Dakouno (Africare KAED, 1997, *Connaissances et Pratiques des Techniques de GRN dans la Zone d’Intervention du KAED*, p. 18). The less secure the farmers are with respect to their land holdings, the less prone they will be to practice any kind of improved NRM.

#### 4.5.4 Credit

The availability of credit is another “umbrella” constraint in Senegal, although some progress has already been made on a limited scale, particularly through the efforts of KAED. The problem is not so much the lack of credit as bank liquidity is high, but more the absence of a recognition of credit worthiness on the part of the local banks, and on knowledge about the availability of credit among the GIEs. Women’s groups are gaining in this area since they repeatedly demonstrate meticulous record-keeping and have excellent reimbursement records. Women, however, have access to little collateral and, therefore, may not be in strong favor by the local banks once donor-guarantees are withdrawn. Men, on the other hand, typically have the collateral, but have not yet established the same level of credit worthiness as the women. Much work remains to be done in this most important area.

Credit will remain a constraint so long as it is only available at very high interest rates (which is the case in Senegal). Farmers will always need credit to: a) procure physical inputs (chemical fertilizer, insecticides, improved seeds, etc.), b) build compost pits, c) rent animal traction or other equipment for better field preparation, and d) fund major investments such as cereal banks, millet mills, and nursery developments—all improved NRM activities supported by USAID and other donors. While the donors are present the access to credit is usually facilitated and the rates are reasonable. Without the donor presence, however, few farmers can afford the credit because the rates will typically be too high as the repayment guarantees typically offered by the donors would no longer apply. The absence of the donor guarantees may precipitate a return to low investment, extensive agriculture—minimizing the use of purchased inputs by opting to expand onto pasture lands or completely eliminate fallow periods. In order to safeguard the considerable progress made, particularly the now credit-worthy GIEs, USAID must maintain a close focus on this very important element of the development process by encouraging projects to nurture the relationships with the local banking community on behalf of the main clients—the local farming communities. Access to purchased inputs is essential to breaking out of the vicious cycle of subsistence-level poverty—to make it possible for farmers to produce surpluses for sale in the urban markets, thus generating incomes which can and should be invested in creating yet additional revenue-generating capital.



**Figure 17: Grain Mill Leger Book.**

Literacy training enables women to improve financial management and increase the transparency and accountability of the group’s leadership; the improved skills and resulting social dynamics help to increase women’s self-esteem and credit worthiness, and open the door to a large of increase-generating activities.

The availability of physical inputs such as chemical fertilizer (phosphates and urea) and insecticides also depends on credit, although it is perhaps the least problematic *in the future* of the constraints discussed here. In the present, however, this constraint is real—fertilizer is scarce and costly, particularly since the GOS abandoned the policy of subsidizing agricultural inputs. Farmers are well aware of the potential crop yield increases attributable to the application of fertilizer and insecticides and would probably buy the inputs if they had the financial means. Until credit is made

increasingly available, the markets for bought agricultural inputs will remain too small to attract the traders.

#### **4.5.5 Other**

Finally, perhaps the biggest constraint to increased adoption is the simple fact that projects can only do so much. The technical advice offered may be appropriate and timely, but it is not enough. CBNRM, for example, will eventually work in only 50 out of 320 CRs in the country, hardly enough to ensure that expected beneficial results will be observed in all areas of the country. There must be a concerted effort on the part of the GOS to ensure that the messages are extended nationwide, such as providing (without any further outside support) technical assistance for the preparation of community level NRM/land use plans, and investments in watershed management and application of soil/water conservation measures in the upper parts of watersheds which have been converted from pastures to farmland, etc. The vast body of knowledge and lessons learned and accumulated through the efforts of projects and programs in some limited areas of the country needs to be spread to other areas where the needs are equally urgent.

## 5. Information Management System

### 5.1 Introduction

USAID/Senegal's entire information management system (IMS) is currently managed by the Program Office. It is part of a Mission-wide effort to store and process all data generated in monitoring and evaluation exercises across all strategic objectives. A Data Architecture Working Group (DAWG) was informally created in 1995 in order to attempt to harmonize and standardize data gathering methodologies so that reporting and analysis could be performed on multiple data sets from a variety of activities and sectors.

The DAWG gathers data from several sources:

- # Routine monitoring and evaluation exercises conducted by the various activity centers;
- # Knowledge, Attitude, and Practice Surveys (KAP) conducted every 2 years since 1992 at a national level;
- # Localized KAP surveys (site-specific KAP) conducted at the activity centers;
- # Agriculture production data produced by the GOS Ministry of Agriculture;
- # Remote sensing information from the CSE which is supported by the USGS/EROS Data Center.

During the set-up phase of the IMS, the Mission contracted with the AID/W centrally funded DESFIL program to assist in the design and implementation of the SO2 IMS. DESFIL's assistance over a two year period culminated in a seven-week consultancy that provided comprehensive support in setting up an appropriate system and providing necessary training in its operation.

In the TOR, the assessment team was asked "to make recommendations for improvements in the existing information system for using field-based information to inform decision-making at all levels." The team looked at the IMS in detail at two levels, data collection and data reporting/analysis. The team also made observations and comments on several larger issues related to NRM information management.

### 5.2 Data Collection

The Mission should be commended on the amount and scope of data collected from a variety of sources. National KAP surveys are commissioned by USAID/Senegal and performed by a local consulting group. Site-specific KAP surveys and other activity-specific data collection are carried out by implementing partners. Other information is available from the Ministry of Agriculture and the CSE. The amount of data collected is vast, but in order for this information to be useful for reporting and decision-making analysis, the approach to data collection and information sought should be standardized. The Mission has, for some time, been aware of this need. When the 1992 KAP was undertaken, the survey was designed to be compatible with previous KAPs conducted in the health sector and larger surveys conducted by the GOS National Statistics Office. Despite these

efforts and substantial assistance from DESFIL from 1993 to 1995 to standardize data collection types and procedures, much still remains to be done.

This assessment focuses on data collection related to the adoption of NRM practices. Observations on the type of data collected and the methodology of collection related to this theme are summarized below.

### 5.2.1 Interview Questions

The KAP and site-specific KAP surveys ask anywhere from 25 to over 100 questions of the persons interviewed. The most important question in terms of this assessment, however, is the one regarding the knowledge and use of NRM practices. Unfortunately, this question was asked in a number of different ways from year to year and from activity to activity.

- # KAP92 asks “Do you know of practices that you can use to improve your field and increase production?.” It then asks the respondent **why** they use the practice, without first asking **if** they use it. It is not clear how use rates were determined without having asked this fundamental question. KAP 94 repeats this flaw.
- # KAP96 does not specifically ask a question, it simply has a list of practices labeled “Knowledge of natural resources management technologies.” The interviewer reads the list and asks about knowledge and use of each practice on the list.
- # AFRICARE asks the same question as KAP92 but only gathers data on practices that KAED promotes.
- # USAID’s core data set questionnaire, which is supposed to be used as a model for all site-specific KAPs, asks “Do you know natural resource management practices?” and specifically tells the interviewer to **not** read the list.
- # All KAPs have a checklist of NRM practices that is used to record the responses of interviewees. Though USAID recommends that this list not be read, some do and others do not.

In the limited survey of NRM knowledge and practice carried out by the assessment team (see Annex H for questionnaire), the list was not read. However, when it became clear that people were under reporting what they actually knew, the original question was reworded. Many of those interviewed could name additional NRM practices they know and use when the question was rephrased. For example, when asked about improving their fields and increasing production, responses were always agriculture-oriented. When asked about conserving natural resources, respondents frequently offered additional information on practices that have less direct impact on agriculture such as improved cookstoves and woodlot planting.

Regarding the impact of reading a list, KAP92 and 94 used a two step process in asking the NRM question. After noting responses without reading the list, the list was read and responses noted

a second time. On average, interviewees indicated knowledge of more than twice as many practices after hearing them read from a list.

Because of the lack of a standardized formulation of the question and further inconsistency in the way it was asked, any comparisons from year-to-year and from activity to activity are of questionable validity.

### **5.2.2 Monitoring NRM Practices**

The KAP92 is used as the baseline for reporting and analysis. It included 19 specifically named practices in the survey and reported on those 19. Any other response was included as “other.” For USAID’s FY96 R4 report, seven of these practices were selected as representative indicators to show the general trends in the adoption of NRM practices by the rural population. Subsequent information reporting, however, reveals a creative variety of names and numbers of reported NRM practices. Some examples:

- # KAP96 reports 31 practices. Of the original 19 from KAP92, 14 are retained in the original nomenclature, three are renamed, and the rest are new additions. The most significant disparity is the change of name from “field trees” to “assisted natural regeneration,” which is one of the seven key indicators for R4 reporting. This difference is noted in the FY 96 R4.
- # KAED reports on only seven practices, leaving out three of the key indicators needed for R4 reporting (manure, improved seed, and fallow).
- # CBNRM reports on 27 practices, of which 23 use the same terms as KAP96, and the other four are new additions. CBNRM does report on all seven of the key indicators for R4 with the exception of fallow. In place of fallow, “improved fallow” is reported.
- # The PVO/NGO holds the record for the number of NRM practices reported, including more than 80 on the list. The problem with having so many practices is that many of them are variations of the same theme. Should “green manure” practices be included under the general heading “manure”?

Standardizing nomenclature is further complicated by the fact that several languages are used in the survey and reporting process (English, French, and local languages). In addition, even among NRM experts who speak the same language, there is often disagreement on terms. One person’s “gully plug” is another person’s “check dam” and so forth. Though the KAP implementing partner (SENAGROSOL) indicated that they have a standard glossary of terms translated in all relevant languages, this has not been delivered to the DAWG.

### **5.2.3 Compounds, Households or Individuals?**

It is not always clear in the various surveys whether adoption rates reported are by compounds (an agglomeration of extended family groups, often within a walled area, known in

French as the *concession* or *carré* - see section 5.2.4 below); households (*ménage* in French); or by individual producer. Africare, for example, reports figures for both households and individuals, which are different. This difference is due to the fact that a household is reported to have adopted a practice if **any one** of its members is using it on any field managed by the household. The individual man or woman interviewed may or may not be the one using the practice. A further complication is due to the complex family structure found in rural Senegal which has *chefs du carrés* making land-use decisions for a number of related households. Though the team was told by those who implemented the national KAPs that male heads of households were instructed to furnish information for their entire household, a look at the data shows that men did not routinely furnish information about practices that their wives were using. For example, in the FY96 KAP, only six percent of household heads report that their households use improved cookstoves, yet 11.7 percent of the females interviewed claim to use them.

#### 5.2.4 Limitations of the KAP

Because of the above noted inconsistencies, there are a number of questions that remain unanswered about the reliability of the information gathered by the KAP, especially in regard to making comparisons among the KAPs themselves or among the KAPs and site-specific KAPs. SENAGROSOL has recognized some of these problems and has proposed a readjustment of data to permit statistically valid comparisons among the three national KAPs (see Annex G). But even if some of these problems are ironed out, there are yet other shortcomings to be reckoned with.

The KAP surveys in general fail to account for the sociological, religious, and political variables at play in most villages (which differ among regions) that influence decisions on whether or not to adopt NRM practices. The national KAP results are generated based on a random sampling approach; the argument here is for stratified sampling based on the following field realities affecting the likelihood of adopting and certain NRM practices one should take into account when selecting households to interview:

- # the “**carré**” is an extended family composed of several autonomous HHs (2 - 5) with a chef de carré (CC) as the head. The HHs are always under the moral authority of the chef and share the same compound living space, yet they are autonomous production and consumption units. The CC exercises authority over the management of the land and natural resources belonging to the carré, particularly with respect to allocating land for the production of staple crops (millet, sorghum, and the like), in collaboration with the individual heads of HHs in the carré, with the oldest and/or richest members having the greatest influence in the decision-making process. This system remains in effect until some of the HHs break off (described as Berrou in Wolof) and form their own carrés by virtue of having been given or inherited some of the land in the old carré, and/or have cleared new land elsewhere;
- # the relative **economic (wealth) status** of the carré member HHs;
- # the **religious authorities** in the region and in the villages (PCGRN, Rapport Interprétatif, Communauté Rurale de Médina Sabkah, Sept., 1997), in particular the

role of the Marabouts in the different sects (confréries)—Mourides, Tidjanes, and Niassené and others;

- # the **political authorities** in the region and in the villages and their alliances with the Marabouts and other religious authorities;

By eliciting this information in informal interviews as part of the process of selecting the HHs to interview formally, the information obtained will be infused with local field realities that serve to better explain upward or downward trends in the adoption of NRM practices in any given region in terms of both numbers and context. Of particular importance is to stratify the samples of interviews with members of at least four groups: a) the CC, b) chef de ménage (HH), c) women, and d) youth. This will capture the full range of attitudes and behavior regarding NRM practices. Questions should also be added to the surveys to determine the roles played by the religious and political authorities and by the economically privileged in the village structure in the decision-making process.

Certain important technical facts are ignored by the KAP as well. Many of the people interviewed claimed that water is the limiting factor for production and the adoption of many NRM practices (tree planting, compost, etc.). Yet the KAP only asks one question about water (“What is your source of water?”). A more thorough analysis of this constraint would be possible if the KAP collected data about the reliability and ease of access of the water source. This information would not only help explain the reasons for low adoption rates of water intensive NRM practices, but also would guide planners towards activities that use less water or conserve existing water supplies.

To expand the KAP questionnaire to cover every possible variable that affects the use of NRM practices would be impractical and virtually impossible. Rather, other forms of information, such as the results of PRAs, should be incorporated in the IMS.

### 5.3 Data Reporting and Analysis

Collecting data does little good unless they can be used for reporting results and making analysis. Indeed, one of the foundations of AID’s efforts to reengineer the Agency is the use of results reporting and analysis to inform program decisions at all levels. At present, most reporting and analysis is done by the implementing partners and/or the entity responsible for data collection. Several interviews with M&E staff from implementing partners gave the impression that their capacity for reporting and analysis was generally quite high. Where there are weaknesses or shortcomings, there appears to be awareness and willingness to make necessary improvements. Reporting and analysis, however, are limited to working with only the data collected. It has been USAID/Senegal’s intention for some time to gather data from the various activities and compile them in a manner that would permit reporting and analysis for an entire program or strategic objective.

In order to assess the current status and effectiveness of USAID/Senegal’s data reporting and analysis capability, a brief exercise was conducted on the Mission’s IMS (see Annex E ). The exercise revealed that a vast amount of data is available at the Mission for reporting and analysis.

Generating reports or doing analysis with these data, however, is a different matter. Some of the problems encountered are summarized below.

### 5.3.1 Data Formats

Though most of the files are in a format readable by Paradox 5.0 (the software used by the Mission for data analysis), some projects are providing data files in SPSS. Africare, for example, presented data from the 1997 site-specific KAP in SPSS format. The SZWM delivered files on diskettes with the .dbf extension, but Paradox was unable to read the files. USAID has a copy of SPSS and can convert files from SPSS to Paradox, but this is additional work that could easily be done prior to delivery.

### 5.3.2 Data Codes, Files and Variable Names

Data codes are not uniform from one data set to the next. For example, in relation to the question “Why do you use this (NRM) practice?” KAP92 uses 8 as the code for “to increase revenues,” while the KAP96 uses 5. File names are different from one year to the next and from one project to another. The file containing information on the adoption of practices by male heads of households was named **nrm\_1.db** in the KAP92 and **shtechn.db** in the KAP96. CBNRM uses **technoh.dbf** while Africare uses **adop1.sys**. As with file names, variable names within the data tables are different from one year to the next and from one project to another. Furthermore, variable names are often given obscure codes instead of using plain English or French names. It was very difficult to make sense of raw data when variables are coded. Variable dictionaries were found for some, but not all, the data files.

### 5.3.3 Erroneous Information

The first file analyzed: **NRM\_use.db**, supposedly contained data on the adoption of NRM practices from the KAP92. After working with the database for about 30 minutes, it was discovered that *knowledge of* NRM practices was erroneously reported as *use of* those practices. The correct file was later discovered, but the erroneous file should be destroyed or corrected.

### 5.3.4 Generating Basic Reports and Analytical Queries

Almost three hours were spent on this exercise. Because of the above problems and an incomplete mastery of the software, however, it was very difficult to generate even the most basic reports. It may have been possible to do one or two simple analytical queries (i.e. “What is the main reason for non-adoption of compost?”) but it was evident that such analysis is rarely, if ever, performed. If the Mission sincerely desires to use the IMS to “inform decision-makers at all levels,” much work remains to be done.

## 5.4 Tracking Results: Which Indicators Should be Used?

Another problem encountered during this assessment was the difficulty in obtaining basic indicator data needed for R4 reporting. Theoretically, implementing partners should routinely furnish

this information to the Mission. However, they need to know what the Mission needs. That, unfortunately, has not always been clearly communicated. The following section describes some of the circumstances that have contributed to this confusion followed by a discussion of the current set of indicators.

### 5.4.1 Indicator Evolution

When the FY95 -FY98 Results Report (dated March 1, 1996) was prepared, the current, revised NRM SO2 had been reformulated and an effort was made to report progress using indicators that could be tracked against the 1992 baseline study (KAP92). For Program Outcome 2 (stated as “increased use of NRM technologies”), adoption rates were reported for 10 NRM practices (windbreaks, live fence, field trees, fallow land, manure, crop rotation, compost, water management, improved seed, and erosion control). Since that time, both the statement of the desired outcome (now referred to as Key Intermediate Result B or KIR B) and the relevant indicators have undergone change or are restated in different ways depending on what source of information is consulted. For example:

- # KIR B is stated in the FY96 R4 as “improved NRM techniques mastered and used by farmers” and reports on seven practices (live fence, compost, improved seed, windbreaks, fallow land, manure, and field trees) as indicators for that KIR.
- # The results packages for KIR B do not track results to the level of the KIR. Rather they track results at a level one step lower on the results framework, IR B1.0, stated as “farmer exposure to improved NRM techniques.” The indicator at that level is “number of farmers reporting their knowledge of improved NRM technologies.”
- # The M&E system for SO2 proposes yet another set of indicators. In a June 25, 1997 ANR sponsored workshop on monitoring and evaluation, participants were given copies of the SOAG and a list of indicators comprising the “core data set” that all activities should report against. The primary indicator for adoption of NRM practices was stated as “percent of men and women who report using one or more improved NRM practice.” The indicator corresponding to knowledge of NRM practices was similarly stated as “percent of men and women who can name one or more improved NRM practice.”
- # According to the TOR for this assessment, the R4 for FY97 is committed to reporting on the same indicators as those chosen in FY96 (percentage of adopting farmers reported for each of seven practices).
- # Recent AID/W guidance now asks the missions to set targets and report results for all IRs as well.

Some of this evolution can be justified in terms of refining the monitoring system in order to more effectively and efficiently measure results of activities, but USAID’s implementing partners deserve clearer guidance if they are expected to furnish the Mission with relevant information.

## 5.4.2 Evaluation of Current Indicators

According to AID/W guidance, “As management tools, performance indicators must first and foremost be valid, useful, and practical to the managers and teams that are operationally responsible for achieving the results being measured. They must appropriately measure what, in fact, we want to achieve. They must provide information that is actionable by managers and teams. And they must be collectable at a reasonable cost... the use of comparable performance indicators should be encouraged for similar programs to the greatest extent possible. This is particularly true for strategic objectives and key intermediate results, which should be directly relevant to broader Agency-wide goals” (AID/W 1996). Accordingly, the current set of KIR B indicators are evaluated by these standards.

In general, the idea of measuring NRM practice adoption rates (stated as percent of users in a sample population) meets these criteria. Adoption of many NRM practices has been proven to have strong correlation with achievement of the SO. The indicator is relevant for all activities under the SO as well as to broader Agency-wide goals. However, not all NRM practice indicators are created equal. Some are more useful, more easily measured, more relevant to all activities than others. The following discussion seeks to rank the current indicator practices accordingly (Five stars is highest ranking):

**Live fences:\*\*\*\*\*** As it is a traditional practice, adoption is not generally constrained by lack of knowledge. It generally indicates a desire to intensify production on the fenced parcel and is therefore often accompanied by other NRM investments such as tree planting, fertility enhancements or irrigation. In addition to protection of the enclosed area, living fences also serve as windbreaks and in the case of improved fences, as sources of fuelwood, fodder, and organic matter. Finally, it is relatively easy to measure and can be monitored using remote sensing technologies. A precise definition is required that includes both traditional and improved practices and specifies whether partial enclosures be included in the count.

**Field trees: \*\*\*\*\*** It is usually indicative of an important change in attitude. In the past, farmers were taught that field trees were harmful to production. Millions of trees were cut down and rooted up to make way for plows, chemical fertilizers, and peanut production. Today, some but not all farmers are cognizant of the consequences of those actions. They are seeking to reverse the process, protecting natural regeneration or planting trees in their fields for a variety of reasons such as fruit production, windbreaks, fuelwood, fertility enhancement, etc. As with living fences, field trees can be monitored with remote sensing. It is important that the indicator be adequately defined to capture all efforts to incorporate trees into the agriculture landscape. Practices such as assisted natural regeneration and planting fruit trees and windbreaks should all be captured by this indicator. Gathering further details such as types of trees, propagation method, and purpose is important, but does not need to be part of the indicator.

**Windbreaks: \*\*** Though often quite useful as an NRM technology, it is not so useful as an indicator. The main problem here is what constitutes a windbreak? Though a significant number of rural producers are making attempts to plant windbreaks on their fields, they are at varying stages. Does a field with a row of struggling woody plants constitute a windbreak? Does a well established

line with serious gaps count? Does a row of corn planted in a field of beans qualify? We suggest that windbreaks be dropped as a separate indicator but that any evidence at attempts to establish them be picked up and noted in the redefined field trees indicator as described above.

**Compost: \*\*\*** A good indicator, but with reservations. It's adoption leads to impressive SO2 level impact. It is widely promoted by a number of agencies and institutions in Senegal, both within and outside the USAID umbrella. However, it is constrained in many areas by the availability of inputs (water, manure, organic matter) and labor. If used as an indicator, these constraints should be accurately quantified, reported and analyzed.

**Manure: \*\*** This is a traditional practice with a very high rate of adoption. It is so high, in fact, (around 80 percent) that it is questionable if USAID can have a measurable impact on further increases. A better indicator may be to measure the percentage of fields covered by manure or other organic matter.

**Fallow: \*** This is a traditional practice that is often linked more to poor soil management than to adoption of NRM practices. Because of the scarcity of land, fields are often not put into fallow until they are completely exhausted and unproductive. Fallow can also sometimes simply indicate a lack of seeds for planting.

**Improved seeds: \*\*\*\*\*** This is an excellent indicator for rice and corn, but not yet for millet. Millet is by far the most important staple crop closely linked to the issue of food security. As clearly indicated in case study no. 3 (Section 3.2.3), improved millet seeds are not available on a large scale, consequently farmers typically do not purchase seeds but select the seeds for next year's crop from the current harvest. If certified improved millet seeds were available at reasonable prices through the private sector and aggressively advertised through the media (radio in particular), it would not be unreasonable to assume that food security could be substantially improved. The availability of improved millet seeds could also be aggressively advertised in conjunction with other improved NRM techniques, notably composting. It is not an unknown phenomenon to the farmers that composting alone will only have a limited impact on crop yields. The full impact can only be realized through a changed soil structure (composting) in association with improved seeds plus application of chemical fertilizer. The absence of the improved seeds and the chemical fertilizer are formidable constraints to the adoption of the composting practice alone.

### 5.4.3 Suggested New Indicators

**Community NRM actions:** All of the current indicators are related to practices adopted by individuals on their household fields. It would be wise to monitor at least one NRM practice that is undertaken by local communities acting together. There are a number of possibilities that could be chosen, such as natural forest management, village woodlots, and watershed management. It would be best, however, to convoke a meeting of all implementing partners to decide on which practice has the best combination of relevancy for all activities and likelihood of increased adoption.

**Percentage of land covered by organic amendments:** Rather than measuring adoption rates, this indicator seeks to get a feel for the percentage of farmland on which NRM practices are being

adopted. As a very high percentage of people use either manure, compost, kitchen waste, or other organic amendments on their fields, this indicator would attempt to measure the percent of surface area covered by these amendments. As the KAP questionnaire already asks for information about the number and areas of fields as well the crops grown, it should be fairly easy to get the additional information necessary for this indicator. Farmers may not be familiar with the concept of percentages, but will be able to indicate which of his or her fields received organic amendments.

***Water conservation or erosion control:*** As soil moisture is the main limiting factor to production in many parts of Senegal, at least one indicator should be monitored to track progress in addressing this issue. Erosion control efforts (stone lines, gully plugs, watershed management, etc.) are probably the easiest to monitor but would not capture some innovative practices observed related to irrigation or management of salt affected soils. A broader indicator, such as water management, would include more practices, but past efforts to monitor such a broadly defined indicator were unsuccessful. For the sake of ease of monitoring, erosion control may be the best indicator.

***Improved cookstoves:*** Though only indirectly linked to SO<sub>2</sub>, adoption of improved cookstoves is an important contribution to broader NRM goals. It is highly gender specific and decreases women's workload, saving time that can be used for other activities of production.

## 5.5 Participatory Monitoring and Evaluation

Although information is gathered from the field and passed to the Mission, there is little evidence of any flow in the other direction. Ultimately, information collected from the field should be processed, analyzed, and reported back to the field for confirmation and additional insight. This has a number of benefits. At the very least, clients will feel more involved in the process which should make their participation in the future more enthusiastic. Another benefit would be the increased insight gained from discussing results of data analysis directly with clients. The very nature of the formal interview process limits analysis to only those variables that are part of the survey. Discussion with clients will add new insights that will help explain analytical correlation and refine further data collection exercises. The bottom line is that in a participatory and client-driven approach to development, the ultimate decision-maker should be the client. They need to be fully aware of the results of data collection exercises and analytical studies to which they contributed, otherwise, they are not full participants in the development process. This approach is already undertaken successfully as part of the PRAs done in many villages, so would not require great effort to integrate it into formal surveys. The CBNRM M&E staff are reportedly planning to do this with the results of the 1997 site-specific KAP.

This participatory process could be extended to data collection exercises as well. Though statistical rigor and requirements for standardized methodologies need to be respected, individuals and communities could easily take a more active role in collecting and reporting information about themselves and the impact of activities they are involved in. For example, instead of conducting random samples to find out who is using live fences in a village, the actual number of users could be reported by a trained village informant. The impact of interventions are often given keen appraisal by local populations. They often are able to report changes in their environment more accurately and with greater insight than outside observers. Efforts to systematize their reporting should be pursued.

Finally, another issue that deserves mention here is the apparent lack of grass-roots participation in the setting of indicator targets. The current method for setting targets is based on a projection of current trends, an exercise performed within the Mission. Given that so much importance is attached to the attainment of these targets, it would be in the interest of both the Mission and their clients to adopt a more participatory approach. If clients were involved in setting targets, there would follow a number of benefits. Foremost would be the sense of ownership of the goal fostered in local populations. In addition, targets would be set more accurately as client input is taken into account. Thirdly, clients would have a much greater appreciation of why decisions are made regarding development programs and funding in their behalf.

## **5.6 Information Ownership**

The Mission IMS is set up to gather, report and analyze data in relation to the achievement of its SOs. These SOs are part of partnership agreements with the Government of Senegal and the Senegalese people. It has already been stated earlier that the people should be more involved in and have greater access to the products of the IMS. The same holds true for the GOS. The GOS is working with a number of partners in the NRM arena and is certainly interested in monitoring the results of programs and interventions. As the Mission is already collaborating with the CSE as part of the USGS/EROS program, it would be a logical GOS institution with which to collaborate regarding KAP and related data. This would also enhance the sustainability of the NRM IMS.

With the dissolution of the SO2 team and the merging of NRM interventions into other strategic objectives, the Mission would benefit from stronger linkages to CSE. However, the Mission should not simply pass the responsibility of NRM monitoring to CSE. With the integration of NRM related activities into the new SOs, new indicators must be developed and tracked that will permit ongoing analysis of the synergies between NRM and the new SOs.

## **5.7 An Alternative Approach**

The USGS/EROS data base for Senegal, most of which is housed at CSE was briefly discussed in Section 2. As an alternative or complement to the KAP approach to monitoring and evaluating, USAID/Senegal should consider making greater use of information generated by the USGS/EROS activity. Following is a brief description of the information available and its implications for improved monitoring and analysis of changes in the landscape and the adoption of different NRM practices.

The types of data collected by USGS/EROS in collaboration with CSE can be used to monitor changes in land-use, in the composition and density of the vegetative cover, in the extent of surface water resources, and trends related to natural resource degradation (e.g. moving dunes, gully erosion) or regeneration (sand dune fixation, woodlots, increased density of field trees). In the areas systematically sampled, the data provide an objective, readily stored (archived) source of information on a variety of easily detected NRM practices (such as live fencing, windbreaks, field trees, dikes, stone lines) which can be analyzed and used to validate the data obtained through KAPs

and other formal questionnaires and household surveys. This information is particularly useful to assess medium and longer term changes over large areas. Using aerial videography, changes can be sample-monitored at both the household and community level, while noting differences across the major agroecological regions, in years of both above-average and below-average rainfall. The time series data from more than 300 sites is geo-referenced and can be integrated into GIS analyses. The information is available through CSE, a national institution (CSE) which makes it accessible to other programs and analytical efforts (such as the preparation of the National Environmental Action Plan) and it has been collected in a manner which has helped to build national capacity in environmental monitoring.

The USGS data reveal a number of significant environmental changes which have occurred over the past 30 years in Senegal, including:

- # disappearance of the majority of riverine stands of *Acacia nilotica* (gonakier) along the Senegal River
- # localized degradation of rangelands from overgrazing and drought in the Ferlo
- # expansion of continuous cropping and widespread soil degradation in the peanut basin
- # reduction in density and biodiversity of woodlands from charcoal production between Kaffrine and Tambacounda
- # increased water erosion in the Saloum and north and south Ferlo
- # uncontrolled clearing of forest and conversion to cropland in the Kaolack, Tombacounda and Kolda regions
- # die-off of mangrove formations, expansion of salt flats and associated loss of cropland in coastal areas
- # significant decline in the use of bush and grass fallow in croplands

This environmental monitoring program has also revealed a number of positive trends and other changes, including:

- # conservation of significant areas of natural vegetation and wildlife habitat in protected areas such as national parks, classified forests and wildlife reserves
- # regeneration and recovery of protected rangeland and woodland sites in the all regions through effective “mis en defens”
- # stabilization of sand dunes and protection of vegetable gardens in the coastal “niayes”

- # reforestation with cashews, Eucalyptus and other introduced species, including the establishment of plantations in the Kaolack and Fatick regions
- # widespread and increased use of manure, following a reduction in the availability of subsidized chemical fertilizer
- # maintenance of *Acacia albida* (kaad) in farmfields, particularly between Thies and Bambey and generally in the central peanut basin
- # increasing frequency of live fencing and border plantings around fields, especially in the area around Fatick, to help protect farmfields from salt intrusion and water erosion
- # increasing prevalence of small-scale dams to control salt intrusion

Other practices observed on a smaller scale include windbreaks, compost pits and various types of erosion control measures. The informal surveys carried out by USGS reveal that rural populations are generally quite aware of the major environmental changes but are constrained in their ability to respond. For example, a shortage of water and competing uses of crop residues has constrained the production and use of compost. In the drier regions, erratic rainfall and periodic drought increase the risks of crop failure, discourage investment in rainfed agriculture and contribute to an exodus of people from rural areas. Even where rainfall is more abundant, people are constrained in their adoption of NRM practices by an insufficient access to appropriate technical information, training, equipment and credit. While there have been problems in marketing some perishable vegetable crops, in general, markets for livestock, cereal crops, wood and other agricultural/NRM products are well-established and accessible to most producers.

The USGS/EROS-CSE environmental monitoring activities provide a valuable source of baseline information to track the results of past investments in NRM programs, as well as insights into the existing opportunities and potential strategies to improve the management of natural resources in Senegal. Despite increasing population pressures in some areas, out-migration can relieve pressures and provide an opportunity to encourage the adoption of improved fallow techniques and “*mise en defens.*” In most areas, information and training could discourage the traditional practice of cutting back sprouting vegetation and instead promote farmer-managed natural regeneration of shrubs and other woody vegetation in farm fields. More efficient use of composted manure and available crop residues could be achieved through the promotion of soil pitting (*zai*), micro catchments and other soil fertility management and water conservation practices. The use of a variety of wind and water erosion control measures, including windbreaks, stone lines, check dams, gully plugs, small dikes, contour planting of grass strips, alley cropping, contour plowing and strip cropping could be supported over much larger areas as part of an expanded program to support community-based land use planning (*gestion de terroir*) and watershed management. In the southern regions and other areas which are being exploited to produce charcoal and firewood, local communities could be mobilized to benefit from participatory approaches to natural forest management. Throughout Senegal, investment could be focused on the development and improved management of water resources, including the construction of small earthen dams, and greater use of runoff harvesting and water-spreading techniques. Well construction could be tied to the adoption

of these and other NRM practices designed to increase infiltration and replenish groundwater supplies.

Experience to date in Senegal has clearly demonstrated the difficulties inherent in monitoring the adoption of NRM practices and in assessing the impact of these practices. At the same time, USAID/Senegal has contributed to the establishment of an excellent foundation for an information system capable of tracking long-term environmental changes which could threaten economic development, as well as guiding investment in NRM programs. A variety of tools have been developed to collect different types of data. This data can be integrated to generate more useful information through the continued support of a system which includes:

- # periodic updating and ground truthing of environmental monitoring data collected by USGS/EROS in collaboration with CSE, through a comprehensive sample of all agro-ecological zones
- # bi-annual household surveys, with a stratified sample of villages which have and have not directly benefited from external investments in NRM programs
- # periodic compilation and analysis of data from diagnostic PRAs, informal interviews, impact assessments and other community-level surveys associated with NRM investments and related rural development activities
- # case studies on specific issues and research topics (e.g. correlation between security of tenure and investments in NRM practices, financial and economic analysis of NRM practices).

## 6. Conclusions and Recommendations

### 6.1 Relationships Among Different NRM Stakeholders

Senegal's natural resource base, the economic engine for growth and prosperity for rural dwellers and the government, degraded over several decades due to periodic droughts, declining rainfall pattern, increasing population pressures, over-use and mis-management. USAID's focus over the years has been to slow the process of degradation by working with the NRM stakeholders at different levels with a view to regenerating the natural resource base capacity to improve productivity through the application of different technical practices and policy reforms. The current restructuring of USAID's SO portfolio is particularly timely, therefore, in view of the wide disconnect between the two major NRM stakeholders in Senegal: a) the natural resource managers (farmers, herders, wood cutters, etc.) at the local level for whose benefit most donor investments are intended, and b) the GOS who owns and controls all of the resources. The disconnect is evident in the absence of an emergence of a strong private sector seizing the initiative to capitalize on profitable investment opportunities within the natural resource sector. Khassim Ndour (Case Study 5) is one of far too few very successful individuals who have broken the vicious cycle of poverty and is now financially independent and prospering—the dream probably harbored by all rural dwellers. There is little reason why many more should not achieve similar success other than the probable fact that the GOS is still in the driver seat exercising explicit and implicit controls over the use of the resource base much more so than the private sector.

Whereas the GOS decision to abandon the policy of subsidizing agricultural inputs is to be commended, the GOS exercised (implicit) control by failing to set the stage for the private sector to fill the void, despite efforts to the contrary (i.e., the decentralization laws and the like). Stopping the subsidies had the effect of promoting extensive as opposed to intensive farming and lower yields all over, causing a further degradation of the natural resource base and worsening the prospects for food security, largely because an aggressive and competitive private sector did not step in to make all agricultural inputs available at competitive prices. The answer is not to reinstate the subsidies, it is, rather to empower the private sector to step in and take over where the GOS left off—the success of doing A is only assured by also doing B. A case in point is the failure of the GOS to allow the private sector to engage in large scale production of improved millet seeds (see case study no. 3, Section 3.2.3). In summary, the conclusion of the matter is that the GOS is on the right track with respect to decentralization policies and local empowerment, what remains to be done is to ensure that the private sector is also strongly encouraged in both word and deed to fill the gaps left behind as the government withdraws.

#### ***Recommendation :***

1. USAID/Senegal should, through the new private sector SO, focus on removing the major constraints to the creation and development of a vigorous private sector industry in the area of the production of certified improved seeds, particularly millet seeds. This should include, but not be limited to, facilitating the availability of credit for investment purposes.

## 6.2 Approaches to Extension of NRM Practices

It is concluded that CBNRM's approach to the extension of NRM practices through the CERPs (Centre d'Expansion Rural Polyvalent) is probably least effective in the short-run but most effective in the long-run. Projects come and go, and those who choose to hire their own extension workers for the short duration of the projects may find that, once the project extension staff is no longer available, the situation in the villages may revert back to a pre-project situation, or worse. The CERP is the only permanent GOS-funded institution currently offering extension services to rural communities throughout Senegal (although there are many institutions in Senegal with rich and varied information on NRM practices in the country that could be accessed). Currently, there are some 93 CERP teams in the country, one for each arrondissement, consisting of five or more well-trained members in different professional disciplines (fish, forestry, agriculture, home economics and management, livestock, etc.) who work under the direction of the Sous-Prefets in each district. Although these teams can easily be characterized as under-funded, under-equipped, under-paid, and too few, and consequently cannot render the kinds of services needed in the villages as can the temporary project-funded extension workers, the important fact is that this (the CERP) is the only sustainable institution remaining after projects have come and gone, however currently under-funded or flawed it may be. CBNRM's choice to work through the CERPs is commended even though more immediate results could probably have been obtained with project-funded extension workers. This should not, of course, be interpreted to mean that the KAED approach with their own agents is not sustainable. The 13 KAED agents are excellent, well trained and well respected by the local communities where they work. They will, however, no longer be there when the KAED ends, the CERPs will be there when CBNRM ends. KAED's approach to providing extension has probably yielded results beyond expectation, to the point where some of the participating women's groups no longer depend on any further regular extension presence, but will be able to carry on with only occasional technical assistance they can request from the CERPs for specific purposes.

The infusion of donor funding will not remain forever. A major constraint, therefore, is the sustainability of the extension services provided during the life of the donor-funded activities—i.e., the assurance that the investments made by USAID and others will continue with GOS funding. The demand for services from the CERP teams will far exceed the ability to provide services once donor funding has ended since the teams are poorly supplied in terms of transportation and equipment. If, therefore, adoption of NRM practices is to be encouraged in the future, the GOS should be strongly encouraged to increase in the number of CERP teams in relation to the future targets for adoption. This would not exclude a strong emphasis on training farmer extensionists—well respected farmers who have received training in the different practices who, in turn, train others in the village.

### *Recommendations :*

1. As CBNRM may be the only remaining activity in the USAID/Senegal NRM portfolio, its role will be recast to fit with the new decentralization and private sector SOs, USAID/Senegal should, through the CBNRM mechanism, adopt the long-term vision under the decentralization SO to increase the number of CERP teams for each arrondissement to accommodate the technical services needs that will continue once the CBNRM and the other projects in the portfolio have ended. Adoption of NRM practices is largely a function of the continued presence of extension workers who

work with the farmers solving technical problems at all levels. All old and new CERP teams should be trained to avoid being too directive or authoritative in their extension approach and instead embrace a participatory approach.

2. For the remaining duration of the KAED, PVO/NGO Support, NRBAR, and OFPEP, activities, project staffs should “ease the process” of transitioning from regular project-related extension advice to one of much greater self reliance. One major part of this process is to instill the confidence in the local communities that, with the work already carried out during the project period and the participation by the local farmers and groupements, they should now have the requisite skills to be able to carry on their own. Another important part of this process, however, is to inform the beneficiaries of the fact that technical extension services are still available through the CERPs, and that they should request these services on an as-needed basis and in the context of their needs.

### **6.3 Economic and Financial Feasibility of NRM Practices**

Although USAID/Senegal’s NRM portfolio can demonstrate (with the KAPs and project site-specific KAPs) that the rate of degradation of Senegal’s natural resource base is slowing down, it remains largely unknown if yet additional positive economic impacts could not have been achieved if the NRM practices promoted had been subjected to rigorous financial and economic analysis from the perspectives of the intended beneficiaries. There is a general absence of an explicit emphasis in the NRM portfolio of activities on knowing the economic and financial realities of the NRM practices extended. It is implicitly assumed, for example, that if farmers implement NRM practices X, Y, and Z, then these practices must be financially feasible, otherwise farmers would not implement them. This assumption is valid only to a limited extent, however. The practices extended to and adopted by the farmers may be and probably are financially feasible, but it is not known if the specific configurations of these practices are the most attractive ones from the farmers’ perspectives. It should be important for the extension workers to be aware of the economic realities of different technical configurations of the same NRM practices. Live fences, for example, can consist of Euphorbia plants which is the dominant type of fence seen all over Senegal, and the type of fence usually extended. These fences only provide protection, however, and they typically attract snakes—a side effect not much appreciated by the farmers. There are many different technical live fence configurations which do not attract snakes, which require different levels of investments and maintenance regimes, and which also generate other commercially valuable products such as fuelwood, poles, and fruits. These technical alternatives should be known by the extension workers in terms of both their biological and economic advantages and disadvantages. Once the participatory approach has recommended live fences as a favored NRM practice in the village, therefore, the automatic technical answer for implementation, therefore, should not always be the Euphorbia fence, but include other technically sound options as well, which pass the test of farmer-perspective financial feasibility.

**Recommendations :**

1. USAID should, through CBNRM, PVO/NGO Support and other remaining activities in the NRM activity portfolio, ensure that all NRM practices identified through the participatory approach be subjected to farmer-perspective and site-specific financial analysis to determine the optimal technical configurations of the practices to extend. It is recognized that such analyses cannot provide minutely accurate results because the data on long-term investments (planting and harvesting trees, for example) is not available. The intent of the analysis, however, is only to obtain *ex ante* results useful for the purpose of determining which among many different technical configurations of the same NRM practice would likely be the financially most attractive proposition to the farmers.
2. USAID should also, in the context of recommendation 1, ensure that user-friendly spreadsheet benefit/cost analysis models are developed for use by CBNRM, NGOs and others as needed to carry out farmer-perspective financial analyses of different technical configurations. The focus of these templates should be to identify the key variables for each NRM practice to allow the user to reflect local field realities—variables that can be activated or changed depending on the specific configuration of the practices tested in different areas.

## 6.4 Information Management System

The limited scope of this assessment precluded an exhaustive assessment of the information management system. The observations summarized in Section 5, however, indicate that there is much room for improvement. This should come as a surprise considering that the DESFIL team identified the same problems in 1995 and made generally appropriate recommendations, conducting training sessions to facilitate the implementation of those recommendations. If the 1995 DESFIL recommendations had been implemented and the learned skills put into practice, the information management system would have gone a long way in becoming a truly useful tool for analysis and reporting of information from the field. Presently, the situation is in many ways worse than it was two years ago. The massive amount of data that have been accumulated since that time, instead of being compatible, useful and accurate, is in such disarray that it will take a major effort to render it usable to accommodate serious analysis. Even then, because of the differences in sampling methodologies and survey techniques from year to year and activity to activity, any comparisons and analyses using more than one data set will be of limited value. Despite the problems, however, the situation can be greatly improved as indicated in the following recommendations.

**Recommendations :**

1. **Revisit the recommendations of the 1995 DESFIL report (USAID Senegal's Information Management System, August 1995) and related documents.** The DESFIL report states “in order to aggregate data to the program level, all the ANRU (now SOT2) projects must use the Core Data Set with a standardized methodology. That means using: a) a standardized questionnaire and its codes, b) standardized

biophysical methods, c) the same sampling strategy, d) a standardized field methodology (administering the questionnaire and taking biophysical measures at the same time each year), and e) a standardized database.” The consultancy that took place in 1995 took care of these issues and more, but it appears that there has been serious shortcomings in continued implementation of the system and its standards. The DAWG should take the necessary measures to resurrect the model system that was set up in 1995.

2. **There are some important deviations from the above endorsement of the DESFIL consultancy.** This is in regard to the recommended indicators for knowledge and use of NRM practices as well as the way the “NRM question” is asked. The indicator proposed by DESFIL for knowledge of NRM practices is “percentage of men and women who can name one or more NRM practices.” For NRM use, it is “percentage of men and women who report using one or more NRM practices.” These indicators are not only different from those needed for R4 reporting, but are woefully inadequate for capturing NRM adoption trends. For example, a farmer may use manure in year one, add improved seeds in year two, plant some trees in year three, and install a living hedge the fourth year. Yet the “one or more” indicator would only capture the first year of this farmer’s progress. The DAWG should revise the core data set indicators to capture adoption of NRM practice trends for each of the practices to be reported.

The question suggested by DESFIL to capture knowledge and use of NRM practices is also deficient. Rather than ask a question, better information would be obtained if a list of well-defined practices were read and the interviewee asked about knowledge and use. Alternatively, if an open ended question format is desired, several questions should be asked in order to be sure that the interviewee’s full breadth of knowledge is explored. For example, in addition to a question about increasing production, a standard set of questions about how to fight against loss of tree cover, soil erosion, drought, etc. could be asked.

3. **Clean up the current data sets:** Once the standard are agreed upon, all data sets should be restructured and made compatible. This will require enormous effort, but the alternative is that the analytical potential of these data sets will be largely untapped. An effort should also be made to account for the differences in methodologies over the years and from activity to activity. Some of that work has already been done by SENAGROSOL. However, as they administered the KAPs, they may not be completely objective in analyzing the validity of their own results. A statistical audit of the KAP surveys may be in order.
4. **Make it absolutely clear to implementing partners what is needed for R4 reporting.** Several implementing partners have received mixed signals regarding SO2 indicators. Yet the key indicators needed for R4 reporting (percentages of adopting farmers for each of seven specific practices) are fairly straightforward. USAID/Senegal should not have to analyze raw data sets in order to come up with these figures, nor browse numerous reports to piece together needed information.

5. **Employ or designate a full-time database management expert.** It is a large task to maintain a useful IMS. It appears that the current person responsible for the IMS has a variety of other responsibilities. The Mission should place an individual in charge of the IMS who can devote full-time to the job. He or she should not only be fully capable in a wide range of IMS skills, but should also be able to make the IMS a system that is accessible to all who wish to perform analysis on the IMS database.
6. **Incorporate EROS other forms of NRM information into the IMS.** It is clear from this assessment that KAP and site-specific KAP surveys do not provide sufficient information to answer all the questions one might ask concerning the adoption of NRM practices, the impact of adoption and other related issues. Much of that information is available, but is not in a form easily integrated with KAP data. The USGS/EROS data, for example, is one such source of information that has tremendous potential for monitoring long-term biophysical changes in the environment. The Mission is currently supporting an effort to integrate selected data from the KAP and remotely sensed sources. This is commendable and should be pursued as part of the M&E plan for the new CSP.
7. **Promote wider sharing of NRM data and analysis.** Once the data sets are in a form that can be shared with others, they should be made available to all interested parties. Products of analyses should be vetted with the communities which are objects of analysis. The Mission should continue working with CSE to establish a long term “home” for NRM data.

## 6.5 R4 NRM Indicators

The seven practices monitored for R4 reporting do not give a complete picture of the adoption of improved NRM practices on the intervention sites nor across the country. Some indicators are better than others in this regard, but others should be refined or dropped. Specific recommendations follow:

### *Recommendations :*

1. Drop three of the current indicators, specifically manure, windbreaks, and fallow. Manure practices will be picked up as part of one of the new indicators (percent of fields covered by organic amendments). Windbreaks will be picked up as part of the redefined “field trees” indicator. Fallow is simply not a good indicator of NRM.
2. Add new indicators as discussed in Section 5.4. These include one communally implemented practice, percentage of fields treated by organic amendments, erosion, and improved cookstoves.
3. Readjust all “field tree” results in the national KAPs to relate to the answer to question 56 (Do you encourage planting of trees in or around your fields?)



## References

### **CBNRM:**

Bertelsen, Michael, Naraine Persaud, Magatte BA, Fatou Kiné Lo Planchon, Aout 1997. *Système Stratégique de Suivi pour le PGCRN*.

McCorkle, M., et al, June 1977. *Gender and Natural Resources Management*. SECID, Virginia Tech.

Moore, Keith M., September 1997. *Comparative Analysis of CBNRMP Strategic Indicators*.

SECID, 1997. *Quarterly Progress Reports (January-December 1997)*. Ministère de l'Environnement & de la Protection de la Nature.

SENAGROSOL-CONSULT, Enquêtes Ménages, Septembre 1997. *Rapport Interprétatif, Communauté Rurale de Médina Sabakh, Version Finale*.

SENAGROSOL-CONSULT, Enquêtes Ménages, Septembre 1997. *Rapport Interprétatif, Communauté Rurale de Mbellacadio, Version Finale*.

SENAGROSOL-CONSULT, Enquêtes Ménages, Septembre 1997. *Rapport Interprétatif, Communauté Rurale de Diaoulé, Version Finale*.

SENAGROSOL-CONSULT, Enquêtes Ménages, Septembre 1997. *Rapport Interprétatif, Communauté Rurale de Kayemor, Version Finale*.

SENAGROSOL-CONSULT, Enquêtes Ménages, Septembre 1997. *Rapport Interprétatif, Communauté Rurale de Ngayenne, Version Finale*.

SENAGROSOL-CONSULT, Enquêtes Ménages, Octobre, 1997. *Rapport sur les Indicateurs, CR de Médina Sabakh, Version Finale*.

SENAGROSOL-CONSULT, Enquêtes Ménages, Octobre 1997. *Rapport sur les Indicateurs, CR de Mbéllacadio, Version Finale*

SENAGROSOL-CONSULT, Enquêtes Ménages, Octobre 1997. *Rapport sur les Indicateurs, CR de Ngayenne, Version Finale*

SENAGROSOL-CONSULT, Enquêtes Ménages, Octobre 1997. *Rapport sur les Indicateurs, CR de Kayemor, Version Finale*

SENAGROSOL-CONSULT, Enquêtes Ménages, Octobre 1997. *Rapport sur les Indicateurs, CR de Diaoulé, Version Finale*

**NRBAR:**

NRBAR, 1993. Inventaire des Technologies Basées sur la Gestion des Ressources Naturelles et Utilisées dans la Production des Cereales.

NRBAR, Nov. 1997. *Fiche de Suivi (project monitoring Report)*.

NRBAR, Jan. 1998. *Contribution a l'Analyse des Résultats du projet*.

DIENE, Médoune, Issa Dabo NDIAYE & Mamadou DAFPE, May 1995. *Midterm Evaluation of the Natural Resources Based Agricultural Research Project (NRBAR)*.

NDIAYE, Mamadou, Désiré Y. SARR & Djibril DIOUF, Avril 1995. *Utilisation des Résidus de Transformation du Poisson Fumé pour la fertilisation des Terres: Effet sur la productivité des cultures*.

DIENE, Médoune, Issa Dabo NDIAYE & Mamadou DAFPE, May 1995. *Evaluation à Mi-Parcours du Projet de Recherches Agricoles Basée sur les Ressources Naturelles (NRBAR)*.

Satin, Michael, aout 1997. *Appui a la validation socio-economique des techniques d'agroforestrie*. USAID 685-SO2, CID, Contract no. 685-0285-C-00-2329-00

USAID & CID. Rapport Trimestriel: Avril - Juin 1997  
Quarterly Report: April - June 1997

**R4**

USAID, March 1977. Results Review and Resource Request (R4 FY 1996-1999).

USAID, March 1, 1996. Results Report.

USAID/Senegal-Strategic Objective #2: Results Package #1, March 18, 1996. Applied AG/NRM Research (Draft).

USAID/Senegal-Strategic Objective #2: Results Package #2, March 18, 1996. AG/NRM Technologies: Training and Extension.

USAID/W, 1994. Operations BAA, Chapter 3: Judging Results

**KAED**

AFRICARE, 1997. Connaissances et Pratiques des Techniques de GRN dans la Zone d'Intervention du DAED.

Impact Assessment of the Kaolack Agricultural Enterprise Development (KAED) Program.

AFRICARE, April 1996 - September 30, 1996. Semi Annual Performance Report.

AFRICARE, December 1997. Rural Microenterprise Support Program.

Echos du KAED - Trimestriel d'Informations, 26 Avril 1996.

AFRICARE, October-November 1997. Monthly Program Report.

“ Monthly Program Report: August 1997.

“ Monthly Program Report: July 1997.

“ Monthly Program Report: June 1997.

The KAED Project well in Keur Yorodou.

AFRICARE, October-November 1997. KAED Program Staff: Monthly Program Report.

AFRICARE/SENEGAL, September 1996. One year Program Extension Plan: Region of Kaolack.

AFRICARE, October to March 1997. Semi-Annual Program Performance Report.

AFRICARE: Kaolack Agricultural Enterprise Development Project Credit Proposal.

AFRICARE, April to September 1997. Semi-Annual Program Performance Report.

AFRICARE, September 1996. Evaluation Tripartite: GOUVERNEMENT-USAID-AFRICARE du  
Projet de Développement de l'Entreprise Agricole de Kaolack (KAED).

AFRICARE, October 1995. Evaluation Tripartite: Version Finale.

## **PVO/NGO**

Year VI Annual Activity Report: 1st July 1996 - 30th June 1997 prepared by: Awa Paye Guèye,  
Chief of Party - prepared: August 1997.

Magazines: Projet d'Appui aux ONGs - USU (3 exemplaires).

The PVO-NGO/NRMS Project prepared by a consortium consisting of World Learning, CARE, and  
World Wildlife Fund.

NGO Support Project, Mai 1997. Rapport d'Activités et Financier du Troisième Trimestre préparé  
par: Anne Petesch-Nesterzuk, Chef d'Equipe..

PVO/NGO, November 1997. First Quarter Activity and Financial Report: July 1- September 30,  
1997 prepared by: Awa Paye Gueye.

PVO/NGO, May 1997. Third Quarter Financial and Activity Report: January 1 - March 31, 1997.  
Prepared by: Anne Petesch-Nesterczuk.

PVO/NGO. Rapport Annuel d'Activités de l'an VI. 1er Juillet 1996 - 30 Juin 1997. Préparé par:  
Awa Paye Guèye.

PVO/NGO. Projet Paper Supplement No. 2 and Project Authorization No. 2 for the Senegal  
PVO/NGO Support Project.

PVO/NGO, November 1997. Rapport d'Activités et Financier du Premier Trimestre: 1er Juillet -  
30 Septembre 1997. Préparé par: Awa Paye Gueye.

SENEGAL PVO/NGO Support Project - Project Paper: June 7, 1990.

### **CONSERE**

Processus d'Elaboration du Plan National d'Actions pour l'Environnement: Conseil Superieur des  
Ressources Naturelles et de l'Environnement (CONSERE): Dakar, 13 - 16 Février 1995.

Plan National d'Action pour l'Environnement: Juillet 1997.

### **KAP**

KAP, 1996. Enquêtes ménages.

Etudes des Connaissances, Attitudes et Pratiques Agricoles et de Gestion des Ressources Naturelles.  
(KAP 1996): Rapport provisoire, Mars 1997.

The USAID/ANRO Knowledge, Attitudes and Practices Survey (1992): prepared by: RKite, M.  
Keita and L.Thiam (Economics Division, Agriculture and Natural Resources Office,  
USAID/Senegal, February 1993.

Etudes des Connaissances, Février 1997. *Attitudes et Pratiques Agricoles et de Gestion des  
Ressources Naturelles* (KAP 1996).

### **GENERAL**

Bucknall, James, Geoffrey Livingston, Robert Kagbo and Douglas Brown, July 1997. *Senegal  
Agricultural Sector Analysis Update*. ISTI, Arlington VA.

Shaikh, Asif M., E. Arnould, K. Christophersen, R. Hagen, J. Tabor, and P. Warshall, 1988.  
*Opportunities for Sustained Development: Successful Natural Resource Management in the  
Sahel*. USAID/AFR/TR, Washington, DC.

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## Annex A

# Terms-of-Reference

### Scope of Work for USAID/Senegal NRM Limited Impact Assessment

**Purposes:** This limited assessment aims to assist USAID/Senegal to:

- (a) Provide site specific input on NRM SO-related results for **R4** preparation; specifically to assess the number and type of NRM practices that have been adopted by rural households in selected activity sites and assess the behavioral changes/constraints of targeted rural areas regarding NRM practices and technologies;
- (b) Prepare examples (case studies) of NRM - decentralized governance - private sector intervention synergies in on-going activities for use in the **new CSP**;
- (c) Capture **lessons** for improving the implementation of NRM investments; and
- (d) Make recommendations for **improvements in the existing information management system** in order to improve capacity for using field-based information to inform decision making at all levels.

The results of this assessment will be useful to the Africa Bureau in exchanging information on results from NRM investments, on assessing those results, and on the nexus of NRM, governance and economic growth.

**Background/Overview:** USAID/Senegal currently is preparing a CSP and R4 Report, both of which require information about the results and impacts of its NRM investments under the current Strategic Objective (SO) #2 : “Increased crop productivity through improved natural resources management (NRM) in zones of reliable rainfall.”

In preparing the March 1998 **R4 Report** (FY97-FY00), USAID/Senegal must consider the last five to six years of NRM investments under the current strategy, which have included:

SRP: Senegal Reforestation Project  
KAED: Kaolack Agricultural Enterprise Development  
NRBAR: Natural Resource-Based Agricultural Research  
CBNRM: Community Based Natural Resources Management  
SZWM: Southern Zone Water Management  
OFPEP/WINROCK: On-Farm Productivity Enhancement Program  
RODALE and several other NGOs’ NRM activities

Significant results have been produced, some of them unexpected. At this point, the full magnitude and significance of all of those results are not fully known. This limited assessment will contribute to providing pertinent information on the results of some of the NRM investments for inclusion in

the March 1998 R4, pending the SO wide impact evaluation, which will be conducted later in FY98 and used for the March 1999 R4 preparation.

Given that this will be a limited assessment, it will not produce comprehensive data on the results. Existing data from these projects and programs will be necessary. During this limited assessment, the team will be expected to analyze the existing data and identify the significance of the trends suggested by the data, as well as gather a small data sample based on selected site visits.

USAID/Senegal is building an agricultural and natural resources management (AG/NRM) data base for Strategic Objective #2 (SO2) results reporting. Under the framework of the current Country Program Strategy Plan (CPSP), a set of indicators was defined, and subsequently refined to monitor impact in the AG/NRM sector. In order to assess people level impact, USAID/Senegal has developed a sector-level impact monitoring system for collecting data on the indicators regarding crop and natural resources management practices. Farm-level information and data have been and continue to be gathered by the SO2 funded activities.

Three AG/NRM-based Knowledge, Attitudes and Practices (KAP) surveys have been conducted in 1992, 1994, and 1996. Data from these surveys are organized in Paradox program files and included in the AG/NRM data base. These KAP surveys collect NRM practices data across the 400 mm zone of intervention, and not just at sites specific to the SO2-funded activities. And the data historically collected from the SO2-funded sites has not generated data consistently which is compatible with the KAP data. This limited assessment of selected SO2 funded sites will generate a small data set compatible with the KAP data set on NRM practices to fill the gap between the contextual KAP data source and the actual intervention sites. Thus, the results of this limited assessment, together with the 1992, 1994 and 1996 KAP survey data, and the existing, compatible activity-specific data will provide a better basis with which to analyze and report results, review performance targets, and reassess the SO development hypothesis.

Under the **new CSP**, USAID/Senegal proposes to continue selected NRM activities as integral components of both the Decentralization and Private Sector Strategic Objectives. The logic behind this approach is that there is a strong synergy between NRM results and the results of both of these SOs. The NRM interventions are dominated by a participatory approach and are done largely in conjunction with income generating interventions that are agricultural and NRM based, such as tree/shrub nurseries, small scale grain mills, cattle fattening, etc. Thus, the NRM practices participatory approach is directly linked to both better governance through empowerment at the local level and more income generating opportunities through NRM-based enterprises. Moreover, the reasoning is that because of these synergies, impacts in all three sectors will be greater by integrating NRM than by having a separate NRM SO. At the CSP presentation to USAID/W in February 1998, the challenge will be to make this case. One purpose of this limited NRM assessment will be to provide field-based examples, information and analyses about these synergies (decentralized decision making authorities - increased use of NRM practices - greater private sector opportunities).

The task of determining **lessons learned**, with regard to the NRM investment under the current strategy will serve to inform not only the new USAID/Senegal strategy, but other USAID operating units involved in NRM investments.

**Specific Objectives:** Generally, for tasks related to **R4 input and information management system improvements**, the assessment objectives include:

- # to assist USAID/Senegal refine its current NRM development hypothesis;
- # to refine the approach to tracking and updating the hypothesis; and
- # to make recommendations for improvements in the existing information system for using field-based information to inform decision making at all levels.

This assessment will be conducted in targeted areas of selected Activities and will address the following questions for use in R4 preparation:

- # Identify sites where NRM changes have occurred within the last five years, with particular attention to percentage of farmers (male and female) using live fence, compost, improved seed, wind breaks, fallow land, manure, and field trees innovations.
- # Identify economic, environmental, and democratization outcomes of these changes, and, to the extent possible, quantify the outcomes.
- # Identify the conditions (socio-economic, institutional, political, biophysical, informational, human resources, demographic, etc.) that seem to have contributed to the changes observed in the management of the natural resources base and, conversely identify conditions which constrain adoption of NRM practices/technologies.
- # Identify the factors (policy and institutional changes, training, diffusion of information, etc.) that contributed to the establishment of the above conditions.
- # “Spread affect” of NRM practices attributable to SO2 activity interventions will be highlighted.

For the **new CSP**, based on the field observations and, to the extent possible, past experiences in other countries, the assessment will conduct analyses to address the following:

- # Identify synergies between NRM and governance, that is, between decentralized decision making authorities and increased use of NRM practices and provide examples; and
- # Identify synergies between NRM and the private sector, that is between increased use of NRM practices and greater private sector opportunities, and provide examples.
- # Prepare 3-4 examples (case studies) from existing activities in the current strategy, and/or from experiences in other countries which demonstrate the linkages and synergies among all three: decentralized decision making authorities - increased use of NRM practices - greater private sector opportunities.

- # For tracking SO outcomes, suggest approaches for tracking progress against the Strategic Objectives, against NRM outcomes and for testing the development hypothesis.

**Methodology:** For this assessment, the team will review available reports and data sets, and will use an interview approach for field work, with a limited structured set of questions (some of which will be taken from the 1996 KAP survey instrument) to be executed to a small sample of the farmers in selected SO2 activity sites. The assessment is to focus on both NRM-based agricultural production activities and forestry activities. The team will assess the utilization of NRM practices or technologies related to both forestry and agricultural production activities in selected SO2 activity sites. In each of the selected households, questions will be posed to the household head and the “woman leader” (*femme leader*) to allow for gender desegregated data.

**Team and Timetable:** A three-person team will spend three to four (maximum 4.5 weeks for team leader) collecting field-based information, conducting analysis and preparing a final report. The team leader will be responsible for the final report. The team will consist of the following:

- # NRM Specialist and Team Leader
- # Economist
- # Social Scientist

All team members must be fluent in French and have strong base of NRM experience in West Africa. The Social Scientist must have a strong understanding of Senegalese culture and practices, be fluent in local Senegalese languages, and be prepared to assist the team with translations from local languages into French.

The assessment will take place in Senegal starting in early January 1998. The US-based members of the team will be briefed in Washington for one day before travelling to Senegal. USAID/Senegal will work with its partners to prepare a one-day briefing on development activities over the last five years. Some of the team members will spend ten days or more in the field. It is anticipated that USAID partners will participate in parts of the field assessment, as well. Given the limited time available, the team will focus on areas where there is significant information already available. These could include some sites affected by the KAED, WINROCK/OFPEP, and/or NRBAR Activities.

Given the limited time, it is understood that this will not be an exhaustive or definitive assessment. But, it is anticipated that it the team will be able to collect sufficient information and bring sufficient knowledge to address the above questions in a credible and plausible way. It is also understood that the team’s report will contribute to a development hypothesis that can be objectively assessed and updated.

**Deliverables:** Ten copies of the final draft report in English will be submitted by the Team Leader prior to his/her departure from Senegal. The draft document will including a table of contents, executive summary, the body of the report, recommendations, lessons learned and appendicies. The body of the report will contain the following elements:

**For the R4 and information management system improvements:** An analysis of results obtained under SO2, both through review of available data and reports and through field level data collection will be included. Concentration will be on Key Intermediate Result B (Improved NRM techniques mastered and used by farmers), but will also include highlights of important results in related KIRs (A, C, and D) which contribute to the SO. It will also include an analysis of unexpected results.

Results of field surveys (small data sample based on selected site visits) showing percentage of farmers (male and female) using selected NRM practices (live fence, compost, improved seed, wind breaks, fallow land, manure, and field trees) in selected Activity sites will be included. Any “spread affect” of NRM practices attributable to SO2 Activity interventions will be highlighted.

The team will provide a data collection plan, using Paradox software, as appropriate. The team will conduct analyses of general trends (desegregated by gender), spread effects, conditions and factors which contributed to these changes, etc. These analyses will be included in subsequent reports to be provided to USAID/Senegal in hard copy and on disk.

The team will make recommendations to assist USAID/Senegal refine its current NRM development hypothesis and to refine the approach to tracking and updating the hypothesis. It will also recommend improvements in the existing information management system for better use of field-based information to inform decision making at all levels.

**For the CSP:** The report will include write-ups of 3 to 4 field-based case studies of existing interventions about the synergies (decentralized decision making authorities - increased use of NRM practices - greater private sector opportunities) which could be used in the new CSP. The write-ups will demonstrate the linkages between the broad participatory approach currently being used to disseminated NRM practices under SO2 and results foreseen under the new Decentralization and Private Sector SOs, thus linking the participatory NRM practices approach to both better governance through empowerment at the local level and more income generating opportunities through NRM-based enterprises.

**Lessons Learned/Recommendations:** The report will include lessons learned and/or recommendations which the team may be able to glean regarding how to track results and/or manage for results more effectively; how to develop better indicators, Results Packages, monitoring and evaluation plans and use them more effectively to make changes in planned outcomes.

The final report (twenty copies each, in English and French) will be submitted to USAID/Senegal no later than 3 weeks after comments are received from USAID/Senegal on the draft report.

## Annex B

# USAID/Senegal NRM Activity Portfolio

***PVO/NGO Support Program, Project no. 685-0284:*** This \$21-million, 8-year activity (increased from \$15 million originally obligated to \$21 million total) has two main components: a) financing mini-projects, and b) institutional support. Three main activities are prioritized: a) health, b) agriculture and natural resources, and c) liberalization of markets. To date, the majority of activities have focused on NRM. A stronger focus will likely be placed on health in the future. The Activity is scheduled to end in June 1999. The goals of the project are to improve the standard of living in rural Senegal by supporting sustainable development activities in the NRM and other sectors initiated by the beneficiaries, and to reinforce the technical and managerial capacity of groups and associations, and the technical and institutional capacity of local NGOs, NGO associations and development institutions. According to the latest quarterly report (July 1 - Sept. 30, 1997), the latest training activities in NRM-related topics included: a) NRM monitoring and evaluation training, 13 NGOs with 45 participants, b) enabling NGOs to develop capacities to design bankable projects, one seminar for 16 participants, c) review of KAP 96 surveys, 13 NGOs, 13 participants, and d) strategic planning seminar, nine NGOs, 11 participants, and d) integrated pest management training.

***KAED: Kaolack Agricultural Enterprise Development, Project no. 685-0302:*** This 5-year, \$8 million activity implemented through Africare has been extended to 30 September, 1998. The project strategy is to: "increase incomes through the use of sustainable agricultural production techniques and investment in viable agricultural-based enterprises." (Africare/Senegal Multi-Year Plan, July 1992). The objective is to increase farmer incomes in some 72 Agriculture-Based Enterprises (ABEs) through the promotion of improved NRM techniques. To date, KAED has successfully established demonstration sites in 56 ABEs where improved NRM techniques are demonstrated to the adjacent participating farming communities. Also included in the portfolio of activities are improved access to credit, training in a variety of technical and management topics, and the provision of some infrastructure and materials.

***NRBAR: Natural Resource-Based-Agricultural Research, Project no. 685-0285:*** This 6-year, \$23.3 million activity implemented through the Consortium for International Development (CID) will end on September 30, 1998. The project provides support for the Institut Sénégalais de Recherches Agricoles (ISRA) in the design and implementation of natural resources-based technologies to increase the productivity and sustainability of cereals-based cropping systems for four selected cereals: millet, sorghum, corn and rice. The four objectives are as follows: a) strengthen ISRA's institutional capacity for research and financial management, b) carry out research on at least 20 different NRM practices, c) develop validated natural resource-based technologies available for adoption, and d) develop a farmer-participatory research system for designing, testing, and validating research (USAID/ISRA/CID, 1995).

***CBNRM: Community-Based Natural Resources Management, Project no. 685-0305:*** As stated in Bertelsen et al (1997). "the stated goal of the CBNRM activity is to increase private sector incomes from the exploitation of natural resources consistent with decentralized, sustainable natural resources management (NRM). The Project sub-goal is to increase soil productivity and its purpose is to increase local community participation in the identification, planning, use, and conservation of

natural resources.” The \$36-million (\$21 from USAID) project implemented by SECID began in 1994 and is currently scheduled to end September 30, 2001. The approach to implementation has been local participation in the identification of NRM problems, priorities and constraints, manifested in the preparation of detailed land use management plans for communautés rurales (CRs) consisting of geographical administrative areas containing several villages. The project works through Comités de Gestion (CGs) established with elected members representing different stakeholder groups in the villages to oversee the implementation of micro-grants within the framework of the management plans. To date, some 15 land use management plans (LUMP) have been completed and more than 145 cost-sharing mini-projects are underway. The target is to prepare 50 LUMPs.

***SZWM: Southern Zone Water Management, Project no. 685-0295:*** The \$18-million SZWM project which began in August 1988, implemented by Louis Berger International, Inc., ended on September 30, 1997. The purposes of the project were to slow down or stop the heavy losses of farm land in the Casamance region (Ziguinchor and Kolda) of southern Senegal due to salt intrusion, and to help farmers reclaim and increase agricultural productivity (for rice production) on much of the land. The components of the project included water management infrastructure developments, institutional support, applied research, and environmental monitoring. As a result of the project, some 15 million hectares have been protected from salt intrusion.

***OFPEP: On-Farm Productivity Enhancement Program:*** OFPEP is a 4-year project with a current PACD of December 31, 1998. It is a regional project funded through USAID/W, implemented in the countries of The Gambia, Uganda, and Senegal in collaboration with the PVO/University Center for Collaboration in Development. The goal is to improve nutrition, income and well-being of small farmers in targeted developing countries. OFPEP’s lead agency in Senegal is Winrock International. The purpose is to achieve sustainable agricultural productivity and conservation of natural resources through improved management of community and individual resources, inputs and knowledge (indigenous and introduced) pertaining to soil fertility management and seed production and handling. The project focuses on on-farm seed technologies to include production, selection, storage, and handling of seed. It seeks to incorporate management technologies that aims at improving soil fertility including biological nitrogen fixation and legume management, better use of organic matter, and agroforestry interventions. It is expected that these soil technologies will assist in erosion control. OFPEP also promotes a participatory approach intended to make farmers partners in the development process. One of the major accomplishments of OFPEP in Senegal is the development of a baseline survey which was designed to gather qualitative information on soil fertility and natural resources. The information from the survey has helped OFPEP: a) identify the constraints related to soil fertility improvement and the needs of farmers; b) establish a benchmark against which OFPEP and its collaborators will measure progress attributable to their actions; c) develop training materials for extension agents of collaborating partners and farmers; and d) identify appropriate applications technologies generated by ISRA.

**Annex C**  
**SO2 Results Framework**



## Annex D

# List of Individuals and Institutions Contacted

### **At USAID/Washington:**

McGahuey, Mike, AFR/SD/PSGE  
Bartel, Paul, AFR/SD/PSGE  
Henninger, Norbert, WRI  
Gray, Jeff, AFRICARE  
Stoney, Carol, WINROCK

### **USAID/Senegal, Dakar:**

BA, Oumou, CATT  
Barro, Abdoulaye, TT  
Cissé, Seydou, CATT  
Diop, Mawa, SO2 Facilitator  
Diop, David, SO2 Facilitator  
Fall, Samba, SO2 Facilitator  
Faye, Francois, SO2 Facilitator  
Niec, Rebecca, SO2 Coach  
Ndiaye, Sounka, PRM, DAWG  
Keita, Moridbadjan, PRM, DAWG  
Allen Reed, Deputy Director  
Nesterczuk, Igor, Controller  
Navin, Woody??, Program Officer

### **PVO/NGOSupport Project, Dakar:**

Paye Gueye, Awa, COP  
Seye, Ousmane Raymond, Institutional and Training expert  
Nesterczuk, Anne Petesch, NTF Advisor

### **Natural Resource-Based Agricultural Research Project (NRBAR), Dakar:**

Cusack, Tom, CID COP NRBAR  
Faye, Adama  
Bocoum, Mohamadou Lamin  
Ndiaye, Jean Pierre  
Dieng, Massamba

### **On-Farm Productivity Enhancement Program (OFPEP/Winrock), Dakar:**

Faye, Alphonse, Dir.

**Community-Based Natural Resources Management (CBNRM), Dakar:**

Sarr, Papa, Chef Aménagement et Gestion des Terroirs (DAGT)  
Elbow, Kent, Expert DAGT  
Diop, Massamba, Chef Etudes et Recherches (DER)  
Povolny, Jeff, Expert Financier  
Ba, Salimata, Sociologue, Division communication  
Dufour, Wendy, Expert Division Communication  
Fickes, Jim, COP CBNRM  
Samoura, Abdourahmane, Directeur Nationale, CBNRM

**Africare, Dakar:**

Taylor-Smith, Robert E., Resident Rep.

**Rodale, Thies:**

Seck, Voré, Director  
Sané, Onsoumana, responsible for NRBAR Program  
Diouf, Ibrahima, Technical Coordinator for agroforestry and other NRM techniques  
Dienj, Ali Gueye, Agronomist

**ISRA, Bambey:**

Seck, Dogo, Director  
Szempruch, Boris, Agronomist

**ISRA, Kaolack:**

Sene, Moudou, Soil Scientist  
Toure, Mme Fatim Dia, Animal Scientist

**Africare KAED, Kaolack:**

Niang, Moustapha Mamadou, Deputy Project Coordinator  
McHugh, Dermot, Project Coordinator  
Thioub, Mamadou Hamidou, field agent  
Marti, Damas, field agent  
Toure, Cheikh Tidiane, NRM specialist  
Marie Jeanne, WID Specialist

**Administrative Services, Kaolack Region:**

Papa Souley Dieye, Ministere de l'Interieur, Service Regional de Developpement a la Base  
Boubacar Haidara, Ministere de l'Agriculture, Inspecteur Regional de Service de l'Agriculture  
Cheik Omar Diop, Inspecteur Regional de Service des Eaux et Forets  
Moussa Yaba Fall, Directeur Administratif et Financier du Conseil Regional  
Mr. Ly, Charge de Mission du Conseil Regional

**Projet d'Organisation et de Gestion Villageoises (POGV), Ministere de l'Agriculture - FIDA,**

Waly Ndiaye, Coordonnateur, Cellule d'Appui (Kaolack)

**Action Humaine Pour le Développement Intégré au Sénégal (AHDIS):**

Diouf, Amacoudou, Coordinateur de Programme

Diouf, Alioune, Coordinateur GRN

**SENAGROSOL CONSULT**

Thiongane, Mme Soukèye, Sociologue

Daffé, Mamadou, Directeur

**Winrock OFPEP village: Ndollor**

Kama, Pierre, Project Director

Benoit, Jean, Vulgarisateur

## Annex E

# Limitations of the Data

In order to come up with consolidated figures for Table 3 (in the main text of the report), there were several adjustments necessary and numerous assumptions made. Because of these, the statistical validity of the results cannot be tested. In fact, there are so many inconsistencies and incompatibilities among the data sets that the value of a consolidated report is questionable. Nevertheless, the results do correspond roughly to what was observed by the team during our ten day, 22-village field trip. That said, these results should be interpreted appropriately: as indicative of general trends and not as statistically valid measures of progress. If used in R4 reporting, they should include this caveat.

### INCONSISTENCIES AND INCOMPATIBILITIES AND HOW ADDRESSED

**Sample populations:** Not every survey used the same sampling techniques. KAED used a stratified sample methodologies to assure equitable sampling of ABE member and non-member households. CBNRM used a random sample methodology similar to the national KAP (SENAGROSOL performed the work for both CBNRM and the KAPs). For consolidation purposes, KAED results are taken from the ABE member household subset, which is considered more indicative of the direct impact of activities conducted by KAED. Overall adoption rates were calculated by simply dividing the total number of adopting households by the total number of households sampled in all four surveys. Sample sizes for the four surveys were as follows: KAED: 177; CBNRM: 571; PVO/NGO: 500; SZWM: 600. Because of KAED's small sample size, their results are under represented.

**Differing time frames:** KAED, PVO/NGO and SZWM surveys were conducted in areas where activities have been conducted for a number of years. CBNRM, on the other hand, conducted surveys in areas where program activities have just begun. It would seem intuitive that adoption rates would have a high correlation with length of presence of programs, but a superficial look at the figures do not bear that out. CBNRM, for example, reports a 70 percent adoption rate of field trees, while KAED reports only 30 percent. A similar difference is found for the use of stone lines (CBNRM: 16 percent vs. KAED: 8 percent) The only practices that do have a strong correlation with program presence are composting and improved cookstoves. There are other factors that may explain these differences, but these differences must be left to conjecture until sampling methodologies are standardized. In any case, the numbers from the various surveys were consolidated without any adjustments.

**Persons interviewed:** Some of the surveys interviewed the male heads of households and asked them to answer questions on behalf of their entire household. Others asked the interviewee to answer only in regard to his or her personal knowledge and practice. Some did not make it clear to the interviewee, so it remains unknown if data reflects household level or individual adoption rates. Females interviewed in general were asked about their individual practices, but it is unclear if female heads of households answered for themselves or for their entire households. KAED interviewed every individual who farms in the sampled households, but consolidated answers to the household level. For consolidation purposes, it is assumed that male heads of households answered in behalf

of their entire household, while women reported only their personal practices. The only truly gender disaggregated data are found in KAED survey results.

**Formulation of the NRM question:** This is arguably the largest source of error and incompatibility in the surveys. Some surveys asked “Do you know of any practices to improve your fields and increase production?” (KAED). Others asked “Do you know any NRM practices” (PVO/NGO). Others simply read a finite list of practices and asked if people knew or used them (SENAGROSOL, CBNRM, SZWM). The methodology recommended by USAID was that followed by KAED, except that KAED did not report all answers (expressly excluding manure, fallow, and improved seed) and did ask specifically about improved cookstoves. In spite of the large differences in methodologies, the resulting numbers are used as is. It is assumed that the KAED and PVO/NGO survey results will underreport actual use figures, while data acquired by reading a list may overstate use rates. As the truth lies somewhere in between, consolidating all results may be as close to reality as can be hoped.

**NRM practice nomenclature:** Names of NRM practices were not uniform from one survey to another, some surveys used several names for what USAID measures as a single indicator, and some key practices were not reported at all. In the case of differing names, close proximity was used. Multiple practice names were consolidated at the indicator level wherever possible and reasonable (i.e. compost, compost pits, and compost heaps were consolidated as “compost”). Where certain practices were not reported (i.e. KAED does not report manure, fallow, and improved seeds), only the results of reported practices were used in the consolidation exercise.

**Incompatible data formats, file names, codes, and variables:** This problem was dealt with by using tabulated results in printed documents rather than by trying to make sense out of disparate data formats. By not working with raw data, validation of results and any further analysis was precluded. The one exception to this was the data from CBNRM, which was successfully decoded and summarized directly from raw data sets, validating figures contained in printed reports.

## Annex F

# Information Management System Exercise

**Purpose:** Assess the effectiveness of the USAID information management system.

**The exercise will look particularly at the following points:**

- # Thoroughness: How complete and up-to-date are the data sets? Are all relevant data sets available for SO2 monitoring, reporting and analysis?
- # Compatibility: Are the data sets in formats that can be read and analyzed with USAID standard software (Paradox)?
- # Ease of Use: How user-friendly is the system? Do the data sets permit efficient reporting and analysis?
- # Capability: The exercise will determine the system's ability to perform increasingly complex data analyses.

### **Exercises:**

1. Are the KAP 92, 94, and 96 data sets available? Are project data sets for site-specific KAPs and R4 reporting available (KAED, NRBAR, CBNRM, SZWM, PVO/NGO) for 1997
2. Provide the following information (data set to be used is indicated in parentheses)
  - # What percentage of the population of Kaolack used live fencing (*haie vive*) in 1992? (KAP92)
  - # What percentage of *chefs du menage* used live fencing in Kaolack in 1996? (KAP96)
  - # What percentage of ABE members used live fencing in the KAED zone in 1997? (KAED97)
  - # What percentage of the population of Senegal used at least one NRM technology in 1992 (KAP92)
  - # Generate the same table that appears on page 1 of annexe 5 in the 96 KAP
  - # What is the percent use of compost in all projects in 1997 (summary report)
3. **Perform the following analyses:**
  - # What is the relationship between level of education and use of compost in 1992? (KAP1992)
  - # What is the relationship between economic level (wealth) and use of live fencing in 1996? (KAP 1996)
  - # What is the main reason for not using compost in 1996? (KAP96).

## Annex G

# Memo from Senegrosol

l'attention de Mr Moribadian Keita.

*DAKAR /e.*    Ie 8 septembre 1997

.....

Ci-contre les éléments relatifs aux travaux de réajustement des données KAP 92/94

Ces éléments comprennent notamment:

le nombre et l'identification des ménages communs aux trois années, y compris les numéros des concessions et les adresses géographiques (villages, CR, arrondissements ...)

les questions communes aux trois KAP qui vont être ressaisies pour créer un nouveau fichier qui va faciliter l'analyse.

Comme je l'ai expliqué nous voulons, dans un deuxième temps, cartographier l'ensemble de ces données de manière à visualiser la situation d'impact des activités de GRN dans les diligentes zones concernées par les enquêtes.

La base ainsi réalisée va compléter le profil environnemental du Sénégal que nous avons initié en 1990 et qu' faisait le point de l'état de des ressources naturelles en place.

Avec nos salutations

Mamadou Daffé

ETUDES - CONSEILS ET REALISATIONS

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## Annex H

# Survey Questionnaire

### *I. Composition Demographique du Ménage*

1. Chef de menage est : homme: \_\_\_\_\_ ou femme: \_\_\_\_\_
2. Si le chef est un homme, nombre d'epouses? \_\_\_\_\_  
Nom chef de menage homme \_\_\_\_\_  
Nom, chef de la femme "leader": \_\_\_\_\_
3. Supprimer

### **RELATIONS ASSOCIATIVES**

4. Est-vous membre: d'un groupe qui travaille avec un projet? Oui: \_\_\_\_ Non: \_\_\_\_  
d'une cooperative? Oui: \_\_\_\_ Non: \_\_\_\_  
d'une association villageoise? Oui: \_\_\_\_ Non: \_\_\_\_  
d'un groupement d'interet economique? Oui: \_\_\_\_ Non: \_\_\_\_
5. Votre femme est-elle membre d'un groupe qui travaille avec un projet  
Oui: \_\_\_\_ Non: \_\_\_\_  
d'une cooperative? Oui: \_\_\_\_ Non: \_\_\_\_  
d'une association villageoise? Oui: \_\_\_\_ Non: \_\_\_\_  
d'un groupement d'interet economique? Oui: \_\_\_\_ Non: \_\_\_\_
6. Composition du Menage: Combien de membres?  
(Menage = Les personnes qui mangent et dorment ensemble, et qui sont presentes le jour de l'interview.)

Age <6ans \_\_\_\_\_                      6 < Age <14ans \_\_\_\_\_                      Age >14ans \_\_\_\_\_

7 & 8. Supprimez

***Adressez les questions suivantes au Chef de Menage:***

### ***II. Ressources Agricoles du Menage***

## A. La Terre et les Cultures

9. Supprimes
10. Combien de champs etait gerés par le menage en 1997 (y compris le jachere)? \_\_\_\_\_  
 Quelle en est la superficie totale?: En hectares: \_\_\_\_\_  
 Autres unites (Precisez): \_\_\_\_\_
11. Remplir le tableau selon la culture et la mode d'acquisition des terres

Culture ou speculation	Superficies (Precisez les unites de mesure)	Modes d' Acquisition (Code)

Code pour le mode d'acquisition:

- (1) Droit de hache    (2) Heritage    (3) Emprunt    (4) Location    (5) Don  
 (6) Achat            (7) Affectes par la CR    (8) Autres

12. Aviez-vous votre "titre d'affectation" de la CR pour vos terres?: Oui \_\_\_\_\_ Non \_\_\_\_\_
13. Pouviez-vous vendre votre terre si vous le vouliez?: Oui \_\_\_\_\_ Non \_\_\_\_\_
14. Risque-t-on de voir une personne qui n'appartient pas a votre menage s'emparer des terres que vous ne cultivez pas actuellement?: Oui \_\_\_\_\_ Non \_\_\_\_\_ Ne sait pas \_\_\_\_\_
15. Si la reponse est "Oui" a la question 14, posez la question suivante:

Que pouvez-vous faire pour prevenir cette situation?

- 1 = planter des arbres fruitiers \_\_\_\_\_  
 2 = planter une haie \_\_\_\_\_  
 3 = installer une cloture \_\_\_\_\_  
 4 = autres (precisez) \_\_\_\_\_

16-19. Questions annulees

20. Combien de mois de consommation votre production de mil/sorgho a-t-elle pu couvrir depuis la recolte?: \_\_\_\_\_

**C. Betail (Supprimes)**

21.

**D. Acces au Credit**

22. Avez-vous obtenu du credit en espee ou en nature pour l'agriculture?: Oui\_\_\_ Non \_\_\_

23. Si oui: combien de fois? \_\_\_\_\_

24. La derniere fois, quel(les) en etaient:

L'objectif du credit?: \_\_\_\_\_

La source: \_\_\_\_\_

L'annee: \_\_\_\_\_ Le montant: \_\_\_\_\_

Les termes. Taux d'interet: \_\_\_\_\_ Delai de remboursement: \_\_\_\_\_

25. Quel est l'etat de la route du village au marche que vous frequenter pendant la hivernage?

Tres Bon \_\_\_\_\_ Bon: \_\_\_\_\_ Passable: \_\_\_\_\_ Mauvais: \_\_\_\_\_

26. Supprimes

**IV. Utilisation de Pratiques de Gestion de Ressources Naturelles**  
**Adressez ces questions au Chef de menage:**

27. Connaissez-vous des pratiques pour ameliorer vos champs et acroitre la production ou pour conserver les ressources naturelles?: Oui\_\_\_ Non\_\_\_

Si Oui, quelles sont-elles? Et qui est ce qui vous a appris ces pratiques?

*(Ne lisez pas la liste figurant sur le tableau ci-dessous. Cochez devant la pratique citee et en demandez la source)*

Pratiques de Gestion de Ressources Naturelles	Pratiques Connues	Source(s) deConnaissance
Utilisation de Fumier		
Epandage d'Engrais Chimiques		
Parcage		
Utilisation d'Ordures Menageres		
Compostage		
Demariage		
Arbres en pleins champs		
Brise-vent		
Haie vive		
Semences ameliorees		
Produits phytosanitaires		
Digues suivant les courbes de niveau		
Regeneration assistee		
Jachere amelioree		

28. **Instructions:** 28:1 Recochez dans le tableau CI-DESSOUS toutes les pratiques connues du repondant, en vous referant au tableau precedent.28:2. Posez la question et cochez les reponses sur le tableau CI-DESSOUS: “Quelles sont les pratiques que vous avez utilisees sur vos champs l’annee passee?”28:3. Pour chaque pratique utilisee l’annee derniere, posez les deux (2) questions suivantes: “Sur quelles cultures?” et “Quelles sont vos raisons pour utiliser cette technique?”

28:4. Pour les pratiques connues du repondant mais qu’il n’a pas utilisees l’annee derniere, posez la question suivante: “Quelles sont vos raisons de ne pas utiliser ces pratiques?”

Pratiques de Gestion de Ressources Naturelles	Con-n.ues (X)	Utili-sees (X).	Cultures interessees	Raisons: Pourquoi OU Pourquoi pas?
Utilisation de Fumier				
Epannage d'Engrais Chimiques				
Parcage				
Utilisation d'Ordures Menageres				
Compostage				
Demariage				
Arbres en pleins champs				
Brise-vent				
Haie vive				
Semences ameliorees				
Produits phytosanitaires				
Digues suivant les courbes de niveau				
Regeneration assistee				
Jachere amelioree				

**Adressez les questions CI-DESSOUS a la femme "leader":** 29. Avez-vous obtenu du credit en espece ou en nature pour l'agriculture?: Oui \_\_\_ Non \_\_\_ 30. Si oui: combien de fois? \_\_\_ 31. La derniere fois, quel (le)s en etaient:

L'objectif?: \_\_\_\_\_

La source?: \_\_\_\_\_

L'annee: ? \_\_\_\_\_ Le montant?: \_\_\_\_\_

Les termes. Taux d'interet?: \_\_\_\_\_ Delai de remboursement?: \_\_\_\_\_ 32.

Quelle est la condition de la route du village au marche que vous frequentez pendant l'hivernage?

Tres Bon: \_\_\_ Bon: \_\_\_ Passable: \_\_\_ Mauvais: \_\_\_ 33. Supprimez

34. Aviez-vous cultive des champs l'annee derniere?: Oui \_\_\_ Non \_\_\_ 35. Si oui: combien de champs? \_\_\_\_\_ 36.

Si oui: en quelles cultures?: \_\_\_\_\_ 37. Aviez-vous

cultive aussi dans les champs de votre mari? Oui: \_\_\_ Non: \_\_\_ 38. Si oui: quelles etaient les cultures?

39. Connaissez-vous des pratiques pour ameliorer votre champs et accroitre la production ou pour conserver les ressources naturelles?: Oui: \_\_\_ Non: \_\_\_

Si Oui: quelles sont-elles?: Et Qu' est-ce qui vous a appris ces pratiques?(*Ne lisez pas la liste du tableau ci-dessous. Cochez devant les pratiques citees et en demander la (les) sources*)

Pratiques de Gestion de Ressources Naturelles	Pratiques Connues	Source(s) de Connaissance
Utilisation de Fumier		
Epannage d'Engrais Chimiques		
Parcage		
Utilisation d'Ordures Menageres		
Compostage		
Demariage		
Arbres en pleins champs		
Brise-vent		
Haie vive		
Semences ameliorees		
Produits phytosanitaires		
Digues suivant les courbes de niveau		
Regeneration assistee		
Jachere amelioree		

40. **Instructions:**

- 40:1 Recochez dans le tableau CI-DESSOUS toutes les pratiques connues du repondant, en vous referrant au tableau precedent.40:2. Posez la question et cochez les reponses sur le tableau CI-DESSOUS: "Quelles sont les pratiques que vous avez utilisees sur vos champs l'annee passe?"40:3. Pour chaque pratique utilisee l'annee derniere, posez les deux (2) questions suivantes: "Sur quelles cultures?" et "Quelles sont vos raisons pour utiliser cette technique?"
- 40:4. Pour les pratiques connues du repondant mais qu'il n'a pas utilisees l'annee derniere, posez la question suivante: "Quelles sont vos raisons de ne pas utiliser ces pratiques?"

Pratiques de Gestion de Ressources Naturelles	Con-nues (X)	Utili-sees (X).	Cultures interessees	Raisons: Pourquoi OU Pourquoi pas?
Utilisation de Fumier				
Epannage d'Engrais Chimiques				
Parcage				
Utilisation d'Ordures Menageres				
Compostage				
Demariage				
Arbres en pleins champs				
Brise-vent				
Haie vive				
Semences ameliorees				
Produits phytosanitaires				
Digues suivant les courbes de niveau				
Regeneration assistee				
Jachere amelioree				

**V. *Material Possede par le Menage (Supprimes)***

**VI. *Eau***

42. Quelle est la source d'eau pour la maison?

1. Puits traditionnel communal \_\_\_\_
2. Puits traditionnel individuel \_\_\_\_
3. Puits modern (ciment) communal \_\_\_\_
4. Riviere, source, ou lac \_\_\_\_
5. Robinet communal \_\_\_\_
6. Robinet dans la concession \_\_\_\_
7. L'eau dans la maison \_\_\_\_
8. Autre (Precisez) \_\_\_\_\_

42a. Il vous faut combien de bassins par jour pour l’approvisionnement de votre ménage en eau?

\_\_\_\_\_

42b. Il vous faut combien de temps par jour pour chercher cette quantité d’eau ?

en Septembre \_\_\_\_\_

en Avril \_\_\_\_\_

**MERCI BIEN!**

## CODES PROVISOIRE

### Standard:

- 1 = Oui, 2 = non
- 1 = Homme, 2 = femme
- 0 = Aucune reponse

### Occupation principal:

- 1. Agriculteur
- 2. Commerçant
- 3. Etudiant
- 4. Travail permanent salarie
- 5. Pecheur
- 6. Eleveur
- 7. Marabout
- 8. Menagere
- 9. Aucune
- 10. Autre, precisez
- 11. Aucune reponse

### Cultures:

- 1. Mil
- 2. Mais
- 3. Sorgho
- 4. Riz
- 5. Arachide
- 6. Niebe
- 7. Manioc
- 8. Patate douce
- 9. Pastèque
- 10. Culture maraichere
- 11. Bissap
- 12. Gumbo
- 13. Aucune reponse

### Raisons pour ne pas utiliser une technique de GRN:

- 1. Manque de temps
- 2. Manque de l'argent
- 3. Manque moyen de transport (manque de charette)
- 4. Le femme ne peut pas faire cet travail
- 5. Ne sait pas

### Source de connaissance de techniques de GRN:

- 1. Projet, specifiez laquelle
- 2. GOS
- 3. Tradition
- 4. Voisins ou amis
- 5. Parents
- 6. Radio
- 7. Par usage meme
- 8. Autre, especifiez
- 9. Aucune reponse

### Raisons pour utiliser une technique de GRN:

- 1. Augmenter la production, avoir un bon recolte
- 2. Le feuillage est vert fonce et les epis sont grands
- 3. Nourrir le culture