

Report

**Measuring the Impacts of Natural
Resource Management Activities
in the OHVN**

May 2000

Report

Measuring the Impacts of Natural Resource Management Activities in the OHVN

By
Valerie A. Kelly

Department of Agricultural Economics
Michigan State University

May 2000

For
Africa Bureau
ENR Policy Support III

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ)
Partners: International Resources Group, Winrock International,
and Harvard Institute for International Development

Subcontractors: PADCO; Management Systems International; and Development Alternatives, Inc.

Collaborating Institutions: Center for Naval Analysis Corporation; Conservation International; KNB Engineering and Applied Sciences, Inc.; Keller-Bliesner Engineering; Resource Management International, Inc.; Tellus Institute; Urban Institute; and World Resources Institute.

Acknowledgments

So many people contributed to this report that it is not possible to name them all individually. Mike McGahuey (AID/W) must be singled out, however, because without his keen interest in NRM and strong desire to better understand how NRM activities fit into the overall scheme of agricultural transformation in Africa, I would not have had the opportunity to visit the OHVN and prepare this report. Mamadou Lamine Sylla also made a major contribution to this report by organizing the field trips, providing me access to a wide variety of OHVN documents, and participating in many open, frank discussions about the strengths and weaknesses of the NRM program that he is managing.

Those who contributed the most to this effort—the farmers who interrupted their daily routines to spend the day with us during our field visits—are too numerous to mention individually. These farmers contributed to this report not only by chatting with us and allowing us to visit their farms, but also by working hard during the last 10-20 years to improve their farming techniques, literacy skills, and management abilities.

Others who helped either in the design of the rapid appraisal work, or by commenting on the various presentations I have made concerning this work are Gausou Traoré and Augustin Dembele of USAID/Bamako and Bob Winterbottom of IRG.

This report was prepared by Valerie Kelly acting as an independent consultant for IRG. Dr. Kelly is a Visiting Associate Professor at Michigan State University.

Table of Contents

Acknowledgments

Table of Contents	i
List of Tables and Figures	iii
Executive Summary	iv
1. Background	1
2. Objectives and Methods	2
3. Conceptual Framework	3
4. Rapid Appraisal Results	5
5. Expanding the Progress.....	9
5.1 What to do	9
5.2 Problems to resolve	11
6. Better Quantifying Progress Made to Date	15
6.1 Improvements in counting and reporting adoption.....	16
6.1.1 Report percent of villages and farms adopting	17
6.1.2 Present more detail to show the ‘strength’ of adoption by villages and farms	18
6.1.3 Clarify the definition of ‘recovered land’ and disaggregate it into different categories.....	18
6.1.4 Make some effort to measure ‘disadoption’	19
6.2 Improvements in reporting OHVN production and yield statistics	19
6.2 Case study approach to collecting and analyzing NRM farm-level income Impacts	21
6.4 Rough extrapolations from case studies to the sector level	22
6.5 Survey of OHVN farmers using a representative sample	22
6.6 Development of an ongoing program of monitoring key income and food security indicators	24
7. Closing Remarks	25

Appendices

- Appendix 1: List of Documents Consulted
- Appendix 2: Preparatory Notes on Assessment of Existing Data Bases and Rapid Appraisal Guidelines
- Appendix 3: Microsoft Powerpoint Slides for Presentations at AID/W
- Appendix 4: Field Notes from Village Discussions and USAID/Bamako Presentation
- Appendix 5: Suggested Format for Periodic Reporting of NRM Village and Farm Adoption in the OHVN
- Appendix 6: OHVN Case Study of Production and Income Changes for a Farmer Having Used NRM Practices During Nine years
- Appendix 7: Draft Questionnaires for Collecting Data from AVB/Animateur Notebooks
- Appendix 8: Illustration of Budget Analysis Possible Using the Types of Data in Appendix 7
- Appendix 9: Contents, Forward, and Introduction from *A Methodology for Estimating Household Income in Rural Mozambique Using East-to-Collect Proxy Variables*

List of Tables and Figures

Table 1:	Area, Production, and Yield Data for the OHVN: 1991/92-1998/99	7
Table 2:	Illustrative OHVN Adoption Report: Physical Indicators of NRM Adoption	16
Table 3:	Illustrative OHVN Adoption Report: Villages, Farmers, and Recovered Area	17
Figure 1:	Sustainable Economic Growth Strategic Objective Results Framework.....	3
Figure 2:	Conceptual Framework of OHVN Impacts, Objectives, and Activities	4

Executive Summary

A visit to 7 villages in the Office de la Haute Vallée du Niger (OHVN) and discussions with about 100 farmers using natural resource management (NRM) practices confirmed that something good is happening in the zone (Section 4):

- Yields of all crops are increasing for farmers adopting GRN intensification methods;
- Farmers are unanimous that life is better now than 10 years ago;
- Farmers are optimistic and enthusiastic about the future.

These results come from a complex process that has been going on for more than 15 years (Sections 2 and 3). Ingredients contributing to the current success appear to be:

- Identification of technologies capable of increasing declining yields
- Potential for increased cash income from improved cotton production
- Community approach to implementation
- Focus on youth
- Focus on villages/farmers most likely to benefit from GRN actions
- Use of demonstration effect thru model farmers and model villages
- Incremental training (literacy, technical skills, community organization, management)

Support services offered

- Roads
- Credit guarantees for limited period following management training
- Input/output transport assistance
- Regular supervision and support to trainees
- Some free equipment for implementing GRN activities
- Market research by OHVN to help with crop diversification

Looking toward the future two questions need to be addressed:

1. Is it possible to extend these results by...
 - further increasing yields/incomes of current NRM farmers?
 - reaching a broader group of OHVN farmers?
 - reaching farmers outside the OHVN area?

2. Is it possible to quantify the impacts of NRM intensification activities in terms of...
 - benefits realized by farmers?
 - benefits realized by Malians in general?
 - benefits realized by the rest of the world?

The answer to both questions is yes. Suggestions for accomplishing these tasks are contained in this report (Sections 5 and 6).

1. Background

Over time, the development community has talked about models of sustainable development including entrepreneurial farmers investing in systems that generate more secure and prosperous livelihoods and decrease degradation rates. By several measures, growing numbers of producers in the OHVN (Office de la Haute Vallée du Niger) zone of Mali appear to be on the road to this type of sustainable development. Information available from informal appraisals and the OHVN data base suggest that a significant number of producers are moving from subsistence systems to diversified, revenue-generating systems where yields are increasing and degradation rates are falling. The system is built on production practices that integrate Natural Resources Management (NRM) with investments in inputs (fertilizers, improved seeds). In principle, this integrated system increases input-use efficiency and allows producers to practice intensified agriculture on less land. Commercial credit is the source of capital for many of these investments, and, judging by the repayment rates, the producers have achieved a high level of enterprise-management competency. There also appears to be progress toward community-financed extension systems and community-financed support to improve the delivery of health and education services. The OHVN experience appears to merit closer study to (1) better quantify the results and (2) draw lessons that can be applied to other situations.¹

¹ This introductory paragraph is adapted from my scope of work which was drafted by Mike McGahuey.

2. Objectives and Methods

Given the general perceptions of what has been happening in the OHVN during the recent past, it appears worthwhile for USAID and OHVN to better measure and document the impacts. This report is a first step in that direction. The specific objectives are to (1) confirm the general perceptions described above, (2) recommend low-cost, easy-to-implement methods for better quantifying the impacts of NRM/intensification practices, and (3) recommend actions that can be taken to increase adoption of promising NRM/intensification practices.

To accomplish these objectives I (1) reviewed a wide range of documents describing activities in the OHVN zone during the last 20 years (see Appendix 1), (2) identified existing data bases concerning the OHVN that could potentially contribute to current objectives, (3) developed a format for conducting group discussions with farmers and OHVN agents concerning their experiences with NRM techniques (techniques adopted, factors influencing adoption, impact on production, impact on incomes and standard of living, etc.—see Appendix 2), (4) conducted the group discussions during 4 days of field visits organized by OHVN, (5) discussed preliminary findings and recommendations with USAID/Bamako and OHVN staff, (6) made two presentations of preliminary findings in Washington, D.C. to AID/W personnel and representatives of organizations collaborating with AID/W on NRM activities, and (7) drafted the current report which describes key findings and recommendations.

In my work I have focused on describing—and, to the extent possible, quantifying—changes in agricultural productivity and incomes that have taken place among farmers having adopted NRM practices during the last decade. It is important to note from the start that these changes cannot be attributed with certainty to any particular USAID investments or OHVN activities because the preconditions for doing an analysis of causality over time are absent. The most important precondition lacking is our ability to isolate USAID contributions from other historical events. USAID is only one of many actors in the OHVN and during the last decade many things have happened in Mali that have contributed to the level of agricultural productivity and incomes that we find in the OHVN today (e.g., structural adjustment, market liberalization, restructuring of OHVN, devaluation of the FCFA, a military regime replaced with a democratically elected government, etc. etc.). Another problem is the nature of the USAID contribution—it was a very diffuse contribution covering a wide range of interventions that varied across time and space depending on initial conditions and the expressed needs of different communities and farmers. Some activities were specific to the OHVN project (e.g., support to extension services, road building, literacy training, support to restructuring of the OHVN, credit guarantees) and others were activities supported by the USAID country program that had an impact in the OHVN area as well as elsewhere (support for input/output market liberalization, governance and democracy activities, youth training/employment activities, etc.). When appropriate, I call attention to some of the USAID funded activities that seem to have been particularly important components of the overall environment that stimulated productivity and income growth in the OHVN, but it must be stressed that these observations are based on qualitative rather than quantitative assessments.

3. Conceptual Framework

In any effort to evaluate the impacts of a program, it is important to begin with a theoretical picture of how the program activities are likely to affect selected indicators and produce desired outcomes. Figure 1 is adapted from the results framework used by USAID/Mali to monitor activities contributing to their sustainable economic growth strategic objective. The major change I have made is to add a row between the intermediate result of increasing sustainable dryland agricultural and natural resource management practices and the strategic objective of increasing value added to national income—this intermediate row represents the positive impacts on agricultural productivity and farm incomes that need to occur if the strategic objective is to be achieved. I consider the collection of farm-level evidence that productivity and incomes are increasing in areas where NRM practices are being adopted as a first step in the longer-term process of quantifying contributions of NRM activities to national income.

Figure 1
Sustainable Economic Growth Strategic Objective Results Framework

<p>USAID Strategic Objective</p> <p>Increased Value-added to National Income in Agricultural Sector</p>
<p>Intermediate Impacts</p> <p>Increased Agricultural Productivity</p> <p>Increased Farm Incomes</p>
<p>Intermediate Result</p> <p>Increased Sustainable Dryland Agricultural and NRM Practices</p>
<p>Activity Results</p> <p>Cropping Tenure Prolonged</p> <p>Degraded Lands Rehabilitated</p> <p>Afforested Area Increased</p> <p>IPM Technologies Increased</p>

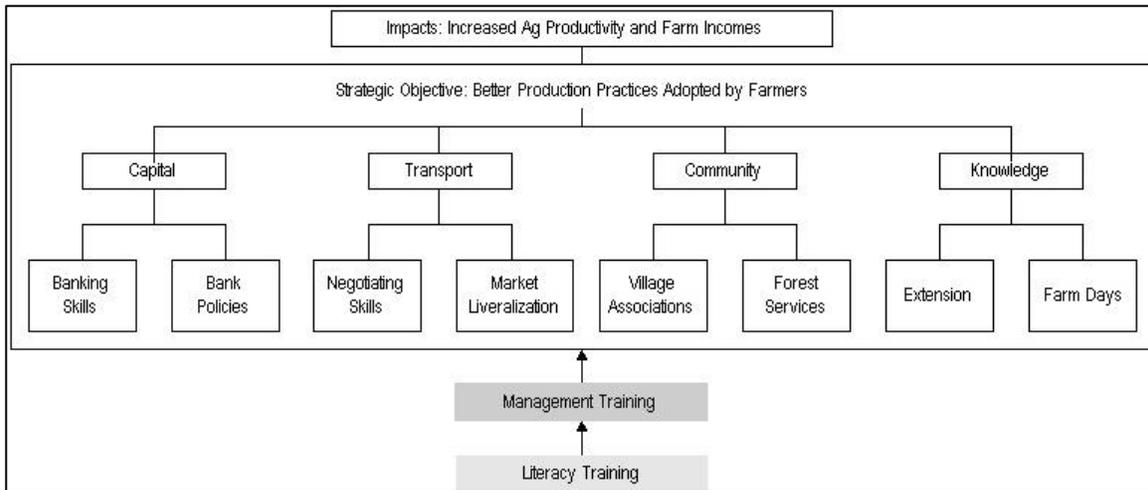
Figure 2 is adapted from the USAID results framework designed specifically for USAID’s OHVN activities. The strategic objective of the results framework is: Better production practices adopted by farmers in the OHVN. Figure 2 shows that adoption of improved production practices is thought to be fostered by improving farmer access to commercial capital, decreasing transport costs, increasing community control over local resources, and improving farmer knowledge about alternative production practices. For a decade now, OHVN and USAID have been monitoring changes in the facilitating variables and increases in the adoption of

improved production practices. These are all variables that can be monitored by counting numbers of loans issued, kilometers of roads built, number of villages managing their own forests, etc. These indicators, however, do not provide us with much information on how much (if at all!) the adoption of these improved technologies is improving agricultural productivity and incomes. As these are the types of impacts we now want to evaluate, I have added a line of 'impacts' above the strategic objective line.

In summary, what I am attempting in this report is to go beyond the OHVN project's strategic objective of increasing adoption of NRM practices to an evaluation of the broader impacts that adoption of these practices is having on agricultural productivity and incomes. I am not, however, at a point where I think we can begin quantifying the contribution of OHVN's NRM activities to value added at the national level. Although this remains the ultimate objective, I do not think it can be done in a credible way until we are able to quantify a few key productivity and income impacts at the farm level.

Figure 2

Conceptual Framework of OHVN Impacts, Objectives and Activities



4. Rapid Appraisal Results

My rapid appraisal (based on 4 days in the field, 7 village meetings that included group discussions with an estimated 100 farmers, and a review of OHVN documents) leads me to confirm the impressions of Mike McGahuey and others who have been working in the OHVN zone for a number of years—Something good is happening in the zone. Evidence of progress include:

Yields of all crops are increasing for farmers adopting GRN intensification methods

We don't know how widespread this is as there is not yet strong evidence in aggregate data that yields are increasing, but all villages visited provided numerous illustrations based on individual farmer records (see Appendix 4)

- Village youth are staying at home to farm rather than migrating.

This was very evident in all villages visited; youth were present at all meetings, they play important roles in management of farmer associations, and they were very active participants in rapid appraisal discussions.

- Farmers are investing heavily in agricultural equipment, traction animals, and livestock.

When asked what they were doing with their increased incomes, the most common response was investment in equipment and/or livestock

- Farmers are diversifying, with many new forays into dry season crops and tree crops.

Increased production of horticultural products during the dry season (green beans for Europe, onions/tomatoes and bananas for Bamako, possible increases in sorrel production for export to the US) is one of the reasons for the reduction in outmigration; marketing remains a problem here, but the farmers' associations appear to have a level of management skills permitting them to deal with the setbacks and move ahead (vs. the old days when they would be expecting the government to bail them out).

Tree crop production (particularly teak for production of construction poles) through development of village and private woodlots is expanding slowly, but most examples seen during the rapid appraisal had not yet begun to generate income.

- Farmers are unanimous that life is better now than 10 years ago.
 - They eat better (more food and better variety)

- They dress better
- They travel more easily (mobylettes have replaced bicycles in many cases)
- Schools and health services are more accessible
- They are better educated (literacy programs and CLUSA management training)
- Farmers are optimistic/enthusiastic about the future.

There is always the possibility that the villages visited were exceptional ones and not typical of the zone. There is no way to know this for sure without doing a survey with a large, randomly selected, representative sample—a potentially costly endeavor. The only source of representative information available for the zone are longitudinal data on aggregate crop production statistics. At present, these data suggest that progress noted in the rapid appraisal is not widespread enough to have made a major impact on the aggregate picture. Summary statistics (Table 1) on production, yields and area cultivated present a picture of impressive growth in production for most crops but little growth in yields—i.e. most of the productivity increases having been realized through area expansion rather than through intensification and better resource management.

Nevertheless, we have a growing base of rapid appraisal results for approximately 20 villages now (two previous trips by Mike McGahuey to different villages) that are all pointing in the same direction. We also have the OHVN data base showing continued expansion in cotton production (to which farmers attribute their recent increases in income) and increased adoption of intensification techniques (to which participant farmers attribute their yield increases). Even if the rapid appraisal results are not fully representative of the entire zone, it is clear that there is important progress being made in many villages and important lessons to be learned about (1) what has been driving the changes, (2) the magnitude of the increased income being generated at the household level by program participants, (3) and the expected impact that these changes in income could have on national income if the types of situations we saw in the rapid appraisals became widespread.

Table 1: Area, Production and Yield Data for the OHVN: 1991/92–1998/99

		1991	1992	1993	1994	1995	1996	1997	1998	Trend
Cotton	area (ha)	10506	12201	8624	11692	14605	23158	30750	35816	'+'
	prod (tons)	11842	12494	10684	13097	16167	21990	28927	33740	'+'
	yield (hg/ha)	1127	1024	1239	1120	1107	950	941	942	-
Tobacco	area (ha)	209	285	331	237	100	83	77	87	-
	prod (tons)	411	525	549	330	160	133	105	112	-
	yield (hg/ha)	1971	1842	1661	1392	1600	1579	1853	1874	-
Millet	area (ha)	30906	31516	31892	34188	36660	35732	38149	37422	'+'
	prod (tons)	30226	23900	26700	31800	32441	36095	38714	35595	'+'
	yield (hg/ha)	978	758	837	930	885	1010	1015	951	stagnant
Sorghum	area (ha)	46603	48334	48140	51213	56009	59431	66390	72572	'+'
	prod (tons)	50508	43911	44622	47904	50292	64638	73047	75901	'+'
	yield (hg/ha)	1084	908	927	935	898	1088	1100	1046	stagnant
Maize	area (ha)	11099	11485	11648	12157	12834	13072	14411	15457	'+'
	prod (tons)	13845	13110	13938	11214	12929	14594	16814	20033	'+'
	yield (hg/ha)	1247	1141	1197	922	1007	1116	1167	1296	stagnant
Rice	area (ha)	4431	4656	4640	5243	5774	6333	7165	8596	'+'
	prod (tons)	4679	4553	4420	5194	5033	7188	8184	9941	'+'
	yield (hg/ha)	1056	978	953	990	872	1135	1142	1157	stagnant
Groundnuts	area (ha)	12297	12823	13331	13993	16210	16878	20286	23420	'+'
	prod (tons)	10889	9415	11807	12473	13896	14488	17962	21773	'+'
	yield (hg/ha)	886	734	886	891	857	858	885	930	stagnant
Fonio	area (ha)		749	1153	1084	1115	1344	1391	1271	'+'
	prod (tons)		287	476	526	507	652	684	796	'+'
	yield (hg/ha)		383	413	485	455	486	492	626	'+'
Cowpeas	area (ha)						255	312	521	'+'
	prod (tons)						216	165	290	'+'
	yield (hg/ha)						842	529	557	-

Source: OHVN, Septième Session du Conseil d'Administration, Plan de Campagne 1999-2000, pg. 16.

This brings us to the question of what is driving the progress noted by the rapid appraisals. This progress is the result of a complex process that has been going on for 15-20 years. It is the result of multiple efforts by many actors. Nevertheless, USAID has been a dominant actor, providing OHVN with an important source of external financing since the 1980s.² Important contributions have also come from the Germans who are supporting NGO activities in the Ouélesseboughou sector. This anti-erosion program (PAE) is focusing on the development of a 'gestion de terroir' approach that gives high priority to improving village-level management of a community's natural resources. In addition, there are an estimated 20-30 NGOs operating in various capacities in the OHVN (not all operating in the agriculture or NRM sector). In other words, progress seen is a result of major investments in the zone over a long period of

² A review of Procès Verbal (OHVN August 98) showed USAID annual contributions to the OHVN budget ranging from \$200-500,000 between 1995/6 and 1998/99, with a planned increase to \$1.3 million for support of the agribusiness unit of OHVN in 1999/2000.

time. Based on information gathered during the rapid appraisals, discussions with USAID and OHVN personnel, and documents reviewed, the key ingredients contributing to current progress appear to be:

- Good identification of *technologies* capable of increasing declining yields
- Potential for increased cash income from expansion of *cotton* production
- *Community* approach to implementation
- Focus on *youth*
- Focus on villages/farmers most *likely to benefit* from GRN actions
- Use of *demonstration effect* thru model farmers and model villages
- *Incremental training* (literacy, technical skills, community organization, management skills using the CLUSA model)

- *Support services* offered
 - Roads
 - Credit guarantees for limited period following management training
 - Input/output transport assistance
 - Regular supervision and support to trainees
 - Some free equipment for implementing GRN activities
 - Market research by OHVN to help with crop diversification

5. Expanding the Progress

5.1 What to do

It is my opinion that the progress seen during the various rapid appraisal trips results from the synergy of the various programs that have been undertaken rather than from any single or limited number of activities or investments. Nevertheless, there are certain components that appear more essential than others if farmers are to make the transition from the semi-subsistence production practices that characterized the zone in the 1970s and 1980s to a level of commercial agriculture consistent with that needed to stimulate agricultural transformation and generalized economic growth.

- There must be a profitable cash crop with reliable markets and stable prices.
- There must be improved, affordable technologies that benefit both cash and food crops.
- There must be training programs that equip young farmers with the literacy and management skills needed to function as effective commercial farmers, both independently and in associations.

Without these basic ingredients, agricultural transformation will not take place. The OHVN program—at least in the villages covered by rapid appraisals—exhibits each one of these key ingredients.

Although the NRM program covers the entire OHVN zone, it has recognized that farmers are unlikely to adopt NRM practices if there is not a strong income incentive. Hence, OHVN's NRM program began by targeting sectors where cotton production was already underway and then began expanding into zones where cotton production was being introduced. This policy has worked thus far, but both farmers and the OHVN administration recognizes the need to identify alternative cash crops for the lower rainfall zones where cotton is not feasible, and to reduce the risks of over-reliance on a single cash crop in zones where cotton is currently king.

The NRM program is to be complimented for their efforts to identify and promote (in collaboration with Malian researchers) (1) truly effective anti-erosion practices that were capable of recovering highly degraded land and (2) improved methods of collecting, composting, and applying organic fertilizers. Although there is a long list of different techniques promoted by the NRM department of OHVN, the data show that it is the anti-erosion techniques (rock lines and plugs, fascines, and vegetative bands in particular) and the improved management of organic matter (compost and manure pits and use of crop residues) that are the most popular components of the program. These techniques, combined with the use of chemical fertilizers applied to cotton that is rotated with (largely unfertilized) cereal crops every 2-3 years has resulted in substantial yield increases over time for participant farmers (see illustrations in Appendix 4).

One of the most impressive components of the OHVN program is the farmer training that was introduced by CLUSA in the early 1990s. The CLUSA approach has a number of characteristics that make it stand out from other farmer training programs—the most important being that the ultimate goal is to empower farmers so they can handle their own affairs as they make the transition from semi-subsistence to commercial agriculture. Given this goal, CLUSA does not set up a training program until farmers exhibit some initiative in (1) becoming literate in local languages and (2) creating an association with a well defined set of goals. At this point, CLUSA offers training designed to help the group meet its goals. In the villages visited, the most common goal for newly formed associations was to obtain bank credit for agricultural equipment and inputs. Our discussions with the many young farmers who were managing the association finances and credit left us with the impression that CLUSA has done an outstanding job in this respect. Associations are assisting individual members prepare loan requests (including proof of reimbursement capacity), making decisions about the creditworthiness of association members, submitting consolidated loan portfolios for all association members (written in Bambara) directly to local bank representatives, dealing with several banks at once (depending on the type of credit sought), negotiating and contracting with input suppliers, and managing the reimbursements which have been in the 95-98% range during the last several years. Once the initial training program is completed, CLUSA tends to move into the background—remaining available for consultations when needed (perhaps to undertake new activities), but encouraging the associations they have trained to manage their own affairs.

If these three key ingredients are in place, I believe the adoption of NRM practices and the productivity increases associated with them can expand to villages and zones not yet reached. The presence of support services will, however, influence the speed of the expansion. For example, assistance with equipment to transport rocks for anti-erosion structures appears to be something that is needed by some farmers and associations but not by others (depending on proximity of rock supplies and number of carts already available in the village). It will be important to carefully evaluate each situation to avoid providing help that unnecessarily raises program costs and stifles local initiative, yet takes into account situations where a bit of help with rock transport could stimulate an entire series of more productive activities. Another important support service is rural infrastructure. Poor roads are a major constraint to farmers trying to diversify into production and marketing of horticultural products and to the acquisition of inputs (both problems mentioned in several of our village discussions). Credit is also important for farmers as well as input suppliers and traders purchasing farm production. USAID's provision of funds to guarantee credit to farmers' associations during their first four agricultural seasons may be one of the reasons that bank representatives are now traveling from village to village to deal directly with farmers (I have no evidence to support this, but it is difficult to believe that the guarantees did not provide some incentive). There are still many villages (particularly in the newly established cotton areas) where associations have not yet been created and therefore input credit is being managed by OHVN and distributed to individuals (rather than to associations) with much less favorable reimbursement performance (see OHVN report: Procès verbal de la 6ème session ordinaire du Conseil d'Administration de l'OHVN, August 1998). Given the poor performance to date for the individual loans, providing guarantees for them does not appear to be the best option. Rather, it appears more appropriate to move as quickly as possible (w/o violating the basic CLUSA principles) through the stages of literacy training, association creation, and management training so these villages can catch up with those in the zones where cotton production is already better established. This requires coordination of

the CLUSA training efforts (now often carried out by Malian NGOs that were trained by CLUSA) and OHVN/CMDT cotton promotion/expansion efforts.

5.2 Problems to resolve

During the course of the rapid appraisal mission and discussions with OHVN staff a number of real or potential problems surfaced that could constrain the desired transition to commercial farming. They are described briefly below.

Backsliding on development of private sector input markets. Although progress was made in the mid-1990s with the privatization of input markets, at present farmer associations appear to be relying entirely on OHVN for their cotton inputs. Both farmers and OHVN reports (e.g., OHVN August 1998) explain that the apparent backsliding came about because the prices of the private sector distributors were substantially higher than those prevailing in the nearby CMDT zones where inputs were still being provided through CMDT channels. This led OHVN farmers to protest the higher prices in their zone vis a vis the CMDT zone. The OHVN response was to rebuild their input supply network, relying on CMDT connections to keep costs and prices at the same level as those prevailing in the CMDT zone. This is an issue that needs to be addressed at the level of national policies—Mali needs to develop a national fertilizer plan based on a thorough analysis of the pros and cons of the continuing CMDT monopoly on cotton inputs. This is not a simple issue as there tend to be important economies of size and scale associated with fertilizer imports. The small, private sector operators who attempted to market inputs in the OHVN were probably dealing in such small quantities that they were unable to realize the economies accruing to the CMDT—hence the inability to be competitive.

Continued OHVN financing of credit and high rates of default for new cotton producers. For the 1998/99 campaign, OHVN financed 62.5% of input credit (down slightly from 65% in 1997/98), with the BNDA financing the rest. I found this information (from the OHVN August 1998 Procès verbal) surprising as the villages we visited were all getting their credit through the BNDA. Understanding that the type of credit situations we saw represent only about 1/3 of the total input credit portfolio for the OHVN suggests, perhaps, that the villages we visited are representative of about 1/3 the OHVN farm population—i.e., those that have succeeded in creating viable farmer associations (not a very scientific way of getting at representivity, but an interpretation that helps us get closer to understanding how widespread the situations we observed might be). This same OHVN report (e.g., Procès verbal, August 1998, Partie Recommandations, pg. 17) indicated that defaults are a problem in zones where there are not well established farmers' associations and OHVN is obliged to provide credit to individual farmers:

Le crédit individuel a représenté 33.15% du crédit total accordé par l'OHVN. Ce type de crédit est en nette progression depuis 3 campagnes. Cet état de faits est liée d'une part à l'inexistence d'organisations paysannes capables de gérer le crédit collectif dans le secteur de Faladié et d'autre part à l'extension de la culture du coton dans la zone de Kolokani et de Kangaba.

These results are in sharp contrast to the high reimbursement rates reported by the farmers associations we visited (95-100% were the typical rates cited) and the higher reimbursement rates reported by OHVN for association credit.³ The lower reimbursement rates of individual credit and the need for OHVN, rather than private banks, to provide the credit raises the question of whether OHVN/CMDT is moving ahead too fast with their plans to expand cotton areas. Is it a good decision for OHVN to be offering credit directly to individual farmers who are just beginning to produce cotton? How rapidly can these credit responsibilities be transferred to the banking sector? Is there a role for USAID credit guarantees in these zones where cotton is now being introduced?

Decisions about financial or in-kind support for rock hauling. As noted above, the issue of whether to provide equipment (carts, tools) for building anti-erosion barriers appears to be one that needs to be evaluated on a case-by-case basis. Too much assistance (when it is not really needed) can pose problems for sustainability if farmers become reliant on external sources of help not only for building but also for maintaining the anti-erosion structures and for extending their benefits to more farmers. On the other hand, when carts are not available and rocks are far away, building anti-erosion barriers can be an impossible task. Some intermediate options might be providing credit or actually providing the equipment as a gift to associations on the condition that they develop a financial plan for replacing the equipment once fully depreciated.

Decisions about which markets to develop for horticultural crops. USAID is putting a substantial amount of new funding into the agribusiness unit of the OHVN which is charged with the task of developing new markets for OHVN products. There have been some signs of progress in developing export markets. Following the CFA devaluation, Mali was able to break into the European green bean market, with most of the exported production coming from the OHVN zone and there are plans underway to increase sorrel (hibiscus) production for export to the U.S.

Efforts to diversify into cash crops that are either complements to or substitutes for cotton are to be commended, but the extent to which Mali should be targeting European and U.S. markets versus other markets in the W. African sub-region needs to be better evaluated in view of the serious problems encountered in the green bean subsector this past season. In the bean producing village that we visited we were shown very large stocks of produce that had not been picked up by the exporter as specified in the production contract. Apparently, the exporter had not made adequate provision for the type of packaging required by his buyers in Europe so he was unable to collect the produce from the villages and ship it on time to France. Although I would not recommend that the OHVN agribusiness unit ignore Europe and U.S. markets, I would suggest that it divide its attention between these markets (which are characterized by extremely high quality standards and complicated transport arrangements) and the markets that are opening up in Mali and nearby countries such as Ghana, Ivory Coast, Nigeria, etc. (see

³ For the 1996/97 campaign association credit due to OHVN was reimbursed at 94% while only 88% of individual credit was reimbursed; taking all outstanding credit into account associations are at 93% reimbursement while individual borrowers are at 68%—a substantial difference. Improvements were noted for the 1997/98 campaign when individual borrowers paid 97% of current debts and 92% of total debts while the associations reimbursed 99% of the current campaign and 98% overall (pg. 11, Proces Verbal, OHVN August 1998).

INSAH, November 1998, which discusses the issue of European versus regional export markets for both horticultural and livestock products).

Inadequate attention to cereals market development. As farmers improve productivity they are increasingly capable of marketing cereals that previously were produced exclusively for home consumption; yet traditional views of cereals as a 'social' rather than a 'market' crop and limited knowledge about managing cereal stocks for profit continue to hamper cereal market development. OHVN probably needs to improve farmers marketing skills as well as the database on cereal production and stocks in the zone. Given recent efforts of the USAID funded PASIDMA program to better estimate regional cereal availability and encourage trade within Mali as well as within the W. African region, it is recommended that OHVN and ACOPAM (which has local associations throughout the OHVN zone) work together in an effort to improve cereal marketing efficiency. In the villages visited, many farmers and associations appear to be holding excess cereal stocks because they (1) feel prices are too low and (2) they prefer building village cereal banks to hedge against poor harvests. One association visited had received a 9-month line of bank credit based on an 80 F/kg valuation of the associations' cereal stocks. Using the line of credit, the association purchased cereals from members at 80 f/kg. To make good on the loan, they need to sell their stocks at more than 80 f/kg or members will need to buy back their own cereals. At the time of our visit they were quite concerned about their ability to pay the loan as current prices were in the 60 F/kg range.

Rapid expansion of livestock herds. Most of the model farmers visited were enthusiastic adopters of the NRM themes involving increased use of manure (improved stables, composting, etc.). With this enthusiasm comes increased herd size—one farmer had increased his herd from about 60 to approximately 120 head in about 5 years! As noted elsewhere, our impression is that we were visiting the better-off farmers and we do not have to worry about most farmers owning 120 head of cattle in the near future. Nevertheless, some thought needs to be given to the long-term implications of the growth in herd size linked to the intensive use of animal manures.

Need to improve integration and complementarity of organic and inorganic fertilizers. At some point (sooner rather than later) farmers will need to start increasing the use of inorganic fertilizers. At present, inorganic fertilizers are used almost exclusively on cotton. If cereal and cotton yields are to increase beyond their current—relatively mediocre—levels, use of inorganic fertilizers on cereals will no doubt need to be part of the picture (in addition to improved seed varieties and continued improvements in management practices). Finding the optimal combination of organic and inorganic fertilizers for different crops and rotations may require more research to identify the combinations that are most efficient from both a private (profit) and a social (environmental) perspective. During our rapid appraisal visits, Mike McGahuey asked several different farmers to describe how they saw organic and inorganic fertilizers fitting into their production schemes. The replies always indicated that farmers viewed the two as complements rather than substitutes, suggesting that farmers could be encouraged to use more inorganic fertilizers if they could be convinced that it would be a profitable investment.

Assuming there is good research evidence that inorganic fertilizer use can be profitable for cereals grown on fields where erosion has been controlled, OHVN might want to consider an

extension approach that resembles the SG 2000 one of encouraging farmers to cultivate a half-hectare control plot (current practices) and a half-hectare test plot (recommended doses of inorganic fertilizers). This permits farmers to easily make comparisons of yields for the two technologies and, given the literacy skills of the OHVN village animateurs, it should not be too difficult to also make comparisons of financial returns. For this approach to work well, the farmers need to be closely supervised to make sure the fertilizers are applied using optimal dates and techniques. SG 2000 has been working in millet/sorghum areas of Segou and Mopti regions for several years trying to introduce yield enhancing technologies that include inorganic fertilizers (including rock phosphates). Thus far, the evidence suggests that the inorganic fertilizer is generally not profitable (see Nubukpo, et al. 1999 for a discussion of SG 2000 programs in the Segou Region). One hypothesis concerning the lack of profitability is that SG 2000—in sharp contrast to the OHVN program—did not begin with a focus on improved NRM practices (anti-erosion investments and improved quality of organic amendments). Thus, it seems important to invest some resources in an analysis of the potential to profitably use inorganic fertilizers on cereals in the OHVN zone that are grown on land which has been protected against erosion and benefited from increased levels of soil organic matter.

6. Better Quantifying Progress Made to Date

Although OHVN has made important progress in documenting adoption trends for a wide range of recommended NRM practices and there is a mounting body of anecdotal information concerning the positive farm-level impacts of this adoption, we are still unable to quantify the income impacts of NRM practices. Data collection and analysis techniques need to be refined and expanded if we want to better quantify both the farm-level and the national-level income impacts of NRM adoption.

Trying to quantify the impacts of NRM adoption over a period of almost 20 years—years which were characterized by major changes in the general economic and political environment—raises numerous questions concerning the real causes of any impacts measured—NRM adoption? Economic reform? Political reform? As noted above, it is impossible to scientifically determine the relative importance of the multiple factors that have affected rural incomes in the OHVN zone during the last 20 years. Nevertheless, a better analysis of what has happened to farm incomes in the OHVN during the last two decades will help us evaluate the impact of NRM promotion in combination with all the other political and economic reforms that have taken place.

The proposal which follows is designed for incremental implementation. It starts with recommendations for small improvements in data collection and analysis that can be made using existing OHVN resources and moves on to more costly but scientifically sound methods of getting at measurements of changes in rural incomes.

Six options are described for improving the measurement of income impacts:

1. Improvements in counting and reporting adoption.
2. Improvements in reporting OHVN production and yield statistics.
3. A case study approach to collecting and analyzing NRM farm-level income impacts (e.g., impacts on cropping, livestock, and non-farm incomes).
4. Rough extrapolations from case studies to the sector level.
5. Survey of OHVN farmers using a representative sample.
6. Development of an ongoing program of monitoring key income and food security indicators.

In addition to measuring changes in income, there are a number of general environmental indicators that should also be monitored in an effort to evaluate the overall impact of current crop and livestock production on soil erosion and forest cover. We may be able to show substantial

increases in income at the farm level, but if this is accompanied by increased clearing of woodlands and forests to accommodate an increase in the number of farmers and cotton fields (Table 1), the income gains are unlikely to be sustainable over time. Hence, it will be important to combine the income data with other sources of information (e.g., aerial or satellite photos) that show overall trends in land use and the extent to which conservation efforts are outpacing or being outpaced by growing enthusiasm for crop and livestock production.

6.1 Improvements in counting and reporting adoption

Over the years the OHVN NRM program has collected statistics on the adoption of various practices. Table 2 is a summary of what OHVN refers to as the ‘physical’ results of their program, updated in December 1999. It shows the growth (1996-1999) in physical measures (e.g., meters, hectares, number) of 22 themes promoted by the NRM program.

**Table 2 Illustrative OHVN Adoption Report:
Physical Indicators of NRM Adoption**

NRM Themes	Level of Adoption (units)				
	Prior to 1997	1997- 1998	1998–1999	1999–2000	Sum
Rock lines (m)	79400	6485	10076	5329	101291
Branch barriers (m)	18500	780	2011	1574	22865
Small dikes (m)	38900	1492	775	457	41624
Vegetative bands (m ²)	8998	1341	4000	3240	17579
Living fences (m)	127022	12000	11831	9309	160162
Permanent field markers (ha)	1098	599	846	544	3087
Protected areas (ha)	450	450	615	750	2265
Diversionsary gullies (n)	1417	625	1171	50	3263
Fire breaks(m)	5250	1406	615	500	7771
Controlled land clearing (ha)	140	300	-	-	440
Village managed forests (n)	1620	35	-	-	1655
Wells (n)	120	13	13	9	155
Deeping of mares (n)	68	2	1	2	73
Improved bas-fond (ha)	20	-	-	-	29
Village tree nurseries (n)	57	15	5	28	105
Plants from tree nurseries (n)	178800	13318	14640	45576	252334
Village woodlots	447	23	19	18	507
Improved cooking stoves (n)	2340	745	312	323	3720
Manure pits (n)	2268	265	338	-	2871
Stables for collecting manure (n)	13608	140	135	-	13883
Improved animal pens (n)	146	8	-	-	154
Compost pit (n)	1303	399	490	-	2192

Source: OHVN December 1999 and other OHVNdata . Notes: m=meters, n=number.

Although the table tells us nothing about how many farmers are involved or the income impacts of adoption, it does provide some insights about the relative popularity of different themes and the extent to which adoption is growing. Theoretically, this type of information could be used to estimate income impacts for the zone if we were able to estimate an average income impact per unit of physical measure.

Table 3 sheds some light on what the physical adoption statistics mean in terms of participating villages and farms. It also attempts to evaluate impacts in terms of hectares of land recovered and number of farms having moved from shifting cultivation practices to being settled on fixed plots of land. Four improvements that could be made to these statistics are described below.

6.1.1 Report percent of villages and farms adopting

At present OHVN is counting and reporting the number of villages and farmers adopting specific practices. These absolute numbers would be much more useful if presented along with numbers showing the relative importance of the adoption that has occurred. If 50 of 5000 farmers in a sector have adopted a theme (1%), that is much less impressive than knowing that 50 of 100 (50%) have adopted it.

To accomplish this, OHVN needs to standardize how they count villages and hamlets in their statistics—some reports reviewed appear to be counting hamlets as individual villages while others count the mother village and all hamlets as a single village. Without standardization and consistent reporting across time and in different types of reports, it is difficult to know if real progress is being made.

Table 3
Illustrative OHVN Adoption Report:
Villages, Farmers, and Recovered Area

Sector	Villages	Farms	Recovered Area (ha)
Kangaba	53	1529	3027
Bancoumana	57	2335	3221
Ouélessébougou	97	3628	7604
Dangassa	33	534	434
Fouani	110	3295	7264
Kati	70	1787	1303
Faladié	35	951	2274
Koulikoro	73	1358	2075
Sirakorola	79	2220	7656
Total OHVN	607	17637	34858

Source: OHVN 1999 data provided by M. Sylla.

The issue of the changing boundaries of the OHVN also poses problems for interpretation of the growth in adoption counts and percentages. During the recent past two

sectors (Banamba and Boro) have been dropped from the OHVN and one (Faladié) has been added. There is no ideal solution for dealing with such changes when preparing statistical reports on changes over time. Adding new zones where adoption is just starting or dropping former zones where adoption was high can give the impression that NRM is taking a big step backwards if one looks only at the aggregate statistics for the entire OHVN area. When a time series of statistics covers a period during which boundary changes have occurred, there must be clear documentation of when the changes took place and the number of villages/households that were added or dropped from the statistics for each year concerned. Without clear documentation of these changes, comparisons of aggregate OHVN data from year to year is clearly inappropriate. Ideally, statistics should be reported at a level that is disaggregated to the level of the units (sectors, circles, or arrondissements, for example) that are likely to be the units moving in or out of OHVN coverage.

6.1.2 Present more detail to show the ‘strength’ of adoption by villages and farms

At present, a village is counted as participating if only one farmer adopts just one theme. This is a pretty weak level of participation and it is not very informative to group this village with another village where 90% of farmers are participating and most have adopted three or more themes. Similarly, a farm is counted as participating if it has adopted only one theme. For example, a farm using a wood-conserving stove but having adopted no other NRM theme is not differentiated in these summary statistics from a farm that has made substantial investments in anti-erosion or composting themes. Such a high degree of aggregation is not particularly useful for evaluating the potential impact of the NRM program. Appendix 5 presents a more disaggregated format for reporting village and farm level adoption that would help OHVN better communicate to others what is happening in the zone.

6.1.3 Clarify the definition of ‘recovered land’ and disaggregate it into different categories

A total of almost 35,000 hectares ‘recovered’ (17% of OHVN cultivated area in 1999) is impressive, but what does it really mean? Is OHVN reporting the entire area of a field if a rock line brought back into production a small corner of the field that was unproductive due to erosion? Or only the area of that small corner that was affected? In my opinion, the latter is the preferred method. What qualifies a field for being classified as unproductive? No yield at all? The farmers’ qualitative appraisal that the land was getting an unusually low yield for the crop in question? The extension agent’s appraisal that yield was below a specified level for a given crop?

For these numbers to have real meaning there needs to be some standardization in classifying ‘recovered’ land. Perhaps OHVN is already using adequate criteria. If so, the definitions need to be better explained in reports so that the end users of the information grasp the distinctions. Deciding on the criteria to be used is more appropriately done by a soil scientist or agronomist than by an economist. Nevertheless, there are certain elements of information that could facilitate economic analysis if they could be taken into account. For example, making the

determination on the basis of before/after yields for specified levels of technology (e.g., seed variety, fertilizer and manure applications, etc.) would contribute to improved economic analysis of the impacts of NRM activities.

6.1.4 Make some effort to measure ‘disadoption’

Adoption data are collected annually by OHVN extension personnel and based on the activities of new adopters that they supervise and/or observe during each season. Each year the new adopters are added to the previous ones to obtain a cumulative level of adoption by theme, village, and farm. A major exception to this was a survey conducted in 1999 that attempted to do an exhaustive inventory of currently practiced NRM themes (see OHVN December 1999).

Because the focus is on increasing adoption, there is no year-to-year effort made to take into account cases of disadoption. For example, if a household purchased an improved stove but decided not to use it the household would remain in the cumulative statistics as an adopter. Similarly, if a farmer planted some living fences but they all died and he made no effort to replace them, the farmer would still be counted in the cumulative statistics for adoption. Given limited resources for monitoring, the issue of ‘disadoption’ should not be turned into a major drain on OHVN resources. Nevertheless, OHVN field personnel should give the issue some consideration and try to develop low cost methods of monitoring ‘disadoption’ for those themes where it is most likely to occur. This monitoring should include some effort to identify the causes of the ‘disadoption’ so that corrective actions can be taken.

6.2 Improvements in reporting OHVN production and yield statistics

The OHVN statistical service conducts surveys every year to measure area cultivated, estimate the probable harvest, and report final results for the entire agricultural campaign. These surveys are designed to accurately estimate aggregate production for the zone. More effort is put into estimating cotton production (much larger sample of fields per enumeration unit) than for cereals and other crops because of the need to organize logistics for collecting and processing cotton.

It is recommended that the NRM service and the OHVN statistical service examine the possibility of adding a few additional variables to the annual production survey in an effort to better grasp the extent to which fields covered by the production survey have benefited from NRM practices. Given the very limited number of fields evaluated for non-cotton crops (see footnote 4), it would be best to limit this additional data collection to the cotton fields. Since land is rotated from cotton to cereals and back, collecting the following type of information on cotton fields only should provide information on a representative sample of fields if the data are collected consistently during at least 3-5 years. The types of information that would be useful are:

1. Meters of anti-erosion structures (ligne en cailloux, fascines, diguettes, bandes enherbées) on the field and dates established;
2. Use of parcellement or mise en défens on the field;
3. Carts of organic matter applied to the field in current year;
4. Carts of organic matter applied to the field in previous year and crop cultivated that year;
5. Number of years since field was left in fallow;
6. Estimate of percent of field currently suffering from erosion (particularly important for fields where no NRM practices are being used).

Because the statistical service's sample is randomly selected and representative of the OHVN zone, adding this type of information to the annual survey should help the NRM service to get a better idea of how widespread the use of these techniques is and permit them to do some analysis on whether yields for fields having benefited from different NRM practices are better, worse, or about the same as those of fields not benefiting from NRM practices. Note that such analyses will NOT permit OHVN to determine the yield impact of the practices because there is no way of controlling for the initial condition of the field prior to use of NRM practices. It is reasonable to assume that most of the fields benefiting from anti-erosion themes were in a state of relatively low productivity prior to adoption of the themes. If this is true, we may find that yields on NRM fields are not any better than untreated fields, or even lower. While this information cannot be used to evaluate the contribution of NRM practices to yields, it can help us better understand the general dynamics of NRM adoption (location, percent of fields, length of use, most common combinations of practices) and give us some idea of current yields for a broad, randomly selected sample.

The NRM program has made a point of focusing on sectors and villages where certain preconditions favoring NRM adoption exist. Among the criteria used are the degree of socioeconomic disequilibrium, the receptivity of the milieu to NRM techniques, and the demonstrated willingness of local populations to actively participate in identifying and implementing solutions to their problems (OHVN December 1999). As a result, NRM adoption is much higher in some sectors of the OHVN (Ouélessébougou and Gouani, for example) than others (Dangassa or Kati, for example). This raises the question of the level of disaggregation permitted by the OHVN sample design. For the purposes of monitoring and evaluating the NRM program, it would be helpful to be able to get statistically significant results at the OHVN sector level. Even this level of disaggregation remains problematic in some cases because the boundaries of OHVN have changed with some sectors (or parts of sectors?) being added (e.g. Faladié) or removed (e.g., Banamba and Boron) from OHVN responsibility.

6.3 Case study approach to collecting and analyzing NRM farm-level income impacts

During our field visits in the OHVN zone we were presented with several case studies describing the adoption of NRM practices and the corresponding changes in land use, cropping patterns, yields, livestock holdings, and investments in animal traction equipment (see Appendix 4 for examples). Although the data presented differed from case to case, there were some common aspects:

- a time perspective starting with the first year of adopting an NRM theme and continuing to present;
- a list of NRM practices adopted (usually quantified in terms of meters or hectares per year);
- annual yield and production figures for either (1) selected NRM fields or (2) an aggregate picture of all fields for the farm;
- an inventory of animal traction equipment owned;
- some information on inputs used each year (carts of manure, sacks of fertilizer, pesticides and insecticides used).

These case studies were presented to us by village animateurs in the presence of the case-study farmer. The animateurs represent the final link in the extension chain. They are members of village associations who have been selected by association members to receive special training in NRM practices from OHVN agent vulgarisateur de base (AVB = extension agents). To become an animateur, one must have successfully completed a literacy program. Most village associations have several animateurs (2-5). Once trained, the village animateurs help organize work/training groups to assist individual farmers or groups wanting to learn about or implement particular themes. The animateurs' own fields often serve as the initial trial sites in the village. Animateurs are encouraged by OHVN to keep records on participating farmers so that they can track their progress. To date, there is no standardized format for this record keeping and no absolute requirement that it be done for all participants. Nevertheless, one gets the impression that the animateurs are in possession of a substantial amount of information that could be used as a starting point for calculating the income impacts of NRM practices if it could be transferred from personal notebooks to a standardized reporting format. OHVN has already used a couple of case studies in reports and a conference paper to illustrate the impacts that NRM adoption has had on selected farmers (see Appendix 8).

My recommendation is that the OHVN begin their efforts to better quantify the income impacts of NRM adoption by seeing how many case studies they can put together from information currently recorded in the notebooks of animateurs and/or AVB. Although we raised the issue of data availability with OHVN personnel at all levels, no one seemed to know for sure

how much information is currently recorded and how difficult it would be to get it transferred to some type of standardized format. Appendix 7 contains some draft ‘questionnaires’ designed to collect information that is currently recorded in notebooks by AVBs and animateurs. The questionnaires were drafted while I was in the field and discussed with OHVN personnel (M. Sylla). My recommendation is that OHVN first do a trial run, filling in about 10 copies. Before continuing with a larger number of cases, because the quality of the data in the first 10 copies needs to be evaluated to see if it is adequate for calculating income impacts. Appendix 8 contains an example of the type of calculations one could do if the data were adequate. OHVN and USAID also need to evaluate the cost (primarily AVB and animateur time) of transferring the data to these questionnaires and decide if doing another 50 to 100 questionnaires would be desirable and feasible given their current resources. .

6.4 Rough extrapolations from case studies to the sector level

Getting another 50 to 100 examples of changes in cropping patterns and yields over time would not permit us to come up with statistically valid estimates of the contribution of NRM to income because we would have no way of knowing how representative these cases were, but it would help us to get beyond the ‘anecdote’ stage (5-10 case studies) in which we currently find ourselves. With 50 to 100 examples, we may be able to say something about typical yield impacts over time for the most popular themes and then develop hypotheses about the aggregate impact that these yield changes would have if more degraded land benefited from the adoption of these techniques. This would probably require a small amount of additional consulting time (5-10 days) from me or another agricultural economist to develop a set of indicative yield change/income scenario based on the data collected and train OHVN staff so they could do similar analyses in the future

6.5 Survey of OHVN farmers using a representative sample

I am not presently recommending the development of a stand-alone survey to evaluate income impacts of NRM adoption. This decision is based on the following factors:

1. My impression is that neither OHVN nor USAID want to commit the level of resources required;
2. OHVN dissatisfaction with the last major survey effort in the zone (done in collaboration with INSAH);
3. My belief that it is more important to build OHVN capacity for regular monitoring.

There is one area, however, that might warrant some type of survey—the quantifying of income from NRM themes that are not directly related to crop production. My terms of reference included the task of identifying and quantifying NRM related income-generating activities that are not normally captured in aggregate income statistics. My impression is that the current NRM program in OHVN is not promoting many themes that would be generating these types of

income, so I have not made any concrete recommendations for trying to quantify these impacts in the short-run. Some background on why I came to this conclusion follows.

There are activities underway in many villages to transfer management of local forests from the forest service to village associations. In all cases encountered during our field visits, the objective was to manage the forests for conservation purposes—permitting harvesting only for personal use of village members. Although one could place a value on the personal consumption, this is not likely to represent a major contribution to local or national income at the present time. In some villages visited, karité (shea butter) harvesting and processing was a major income generating activity for women. The NRM program per se does not have any themes that relate directly to karité production, so valuing this production to measure the contribution of the NRM program to household and national income does not appear justified at the present time. The value of the karité harvested and processed should be considered in national accounts; I have not been able to confirm whether it is (I suspect that karité exports may already be taken into account).

Perhaps the most likely NRM activity to be included in this category is the establishment of woodlots by both villages and individuals. During our fieldwork, we saw a number of woodlots planted in teak for production of construction poles. Most had been recently planted and were not yet generating income. As the currently planted woodlots mature and the total number of woodlots increases, OHVN should develop some method for monitoring consumption and sales so that the contribution of these woodlots to household, village, and national income can be taken into account. At present—based on what was observed in villages visited—it seems premature to put much effort into quantifying woodlot incomes.

There are undoubtedly a number of other forest products that are gathered, processed, and sold (condiments, herbal teas, medicines) by rural households in the OHVN zone. It was difficult, however, to get a feeling for the importance of these incomes relative to income from cropping and livestock activities. The focus of the OHVN/NRM program has clearly been the promotion of anti-erosion and soil fertility techniques. The groups of farmers we met with spoke enthusiastically about how NRM adoption had affected crop and livestock production practices and incomes but never mentioned any impact on other types of income. This could be an omission on their part (and mine, for I did not raise the issue). Had we been speaking with women, we may have had more discussion of such incomes, as they are more likely than men to be gathering and selling forest products. Given the general lack of NRM themes related to generating income from forestry products, however, I suspect that the OHVN/NRM program has not had much of an impact on the level of incomes generated from these activities. If this is true, expending OHVN/NRM resources in an effort to quantify these incomes is probably not warranted at present. As more and more villages assume the responsibility for managing their forests and OHVN assists with the development of management plans, it may be important to evaluate the extent to which villages or individuals are able to increase the income generated from the forest's renewable resources.

6.6 Development of an ongoing program of monitoring key income and food security indicators

Household income growth is an important indicator of program success for most of USAID/Bamako's projects. Unfortunately, the task of monitoring income growth is so daunting that USAID staff and project personnel usually opt for monitoring less informative but easier-to-collect indicators. This has clearly been the case with the OHVN project.

I am recommending that USAID/Bamako look into the possibility of using some promising new methods for income monitoring that were developed by MSU as part of a USAID funded project in Mozambique. At present, the methods are also being tested in Kenya (again, with USAID funding). There is an initial cost in using these methods (see below) that is easier to justify if it is applied to monitoring a large number of diverse projects rather than to a single project such as the NRM component of the OHVN program, hence my recommendation that this type of monitoring be considered by USAID rather than by the OHVN.

A comprehensive document describing the methods used in Mozambique is available (Tschirley, Rose, and Marrule, 2000). An excerpt of a few pages from the report is attached in Appendix 9 to give readers a better idea of what this type of monitoring can do and the level of survey work required. This income-proxy method provides the possibility of obtaining regular (for example, yearly) information on household income without performing cumbersome quantitative surveys each time.

In brief, implementation of these methods requires that there be an initial survey conducted to collect detailed information on an extensive range of both income and potential proxy variables (this is the most costly part). These detailed data can then be used to create econometric models that estimate total household income and permit analysts to identify appropriate proxy variables. Data for the smaller set of proxy variables are then collected in subsequent surveys and used to monitor changes in income over time. Two models were developed for Mozambique. The more detailed model uses 40 variables to estimate both total income and the amount of income earned in 10 separate income categories; the less detailed model uses 16 variables to estimate total household income. In the Mozambique case, this initial survey was funded by USAID and conducted collaboratively by MSU and a number of NGOs working on USAID projects, many of which required some type of income monitoring to satisfy USAID reporting requirements. In Mali, it might be possible to use the upcoming budget/consumption study or some other major survey now in the planning stages as a base to which the proxy work is added rather than funding an entire survey.

If USAID decided to move in this direction, the issue of monitoring income from forest products (see above) could probably be incorporated into the initial surveys and proxy-variables—as could other project-specific interests.

7. Closing Remarks

In summing up I would like to reiterate that I was very impressed with what I saw during the four days I visited OHVN farmers and farmers' associations currently working with NRM themes. The farmers were among the most knowledgeable, motivated, and enthusiastic farmers that I have met during the many years that I have been working in the Sahel and elsewhere in Africa. In a qualitative sense, I am very comfortable stating that the farmers visited have clearly improved their food security and incomes because they adopted NRM practices at a time when a wide range of policy changes and sectoral investments made it particularly profitable to do so.

The limitation of this type of rapid appraisal is that I cannot say anything concrete about how representative the farmers with whom we met are. Nor can I say anything quantitative about the size of the income impacts stimulated by the NRM program at either the farm or the national level. These are two very important types of information that both USAID and OHVN need to gather in order to evaluate where they are and what they need to be doing to further expand the benefits of NRM practices. Implementation of the recommendations in Section 5 of this paper should bring us all much closer to understanding what is really happening with respect to NRM in the zone.

Given that there appear to be a number of very useful lessons to be learned from the OHVN experience, it seems important to me that both USAID and OHVN invest some resources in (1) improving their ability to better quantify the size and extent of the income impacts stimulated by the NRM program and (2) documenting and publicizing the OHVN story so that others in Mali as well as elsewhere may benefit from the experience.

Appendix 1

List of Documents Consulted

Bingen, R.J. and B. Simpson. 1995?. Technology Transfer and Agricultural Development in West Africa in Technology Transfer and Public Policy edited by Y.S. Lee. Westport, CN: Quorum Books.

Crawford, E., V. Kelly, J. Howard. Forthcoming. Evaluating Measures to Improve Agricultural Input Use, MSU International Development Working Paper. E. Lansing, MI: Michigan State University.

Crosson, P. and J.R. Anderson. March 1995. Achieving a Sustainable Agricultural System in Sub-Saharan Africa. Building Blocks for Africa 2025, paper no. 2. Washington, D.C.: The World Bank.

Hagen, R. 199?. NRM Timeline and Issues for West Africa. Unpublished draft document.

Hijkoop, J., P. van der Poel, B. Kaya. 1991. Une lutte de longue haleine: Aménagements anti-érosifs et gestion de terroir. Bamako and Amsterdam: Institut d'Economie Rurale and Institut Royal des Tropiques.

Institut du Sahel (INSAH). November 1998. Food Security and Agricultural Subsectors in West Africa: Future prospects and key issues four years after the devaluation of the CFA franc. A set of policy briefs on livestock, cotton, horticulture, and food consumption prepared for a CILSS Policy Conference, November 30–December 2, 1998. Bamako: Institut du Sahel.

Maiga, A.S., B. Teme, B.S. Coulibaly, L. Diarra, A.O. Kergna, K. Tigana. September 1994. Etude: Ajustement structurel et développement durable—Cas du Mali. Bamako and London: Institut d'Economie Rurale and Overseas Development Institute.

McGahuey, M. December 1998. Developing a Methodology and Baseline Data for Monitoring and Evaluation of Natural Resources Management and Environmental Impact of USAID Interventions in Mali. Washington, D.C.: USAID (AFR/SD/ANRE/NRM) trip report.

Nubukpo, K., V. Kelly, M. Yade, M. Galiba. October 1999. Accelerating Agricultural Intensification in the Riskier Environments of Sub-Saharan Africa. Select Paper to be presented at the International Association of Agricultural Economists meetings in Berlin, August 2000.

OHVN. May 1992. Contribution de L'O.H.VV.N. à la Gestion des Ressources naturelles dans sa Zone d'Intervention. Report of an annual seminar held 12-14 May 1992.

OHVN. September 1995. Evaluation du Programme de Gestion des Ressources Naturelles en Zone OHVN. Bamako: OHVN.

OHVN. August 1998. Procès Verbal de la 6^{ème} Session Ordinaire du Conseil d'Administration de l'Office de la Haute Vallée du Niger and other documentation discussed at the Septième Session du Conseil d'Administration de L'OHVN. This appears to be a set of documents given to participants at the 7th meeting of the OHVN Administrative Council that met in 1999. I have used August 1998 as the date because that is what appears on the first document in the set—the minutes of the 6th Session. Bamako: OHVN.

OHVN. December 1999. Communication de l'Office de la Haute Vallée du Niger à l'Atelier Régional sur les Expériences de la Gestion des Ressources Naturelles: Evolution et Perspective. Koudougou, Burkina Faso.

Rose, D. and D. Tschirely. January 2000. A Simplified Method for Assessing Dietary Adequacy in Mozambique. Research Report No. 36. Maputo: Ministry of Agriculture and Fisheries. Full document is available on the Michigan State Web Site (www.aec.msu.edu/agecon/fs2).

Ruben, R. and D.R. Lee. March 2000. Combining Internal and External Inputs for Sustainable Intensification. IFPRI 2020 Brief 65. Washington, D.C.: International Food Policy Research Institute.

Sanders, J., D. Southgate, and J.G. Lee. December 1995. The Economics of Soil Degradation: Technological Change and Policy Alternatives. Soil Management Support Services Technical Monograph No. 22. W. Lafayette, IN: Purdue University.

Sanogo, A., B.S. Coulibaly, M.K. Ndiaye, M. Sidibe, B. Teme, M. Togola. April 1993. Etude des phénomènes de dégradation des terres au Mali: Esquisse d'un programme national de conservation et de restauration. Bamako: Consulting report done for FAO.

Scherr, S. and S. Yadav. May 1996. Land Degradation in the Developing World: Implications for Food, Agriculture, and the Environment to 2020. Food, Agriculture, and the Environment Discussion Paper 14. Washington, D.C.: International Food Policy Research Institute.

Shaikh, A., E. Arnould, K. Christophersen, R. Hagen, J. Tabor, P. Warshall. 1988. Opportunities for Sustained Development: Successful Natural Resources Management in the Sahel, Volumes 1-3. Washington, D.C.: e/di (a member of International Resources Group).

Speirs, M. and O. Olsen. 1992. Indigenous Integrated Farming Systems in the Sahel. World Bank Technical Paper Number 179, Africa Technical Department Series. Washington, D.C.: The World Bank.

Tefft, J. Forthcoming. Cotton in Mali: The "White Revolution" and Development in Democracy and Development in Mali edited by D. Robinson and J. Bingem (?). E. Lansing, MI: Michigan State University Press.

Tschirley, D., D. Rose, and H. Marrule. February 2000. A Methodology for Estimating Household Income in Rural Mozambique Using Easy-to-Collect Proxy Variables. Research Report No. 38. Maputo: Ministry of Agriculture and Fisheries. Full document is available on the Michigan State University Web Site (www.aec.msu.edu/agecon/fs2).

USAID/Bamako. various dates. Several documents, reports, proposals, etc. concerning the OHVN projects that were provided by Mike McGahuey.

Weight, D. and V. Kelly. 1999. Fertilizer Impacts on Soils and Crops of Sub-Saharan Africa. MSU International Development Paper No. 21. E. Lansing, MI: Michigan State University. Full document is available on the Michigan State University Web Site (www.aec.msu.edu/agecon/fs2).

Yanggen, D. December 1995. Understanding Small Farmer Adoption of Natural Resource Conservation Techniques in the Sahel: A Conceptual Framework with an Application to the Cotton Growing Zone of Koutiala, Mali. Unpublished mimeo.

Yates, R.A. and A. Kiss. January 1992. Using and Sustaining Africa's Soils: Summary of the proceedings of a World Bank Seminar held in Washington, D.C. in January 1992.

Appendix 2

Preparatory Notes on Assessment of Existing Databases and Rapid Appraisal Guidelines

Preliminary assessment of data currently available for measuring impacts of OHV project

1. We need to be able to compare what is happening in project villages with either a baseline situation or current patterns in non-participating villages.

Page 53 of project paper says: It is anticipated that the first year of project implementation will include a base-line data survey of HV inhabitants, using proxies for income such as sales, coop profits, consumption patterns, business volume in private sector, increase use ag inputs and equipment. Was such a survey conducted?

- A. If baseline data are available from OHV or other sources...

What is the baseline year/period?

What types of info are available?

Variables

Practices used (number farmers adopting over time)

Yields associated with specific practices or absence of practices

Production sufficiency ratios for cereals

Income from cotton

Productive assets owned

Crop mix

Area cultivated

Sources of non-farm income (local off-farm or remittances)

Proxies for HH income

How were data collected?

Type of sampling

Geographical coverage

Frequency of collection

Analyses already done

Current availability of data base and/or analyses

B. If baseline data are not available...

What are other options for making comparisons?

Participants/nonparticipants from same village

Village with/without project activities

(Need to control for possibility of activities from other projects)

Simple recall from interviewees concerning changes

(Not good evidence of project impacts unless we have a control group)

2. It is useful to think of databases that already exist and from which we could develop indicators. Some suggestions:

DNSI ag survey (annual data permitting one to track trends):

Production, area, and yields by zone (H.V.) and by region;

Percent of males/females migrating from region during year

OHV surveys:

1995 survey to evaluate farmers impressions of program activities in 96 villages

What variables covered? Can it be used as a baseline or too recent?

Use to ID villages that saw benefit (75%) vs. those that didn't (25%)

Clarify point about different opinions by type of group:

Groupes de vulgarisation 49%

AV (auto encadré) 25%

Individuals (24%)

I/O data/records kept by farmers (e.g., Bagayoko/Coulibaly case studies).

How many do this?

How accurate are production/area/yield measurements?

Do they cover all fields in exploitation or only some?

Need to think about how economic analysis is done:

“Constant prices” is not done in the conventional way

Have not taken into account costs of getting increased production

Annual surveys? What data collected? On what sample?

What do the interviewers based in each sector do?

Dec. 1999 survey:

Do you differentiate between project/non-project changes? For example, count only activities after a certain date?

Objectives of Mission

My understanding is that we want to focus on measuring environmental and income impacts associated with the adoption of NRM practices. The USAID OHV project is much broader than expansion of NRM practices (it includes roads, markets, OHV restructuring, credit, etc.), but my understanding is that we will examine these other aspects in terms of their relative importance in promoting adoption of NRM practices (i.e., no effort will be made to measure impacts of the various project components).

I hope to get answers to these questions using a combination of group discussions (primary focus) and individual interviews (to supplement group discussions). The plan is to talk to groups of project participants and nonparticipants in separate sessions. Each session will be divided into two parts: (1) perceptions of income and environment impacts due to the expanded adoption of NRM practices and (2) perceptions of key determinants of NRM adoption and other factors that have contributed to increased profitability of agricultural activities in the OHV.

Perceptions of Income and Environmental Impacts

Discussions with groups of participating farmers will establish whether they believe (1) incomes have increased for most participants, (2) the quality/quantity of their farm land has improved, and (3) the quality/quantity of their village's common resources have improved (pasture, forests, water).

If there is a consensus that there have (or have not) been improvements, we will ask the group to give us concrete examples, explaining what criteria they used to come to their conclusions. If there is disagreement among those in the group, we will ask both sides to present their views.

The hope is that farmers can be encouraged to discuss these questions without being influenced by a series of predetermined questions. By the end of the discussion I anticipate that we will have touched on most of the questions/issues listed below. If not, I will probably ask direct questions to fill in the areas not covered by the general discussion. The group discussion should help us identify the relative importance of different criteria farmers are using to evaluate impacts. During the discussion I will be pushing the farmers to see how well they are able to quantify some of these impacts. The expected outcome from the group discussion is information that will help me develop recommendations on a limited set of easily monitored proxies for income and environmental impacts.

List of issues to be covered in group discussion of income and environmental impacts

Have real HH incomes (i.e., purchasing power) increased?

- Improvements in food consumption/diet?
- Improvements in non-food consumption?
Radios, bikes, clothing, access to health care/medicines, celebrations/fêtes

Have income sources become more diversified?

If yes, what are new activities not practiced in zone before 1993?

- What has been impact of diversification on ...
- Total HH incomes
- Amount of production marketed?
- Inter-annual variability in income and food access?
- Distribution of income and responsibilities w/ households

Has diversification had any impact on natural resources owned by individual farmers?

- soils
- tree cover
- erosion control

On community natural resources?

Have investments in productive assets increased for...

- Men?
- Women?

Have benefits been widespread or concentrated?

- Realized by project participants and nonparticipants?
- Only realized by project participants?
- Only realized by some project participants?

If concentrated, what differentiates those who benefit from those who do not?

- Participants vs. nonparticipants?
- Successful participants vs. unsuccessful participants?

What can be done to spread these benefits to a wider group of farmers?

Factors determining the adoption of NRM practices and increased incomes

Once the discussion of impacts comes to an end, we will move the group into the next topic that attempts to identify the relative importance of different factors having contributed to the outcomes discussed above.

What has contributed the most to recent increases (or lack of increases) in income and environmental quality?

Again the preferred method is to have members of the group offer their ideas w/o being prompted for specific factors. Hopefully, the discussion will touch on most, if not all, of the factors in the list that follows.

List of factors potentially influencing NRM adoption and income growth.

- Improved extension messages and training? (Specify most important messages/technologies)
- Improved capacity of village associations to organize farmers?
- Major government policy changes (liberalization, devaluation, and cotton policies)
- Improvements in primary and secondary education
- Alphabetization in local languages
- Better roads
- Improved access to credit

What exactly is the role that cotton plays in the production systems of farmers who have increased incomes lately:

- Is it a catalyst that provides inputs and income for farmers to start improving production?
- Are there farmers who have adopted NRM practices but do not produce cotton?
- Do most farmers want to increase/decrease/remain at present areas cultivated in cotton?

What are the most important things that farmers can do to encourage others to adopt NRM?

What are the most important things for OHV to do...

For the government to do...

Appendix 3

Microsoft Power Point Slides for Presentations at AID/W

Appendix 4

Field Notes From Village Discussion and USAID/Bamako Presentation

FIELD NOTES

Visit to OHVN Villages to Examine Impacts of GRN Practices and Prospects for Continued Expansion

22–25 February 2000

**Valerie A. KELLY, Consultant
Mike McGAHUEY, USAID
Mamadou L. SYLLA, OHVN**

DATE: Tuesday, 22 February 2000
VISITORS: Sylla, Kelly, McGahuey
LOCAL CADRE: Habib Bah, AVB; Ibrahim Keita, SD Central
SECTOR: Ouélessabougou
SUBSECTOR
VILLAGE: Sanombélé

MODEL FARMER: Sédou Coulibaly

- Speaks French, some formal ed (finished school in 1946).
- About 20 Ha. total.
 - Always has tried to control erosion but old methods (tree stumps) were inadequate; notes that clearing natural vegetation to farm leads to erosion.
- Began composting household waste in 1985.
- Began improved livestock management for manure 1993 (with arrival of OHVN).
- Currently using about 100 carts (20 tons) of compost and 150 carts (15 tons) manure/year.
- Uses fertilizer on cotton only (3 sacs NPK and 1 of urea/ha) and combines with FO.
- Does following GRN: rock lines and improved animal park since 1993, vegetative bands since 1999, using parcellement now, some rock barriers, 12 improved stoves.
- About 60 + head of cattle.
- Doesn't generally sell cereals.
- Used to sell peanuts, but price too uncertain now (i.e., doesn't like liberalization of prices).
- Was easier for him to get started on rock lines as his fields were full of rocks—transport easy.
- Asked why he thought he had such impressive increases in cereal yields. Notes that cereals follow cotton and benefit from residual effect BUT VK notes this has always been the case—what is new since 1993? Says he has experimented with different cereals and thinks sanyo (petit mil) is better for his poor (shallow) soils than sorgho—this is part of reason given for increase in sanyo yields.

SANOMBÉLÉ VILLAGE OBSERVATIONS/COMMENTS

- About 15 present—several animateurs, predominantly young guys.

- 47 exploitations in the village.
- AV formed and all HH belong. AV has work team to help with erosion control activities.
- Claims that all have tried some GRN techniques.
- Consensus that both anti-erosion and soil enhancement necessary, but erosion must be controlled first to get full benefits of soil enhancement actions.
- Organic matter and fertilizer are complementary; former has longer residual effect; only chem fertilizer is not good for soil.
- Many don't do rock lines due to lack of transport.
- Two young fellows mentioned trying but not having much success—rock hauling damaged their cart and they didn't manage to stop erosion with amount of rocks placed.
- One participant recovered about 3 ha and has noticed that soil more fertile.
- Rock barriers, if needed, must come before increases in manure use.
- Consensus that yield increases experienced were due too more than just better rain!
- In absolute terms most are better off now than 10 years ago BUT increased income means increased desires...More equipment cited as sign of improvements.
- Use of income: ag equipment.
- Diversification: Village doing tomatoes and onions...no problem with sales as trucks are coming right to village and hauling off to Bamako; water table is good; men and women both do hort but some claimed "no real benefits from contra saison." Did green beans for several years BUT have warehouse full now and liaison for sales hasn't come to get them. Sylla thought there was a problem with supply of shipping boxes that hadn't arrived from Dakar.
- Rock work done by village teams. Farmer needs to collect rocks and get them to field then the team helps with the work.

DATE: Tuesday, 22 February 2000
VISITORS: Sylla, Kelly, McGahuey
LOCAL CADRE:
SECTOR: Ouélessabougou
SUBSECTOR
VILLAGE: Sougoula

MODEL FARMER: François Coulibaly

- Private visit requested, based on Mike's previous visit in late 1980s.
- Bande enherbé promoted in area by an NGO—takes about 3 yrs. to be effective but a good choice if rocks are not easily available. Still need to reinforce it with rock.
- Vegetative bands stop runoff and can be used for secco construction and forage.
- “Les événement” have changed lots of things—young and women don't respect elders anymore, young don't work as hard as his generation did, etc.
- His village stopped woodcutting for sales in 1980s—first village in area to do so. Used village patrols to enforce. Cutting permitted for construction poles but only deadwood can be harvested for firewood. Caused problems for women who had been getting income from wood so Lyons club started them on veggie gardening.
- Impressive collection of annual notes on expenditures and harvests from early 1970s used to manage resources.
- Protestant.
- Doing artificial insemination.

DATE: Tuesday, 22 February 2000
VISITORS: Sylla, Kelly, McGahuey
LOCAL CADRE:
SECTOR: Ouélessabougou
SUBSECTOR
VILLAGE: Dafara

MODEL FARMER: ?? Tarawélé (pudgy guy in green boubou)

- Wood lot—not as well maintained as it could have been (no clipping of side branches); 25 X 25 meters; begun in 1995.
- Over 125 head of cattle (from 60 in 1993). Trying artificial insemination to improve milk production and animal strength; animals = savings; selling now due to poor cotton harvest and debts.
- Feeds traction cattle molasses and cotton seed cake; milkers get molasses and hay.
- Live hedges with poughere and rock lines begun in 1993; 4 rock barriers.
- About 300 carts (60 tons) of manure per year.
- About 60 carts (12 tons) of household compost per year.
- 14 improved stoves (since 1997).
- Increase in cultivated area due to increase in hh size, anti-erosion measures, and more equipment.
- Doesn't usually sell cereals except occasionally to neighbors.
- Asked about reasons for strong increases in cotton yields when general trend in Mali is declining yields: due to increased application of FO/compost plus fert; yields down again in 1999/00 because of late rains BUT he put high amts of FO on anyway hoping to get good yield.
- Signs that things are better: more equipment, new house, and new wives improving livestock through artificial insemination and purchases.
- Recovered about 2 hectares of land.
- About 20 ha. total ??? (13 where we were...more elsewhere).
- Improved animal park in 1993.
- Improved stoves (14 by 1997).

DAFARA VILLAGE OBSERVATIONS/COMMENTS

- 9 present; all but model farmer seemed to be amateur and young.
- 43 exploitations in village; all members of AV.
- Where there are erosion problems farmers have tried some GRN activities (about 30 of 43 hh); rock lines, poughere, fascine, veggie bands, contour plowing, FO.
- Why not more like Tarawélé? Need equipment (cart, wheelbarrow, picks, and shovels); need animals to get manure; all can do compost but even this is limited to hh fields if no cart and fields are far away.
- Priorities—ag equipment for increasing production would come before wheelbarrows, picks, etc. for rock lines. When have equipment, can cultivate more area so recuperating land becomes more important.
- Equipment priority: charrue and oxen.
- Evidence of changes: more ag equipment improved housing (noted lots of tin roofing) BUT still people that have problems making ends meet.
- Diversification: niébé, hort (15T of green beans sold in 2000, but problems with market for remaining production).
- Women: producing soap from poughere hedges.
- Forest protection: trying to get organized to control own forest as described above in François Coulibaly case; want no cutting for fire wood, no sales, just cutting for construction by village hh.

DATE: Wednesday, 23 February 2000
VISITORS: Sylla, Kelly, McGahuey
LOCAL CADRE: Seydou Berté, AVB Keita; Sidi L. Samaké, Chef du Secteur
SECTOR: Danassa
SUBSECTOR
VILLAGE: Moribougou (village = Kanja)

MODEL FARMERS: Moussa Doumbia and M. Coulibaly (both animateurs)

- Moussa Doumbia:
 - 20 ha total (some far away)
- Was 'chased' from land where he was so decided to try to intensify what he had left.
- Has expanded from 3-4 to 10 ha of cultivated land close to his home through use of rock lines and band enherbé. His fields are at the foot of hills that still have their natural vegetation.
- Notes that tenure not a problem; even if he leaves distant fields fallow he can get them back.
- 48 head of cattle.
- In 1992 ravine in his fields posed a problem for the village.
- Data presented shows rising yields, increased area planted, and more manure use.

	Area cultivated	Inputs	Production	Yields
1991-cotton	4 ha	30 ch FO; cotton pkg	3T825	
1992-sorgho	4 ha		3T600	
1993-cotton	4 ha	40 ch FO; 11 sac NPK	6T170	
1994-sorgho	4 ha		4T600	
1995-cotton	7 ha	58 ch FO; 14 NPK; 4 Urea	9T578	
1996-sorgho	7 ha	no FO	7T700	
1997-sanyo	8 ha		7T200	
1998-cotton	10 ha	100 ch FO; 10 NPK	10T228	
1999-sorgho	10 ha		8T900	

- Able to compare yields from improved fields with fields further away. Methods not always comparable on the two sites—e.g., not FO on far away but sometimes used fert.

- Sample yields for non GRN fields where soil is poor and shallow:
 - 17 sacs sorgho / 4 ha in 98/99; 2312 kg cotton/ 4 ha in 99/00 (too much rain)

Mountaga Coulibaly:

	Area cultivated	Inputs	Production	Area recovered
1991-sanyo	8 ha		3T000	1-2 ha??
1992-sanyo			3T500	
1993-cotton			9T000	
1994-sorgho			6T500	
1995-sanyo			5T300	
1996-cotton			13T000	
1997-sanyo			7T100	
1998-cotton			20T400	
1999-sorgho			8T100	

Cotton gets FO and fert; cereals get FO.

Yields on other fields:

10 ha cotton = 14T700

6 ha cotton = 13 T000 (earlier years)

Maize 30-35 sacs/ha

Sorgho 5 ha = 4.5–5.5 tons

- Belongs to family that has important external resources (large entrepreneur in Bamako who has built concrete housing (looks like a school) for all and may be funding large share of investments—peppers, bananas, etc.)
- Big investment by Coulibaly family in bananas (began with 600,000 F returns to pepper production/sales and then they expanded to bananas in Aug of this year.
- All agreed (including Sylla) that there is a great market for bananas in Bamako; family already has someone in Bamako with whom they deal.
- Have about 100 head of cattle.
- Used lots of rock lines (hold even in heavy rains).

MORIBOUGOU VILLAGE OBSERVATIONS/COMMENTS:

- 10-15 present at various times; young at first, then some older guys, then some women.

- A hameau of another village.
- 14 exploitations total in hameau; all members of AV.
- AVB since 1992.
- AV appears to be very advanced in credit management.
- 3 year loan from BIM for 30 boeuf de traction—will pay off this year.
- BNDA was providing input credit but they figured out that if they all put money up front they wouldn't have to pay the 11% interest so this is what they have been trying to do. If funds not enough, purchase what they can on cash and take credit for the rest. Check on prices of various distributors but usually end up purchasing from OHVN as prices are better. Input credit is guaranteed by OHVN and 'group solidarity'.
- Example of prices:
 - OHVN cash: 9,600/sac vs. others 11,000
 - OHVN credit 10,060/sac vs. others 11,650
- Price differences raise question of OHVN subsidies—why are OHVN prices lower?
- Both prices include transport to AVB—began in 1994.
- Animateurs make recommendations on who has a production plan that merits getting credit; those with poor plans are asked to make down payments of various amounts; final decisions made by full AV but seem to be based primarily on animateur recs.
- Woodlot is community effort; 3-4 years old; not yet harvested but plan to sell.
- Villagers ideas about expansion of GRN:
 - What's more important technical or management?
- Need technical first to show that there is a chance to earn income—then there is an incentive for learning/applying management skills.
- If already getting good yields, go right to the mgt. training.
- Village got started on GRN with gift of basic equipment (2 charts, wheelbarrows, picks, etc.) BUT they have been having farmers pay 2000 F each to the management committee so the equipment can be replaced when worn out. There is an anti-erosion committee that helps people lacking means.
- Cotton is critical to village economy BUT looking for ways to diversify (e.g., hort).

- Animateur are ones who collect/record yield info, but no fixed reports/requirements.
- AVB thought he needed a computer to better collect and analyze data and have access to internet (e.g., prices, etc.).
- Women have seen what men have been doing and have tried some of GRN techniques on their own peanut fields (to be verified, but 3 old ladies came to visit and said it was true!).
- There is no absolute land constraint in the area BUT *good* land is hard to find.
- Markets: take products to DjalakoroBa at goudron (Bananas mostly).
- Older guys remember they used to do peanuts and take them to Bamako by boat. Many went to Senegal to do ag labor in peanut fields; they think biggest change is due to cotton.
- Diversification: bananas are good BUT water problem... (need hydrologist).
- Improvements during last 10 years: recuperation of land, access to credit from village fund and banks, transport cotton and inputs by OHVN helps given their enclave. Still need to do something about roads.
- Other NGOs have brought visitors to their village to see what they have done.
- Asked us about US—did they also have erosion problems? How dealt with? Another sign that people are trying to learn and improve techniques??

DATE: Thursday, 24 February 2000
VISITORS: Sylla, Kelly, McGahuey, Ramadjita Tabo (ICRISAT)
LOCAL CADRE: Souleyman Tarawélé, Chef du Secteur; Dramane Coulibaly, TS ag
SECTOR: Koulikoro
SUBSECTOR
VILLAGE: Masamanboucou? A hameau of Djogo
This is a zone where cotton just introduced; rainfall 700-800 mm/year

MODEL FARMER: Sidiba Kané (pépinieriste and head of village association)

- Trees are a passion—got interest from mother's side of the family.
- Began trees in 1972. Guava, mangos, citrus.
- Currently has 1870 mango seedlings to be sold @ 500 F/seedling.
- Has benefited from substantial (but not quantified) assistance (e.g., training in grafting) from forestry service since mid-1980s; also got idea for doing eucalyptus seedlings from Eaux et Forêts.
- Claims that he has trained many others in turn and helped them get started with their own pepinière.
- Soon after, GRN needed eucalyptus seedlings so he started that (sold 900 this year).
- Much of business is with projects that place orders for seedlings with him.
- Roads pose a major problem as he is often cut off in rainy season when demand for seedlings is highest.
- Major problem from animals breaking through his fence...wants help building stronger fence.
- Tried different types of live fences but animals ate them.
- Also needs a bigger well.... current one about 14 meters and small diameter.
- Got a 250,000 F loan from OHVN for something (not clear what it was for and if he has been able to pay it back.... check with Sylla).

MOSAMANBOUGOU VILLAGE OBSERVATIONS/COMMENTS:

- 6 hh in hameau.
- No land constraint. All feel secure in land tenure.
- Began cotton last two years: 4 hh at first and 9 this year.

- Not very organized compared to other villages in terms of association/credit.
- Began alphabetization but no real animateur and no independent credit activities.
- Cash before cotton from: tobacco (Sonatam came to village to collect) and onions sold in local markets and Sirakorola.
- Maize as a garden crop but chief tried a full field this year.
- 4 individuals present claimed they had purchased fert for cereals at least once. Users agreed it had increased yields.
- This is an 'old style' Malian village..... discussion focused on list of needs (what we can do for them) vs. ideas about what they can do for themselves—a sharp contrast to other villages.

DATE: Thursday, 24 February 2000
VISITORS: Sylla, Kelly, McGahuey, Ramadjita Tabo (ICRISAT)
LOCAL CADRE: Souleyman Tarawélé, Chef du Secteur; Dramane Coulibaly, TS ag
SECTOR: Koulikoro
SUBSECTOR
VILLAGE: Dibaro

MODEL FARMER: Issa Kulibali

Cereal yields increased at first and then remained stationary for several years. He began experimenting with different cereals and varieties and finally got good yields with sorgho. Thinks it was 'rotation' that finally improved yields BUT OHVN/ICRISAT reps pointed out to him that changing cereals wasn't considered a real rotation.

DIBARO VILLAGE OBSERVATIONS/COMMENTS:

- 38 hh in village; about 700 people.
- This is a special case where GRN was introduced to save the village which was being flooded every year and required substantial investments by village members to rebuild their houses. As a result of putting in rock lines that saved the village from flooding, the model farmer was able to recuperate a substantial amount of his land—i.e., he benefited personally from community efforts to save the village.
- Amount of rock lines put in summarized by animateur: total of about 2824 meters over a period of about?? years. Other GRN activities: pépiniariste, 32 improved stoves, 16 fosse, 2 village woodlots (one private, one village), increase in manure use and adoption of shorter cycle cereal varieties. Has also been learning about rotations.
- Woodlot used as bank—sell poles when cash needed.
- Began rock lines after getting training. Used village-owned equipment.
- CLUSA/ACORD involved in training villagers.
- Have 5 animateur who were not present as they were at the weekly market.
- Pepiniarist is a private initiative.
- Have a school in village and pay for their own teacher.
- Cotton began 2 years ago: 12 this year, 19 signed up for next year.
- Peanuts were major source of cash income in the past.

- Inputs through OHVN to AV. Have found Arpon+ helps with rules.
- Mostly old-timers present as it was market day...Agreed things were better: food security, education.
- Problems: 700 people for one forage (20-24 meters)—a problem for woodlots and pépiniarist.
- Did a comparison of benefits to cotton vs. peanuts—former much more profitable.

Peanuts	.75 ha	600 kg coq = 300 kg grain; sold 250 kg @ 350 F/ha; kept 50 kg for seed = 87,500 F net income
Cotton	1 ha	1030 kg production = 135,000 F net income

- Re Women: trying to get into sesame instead of peanuts. Did a common field and got 275,000 F (gross?) last year for one hectare (?) Women’s role in production—used to do peanut degoussage; now do cotton harvest. Cotton work demands more time but they are paid—do it as a group of about 30 women who get about 2,500 F/day for the entire group. Money goes into association caisse. When men do group work for millet harvest they get about 40 kg of millet for a group of 30-40 men/day (i.e., less than women!). Discussed issue of increasing cotton production posing problems for women—clearly not viewed as a problem by group of men present (including sector head who was doing the translation!).

DATE: Friday, 25 February 2000
VISITORS: Sylla, Kelly, McGahuey
LOCAL CADRE: Drissa Tangara, Chef du Secteur; Fodé Koumaré, AVB Central;
Issa Coulibaly AVB Kouraba
SECTOR: Gouani
SUBSECTOR Nkuraba
VILLAGE: Mokoyakunko; Hameau = Djonon

This is one of 8 hameaux linked to a mother village (444 exploitations total). There are 6 animateurs for the village and hameaux. The village-wide group is 'supervised' by the head animateur (Issa); he is one who does critical work of organizing loan applications from all hameaux. Those present at Djonon were mostly older men (about 10) as the animateur and other younger guys were taking part in circumcision ceremonies.

MODEL FARMER: Daouda Fomba

- Contacted by an OHVN agent and told that his land was experiencing serious erosion problems. Agent offered to help him stop erosion. Without creating a formal AV the village organized a work group (7 people); their activities are planned by a committee of 4 people. One of first things recommended was plowing perpendicular to the slope. Rock lines also recommended and then manure.
- Copy of notes on activities and yields attached.
- Began GRN erosion control in 1995.
- Summary shows total production of farm from 1995/96–1999/2000 (i.e., don't get details of changes on improved fields only). Area increased but not clear from notes how much due to GRN and how much from bringing other land into cultivation.

DJONON VILLAGE OBSERVATIONS/COMMENTS:

- This hameau has 9 hh.
- Cotton in village since the time of Modibo!
- Five of 9 are doing some GRN land recuperation activities; work done by entre-aide groups.
- One hh took 5 years to regenerate land using rock lines and fallow.
- Four of 5 hh represented at meeting had done rock lines and they agreed this was the most important technique for their village.
- Four of 5 had fosse fumière.

- Several did parcellement and piquetage.
- One tried poughere but it didn't work (eaten by animals?).
- Credit organized by animateur en chef (Issa) but local animateur does recensement
- Tried to get a feeling for how much fert used on non-cotton crops and whether it was purchased directly for these crops or redirected from cotton purchases—seemed to be avoiding question.
- Admitted that when they increased FO on cotton they decreased fert (but didn't clearly state that they still purchased recommended amounts and applied to other crops).
- Seems to be preference for use of cotton complex on all crops (suggesting that it be being redirected?). Some use urea. Mike asked about ideas on fert vs. FO use. Answered showed they understood complementarity issue and that fert only wasn't good BUT they came back later and asked Mike if their answer had been 'correct'—sign of real interest in learning/improving techniques?
- One fellow recalled seeing a demonstration of soil absorption qualities in the mid 1980s (?) (bottles compared with soil and water and soil and FO and water) and said that was what got him started on using FO; improved FO, however, was not generalized until mid-1990s.
- Changes perceived: Some increases in production, more ag equipment, people are generally more 'at ease'. Instruction important benefit (but old folks feel as though it showed them to not have been very smart-comment by fellow with funny teeth?). Improvements in homes. Less displacement (of fields?).
- Re women: their work has increased as cotton area/yields increase. They use the income from the cotton harvest for nivaquine treatments for the kids. Had to drop their communal field the last two years because the rainy season started late and the men didn't have time to plow their field. Still had their Karité income which is substantial (lots of trees in village—easy access to nuts).

DATE: Friday, 25 February 2000
VISITORS: Sylla, Kelly, McGahuey
LOCAL CADRE: Drissa Tangara, Chef du Secteur; Fodé Koumaré, AVB Central;
Issa Coulibaly, AVB Kouraba
SECTOR:
SUBSECTOR
VILLAGE: Mokoyakunko; (village = Bassian)
MODEL FARMERS: Samu Kamara and Divisa Bakayoko

- Samu Kamara (older guy: began 1997).
- HH: 31 people; 8 men and 9 women active.
- Divisa Bakayoko (jeans jacket: began 1995).
- Most impressed with maize yields.
- Using lots of fascine plus rocks and barriers; land in process of being recovered.
- Resources of hh substantial (>150 cattle; 14 traction oxen, 3 charrue, 4 multicult.)
- Laborers: 10 men, 8 women
- Fosse: 4x3x1.5 yields 45 carts from 14 traction animals.
- Animal park produced 120 carts from 150 head of cattle.
- Copies of summary sheets for these two farmers are attached.
- Reports cover entire farm, not specific GRN fields. Yields generally increasing.

MOKOYAKUNKO VILLAGE OBSERVATIONS/COMMENTS:

- 1982 was beginning of alphabetization.
- 1985 AV created.
- Located 68 km from Bamako; 43 km from chef l. Arrondissement; 3-15 km from other hameaux attached to village.
- Total village pop = 731; 578 bras valide; 281 men.
- Seems to be a problem of cereal surpluses in the village and question of how to manage them. Received a credit from the bank (9 mos.) to purchase surplus cereals and create village-level cereal bank. Have 19T stock purchased at 80 F/kg --- current price about 65 F.

Need to sell at about 100 F to cover all charges storage/interest/etc. Discussed issue but clear that management of cereal stocks is a mix of traditional attitudes about village solidarity and modern access to bank credit...Will need help to work through economics of borrowing money on cereals if intent is not to sell them outside village.

- Also anticipate problems paying back cotton credit this year due to lower yields...Seems like best option would be to sell of animals that they have augmented during past good years but this goes against the grain (don't want to go backwards on recent progress).
- Changes observed: Have stopped clearing new land; striga is down; keep manure for themselves now when before it was left lying around for anyone to collect (demonstration effect); lots of training and group work on GRN; more equipment (can cultivate >20 ha now but not earlier); quality of the sauce is better (note that both men and women contribute); more moulin; more eclatement as young guys can afford to set out on their own; younger marrying age means young stay in village; new people moving into zone (?); fallows down to 1 year now since other methods being used to restore soil; young guy pointed out that there was less (virtually no) migration to Côte d'Ivoire now because those staying at home better off than those migrating; also noted increase in motor bikes, wives, clothing.
- Tried to get them to say that yield increases due to rain but those who spoke pointed out that yield increases due to hard work and improved techniques as well as rain.
- Note that increase in cotton prices stimulates increases in cotton area.
- Village does have pressure on land.
- Asked what they would do if cotton price kept falling; had clearly thought about diversifying and were looking into sesamé and bissop (both products being promoted by OHVN agribusiness office).
- Onion/tomato production difficult to evacuate given poor condition of roads.
- Most are reinvesting cotton income in livestock.
- Seems to be general understanding of role that FO and fert play—complements.
- Credit thru OHV began in 1979; commercial banks began in 1985.

UNDERSTANDING THE OHVN PUZZLE

(SOME KEY WORDS)

	G											
S	O	M	E	T	H	I	N	G				
	O				A							
	D				P							
					P	R	O	C	E	S	S	
	V	A	L	U	E			O				
					N			M				
					I			P				
			G	R	N			L				
					G			E				
							E	X	P	A	N	D

Something **GOOD** is happening!

A visit to 7 OHVN villages and discussions with about 100 farmers confirmed that:

- Yields of all crops are increasing for farmers adopting GRN intensification methods.
- Farmers are unanimous that life is better now than 10 years ago.
- Farmers are optimistic/enthusiastic about the future.

This **GOOD** comes from a complex **PROCESS** that has been going on for more than 15 years. It is the result of **MULTIPLE EFFORTS** by **MANY ACTORS**.

INGREDIENTS contributing to current success appear to be:

- Identification of *technologies* capable of increasing declining yields
- Potential for increased cash income from improved *cotton* production
- *Community* approach to implementation
- Focus on *youth*
- Focus on villages/farmers most *likely to benefit* from GRN actions
- Use of *demonstration effect* through model farmers and model villages
- *Incremental training* (literacy, technical skills, community organization, management skills)
- *Support services* offered
 - Roads
 - Credit guarantees for limited period following management training
 - Input/output transport assistance
 - Regular supervision and support to trainees
 - Some free equipment for implementing GRN activities
 - Market research by OHVN to help with crop diversification

Looking toward the **FUTURE** two questions need to be addressed:

1. Is it possible to **QUANTIFY THE IMPACTS** of GRN intensification activities in terms of.
 - benefits realized by farmers?
 - benefits realized by Malians in general?
 - benefits realized by the rest of the world?
2. Is it possible to **INCREASE THIS GOOD** by...
 - further increasing yields/incomes of current GRN farmers?
 - reaching a broader group of OHVN farmers?
 - reaching farmers outside the OHVN area?

Appendix 5

**Suggested Format for Periodic Reporting of NRM Village and Farm Adoption
in the OHVN**

Suggested format for periodic reporting of NRM adoption by villages and farms in the OHVN												
Date:												
Degree of village-level participation in NRM program												
	Total Number of		Number and % of Villages Adopting			Number and % of Villages Adopting			Number and % of Villages Adopting			
Sector	Villages*	Population	1-3	4-5	>5	1-3	4-5	>5	1-3	4-5	>5	
			Different Soil Fertility Themes			Different Anti-erosion Themes			Different Forestry Themes			
Kangaba	55		53 (96%)									
Bancoumana												
Ouélessébougou												
Dangassa												
Gouani												
Kati												
Faladiè												
Koulikoro												
Sirakorola												
* need to specify if hamlets counted as villages or not												
Degree of farm-level participation in NRM program												
	Total Number of Farms		Number and % of Farms Adopting			Number and % of Farms Adopting			Number and % of Farms Adopting			
	In the Sector		1-3	4-5	>5	1-3	4-5	>5	1-3	4-5	>5	
			Different Soil Fertility Themes			Different Anti-erosion Themes			Different Forestry Themes			
Kangaba												
Bancoumana												
Ouélessébougou												
Dangassa												
Gouani												
Kati												
Faladiè												
Koulikoro												
Sirakorola												

Appendix 6

OHVN Case Study of Production and Income Changes For A Farmer having Used NRM Practices During Nine Years

Case Study Tables from OHVN December 1999

Introduction. The following pages contain an example of an OHVN case study taken from an OHVN conference paper (OHVN December 1999). Although it tells the story of only one farmer, it shows a good understanding of the types of data that must be collected for a large number of farmers if OHVN is to do a more thorough job of reporting on zone-level impacts of NRM adoption.

A number of improvements could be made in the economic analysis. Among the more important would be (1) accounting for differences between the with and without adoption scenarios, (2) accounting for year-to-year changes in production and prices for the economic analysis (rather than a simple comparison of first and most recent years), and (3) using real prices (nominal prices deflated by an index such as the consumer price index) that reflect seasonal and interannual price risk (the current analysis uses a single price across all years to value output). Note that Appendix 8 uses data for the same farmer, but with some changes in the method of calculating benefits introduced.

Farmer: Masiamé COULIBALY

Village de Bini

Secteur Développement Rural (SDR) de Gouani

Themes employed by the farmer

- lignes en cailloux (cordons pierreux) sur courbe de niveaux;
- bandes enherbées;
- végétalisation;
- labour perpendiculaire à la pente;
- grattage à sec
- utilisation fumure organique;
- parcellement et piquets verts;
- labour de fin cycle.

Evolution of area, yields, and production : 1990 – 1991 – 1998 – 1999

Crops		Agricultural season									Average
		1990	1991	1992	1993	1994	1995	1996	1997	1998	
		1991	1992	1993	1994	1995	1996	1997	1998	1999	Area
	Area (ha)	2	3	2	2	3	-	4	2	4	2,7
Millet	Yield (Kg/ha)	0,8	0,95	1	1	1,2	-	1,28	1,3	1,3	
	Production(T)	1,6	2,85	2	2	3,6	-	5,1	2,6	5,2	
	Area (ha)	4	3	5	6	3	5	3	4	4	4,1
Sorghum	Yield (Kg/ha)	0,95	1,2	1,43	1,63	1,7	1,8	1,8	1,8	1,85	
	Production(T)	3,8	3,6	7,25	9,78	5,1	9	5,4	7,2	7,4	
	Area (ha)	3	4	3	4,5	4	4	4	3,5	4,5	3,8
Maize	Yield (Kg/ha)	1,25	1,3	1,8	1,95	2	2,15	2,4	3,05	3,2	
	Production(T)	3,75	5,2	5,4	8,78	8	8,6	9,6	10,7	4,4	
	Area (ha)	0,7	0,7	0,7	0,7	0,7	0,7	0,7	0,75	0,75	0,7
Rice	Yield (Kg/ha)	0,85	0,9	0,9	0,95	0,95	1	1	1,02	1,2	
	Production(T)	0,6	0,63	0,63	0,66	0,66	0,7	0,7	0,77	0,9	
	Area (ha)	0,5	0,7	0,7	0,7	0,5	0,5	0,5	0,5	0,75	0,6
Peanut	Yield (Kg/ha)	0,6	0,7	0,75	0,75	0,8	0,8	0,85	0,7	0,58	
	Production(T)	0,3	0,49	0,53	0,53	0,4	0,4	0,42	0,35	1	
	Area (ha)	10	10	10	6	10	11	9	9	11	9,5
Cotton	Yield (Kg/ha)	1,41	1,55	0,93	2,59	1,52	1,52	2,11	2,11	1,41	
	Production(T)	14,1	15,5	9,93	15,56	15,2	16,7	19	19	14,1	
	Area (ha)	0,5	0,75	1	0,5	0,5	0,5	0,5	1,25	1	0,7
Cowpea	Yield (Kg/ha)	0,3	0,4	0,5	0,5	0,5	0,55	0,6	0,6	0,5	
	Production(T)	0,15	0,3	0,5	0,25	0,25	0,28	0,3	0,75	0,5	
Total area		20,7	22,2	22,4	23,4	24,7	24,7	24,7	23	28	

Analysis of changes in yields between 1991 and 1999

Crops	Years		Yield differences		Observations
	1990-91 kg/ha	1998-99 kg/ha	Yield kg/ha	Percentage change	
Millet	800	1300	500	62,5	For cotton; low density in 1999, but if 1990/91 is compared to 1997/98 the yield difference was 703 kg
Sorghum	950	1850	900	94,7	
Maize	1250	3200	1950	156	
Rice	850	1200	350	41	
Cowpeas	300	500	200	66,6	
Peanuts	600	780	180	30	
Cotton	1410	1414	4	0,28	
				49,8 (97-98)	

Economic analysis of the farm

Crops	Mean Area (ha)	1990 yield kg/ha	1998 yield kg/ha	1990 Prod (T)	1998 Prod (T)	Value (FCFA)		Yield increase (kg)	Income increase (FCFA)
Millet	2,7	800	1300	1600	5200	112000	364000	325	252000
Sorghum	4,1	950	1850	3800	7400	266000	518000	195	252000
Maize	3,8	1250	3200	3750	4400	262500	308000	117	45500
Cotton	9,5	1410	1410	14101	14101	1198585	1198585	0	0
Peanut	0,7	850	1200	600	900	72000	108000	150	36000
Rice	0,6	600	780	300	1000	45000	150000	333	105000

N.B: Prix constants: - Céréales 70 F/kg
 - Coton 85 F/kg
 - Arachide 120 F/kg
 - Riz 150 F/kg

Appendix 7

Draft Questionnaires for Collecting Data From AVB/ANIMATEUR Notebooks

Appendix 8

Illustration of Budget Analysis Possible Using The Types of Data in Appendix 7

The production data used in this appendix are taken from the case-study farmer presented in Appendix 6. The point of this appendix is not to do a full-blown analysis of the net increases in income realized by farmers adopting NRM practices, but to illustrate a number of things that could be done to improve the analyses currently done by OHVN. The tables below illustrate three changes that OHVN could easily make in the way they do their financial assessments of adoption.

(1) The first table quantifies the yields for a without project scenario rather than simply comparing yields in the initial starting year with current yields (as done in Appendix 6). A comparison of a with and without scenario does a better job of showing the full extent of yield differences that can be attributed to adoption of NRM practices. In the example that follows I assume a rate of decline in yields over time due to erosion and nutrient depletion that approximates that shown in aggregate national yield statistics for Mali.

(2) The second and third tables use both the with/without scenario and two different price scenarios to capture the potential impact of price instability on income (Appendix 6 used only one price for the entire nine years). The illustration values the nine-year cumulated differences in yields between the case-study farmer and the without project scenario using both a favorable and unfavorable producer price (prices for the illustration were arbitrarily selected but reflect recent reality).

A more appropriate method would be to value the yield difference for each year using the average price during the harvest season (unfavorable scenario) at a major OHVN market and the average price during the hungry season (favorable price scenario), converted to real terms using a price index. By using actual prices, corrected for inflation, we get a better picture of how price instability (which is generally high in Africa) affects the value of agricultural production. I did not have adequate time to get the price data needed for this type of analysis during my visit to Mali, but the market data available in Mali is adequate for this type of valuation.

(3) The fourth table adds an additional consideration—the time value of income. The table uses the favorable price scenario of the preceding table, but discounts the stream of income using a 10% discount rate to obtain a net present value (NPV) of the stream of annual increments to income obtained by the farmer adopting NRM practices. This type of analysis takes into account the likelihood that farmers place a greater value on present than on future income. Doing

this type of analysis tends to reduce the benefits a farmer might realize from investing in NRM because the yield/income differences tend to be larger toward the end of the nine years than at the beginning of the period.

A major shortcoming of the analyses presented in these four tables is that it does not account for differences in farm-level costs between the with and the without project scenario. If we are able to get more complete information on levels of inputs used each year by participant and nonparticipant farmers and the costs of constructing some of the anti-erosion structures (see Appendix 5 for details on types of data needed), a more thorough analysis could be undertaken using a standard benefit/cost framework. This type of framework has recently been applied to an analysis of the use of Tilemsi rock phosphates in Mali (IFDC 1999). If we are able to get at least 10 cases of the questionnaires recommended in Appendix 5 filled in, some effort should be made to use them in a benefit/cost framework similar to that used by IFDC. A forthcoming MSU working paper (Crawford, Kelly, and Howard 2000) provides useful guidelines on how a simple benefit/cost framework can be applied to analysis of projects promoting input use and/or NRM practices that have both private income and public environmental impacts.

Appendix 9
Contents, Forward and Introduction
from
A Methodology for Estimating Household Income In Rural
Mozambique Using Easy-To-Collect Proxy Variables

by
David Tschirley
Donald Rose
Htiginio Marrule

Foreword

Adapting INCPROX and INCPROX Lite to Other Data Sets

This report is a slightly modified version of a report originally prepared for use by USAID-funded NGOs in Mozambique in developing household income estimates for evaluation of their programs and reporting to USAID. Readers interested in the income proxy methodologies but not specifically in Mozambique might skip section II.A (Data Collection and Processing), as it contains primarily information very specific to Mozambique.

The methodologies reported on here represent a general approach applied to specific circumstances. The approach described in section II.B (INCPROX: A Structural Approach to Estimating Income) and II.C. (INCPROX Lite: A Simpler Alternative) could be applied in other countries or in other geographical areas of Mozambique, but would need to be adapted to those circumstances. Adapting INCPROX or INCPROX Lite to other areas would involve:

1. Collecting or gaining access to an existing household level data set that contains all the data needed to (a) directly calculate income for each household, and (b) develop income proxy variables for each household similar to those utilized in this report;
2. Utilizing regression techniques to develop INCPROX or INCPROX Lite models based upon this data set; and
3. Developing standard procedures for (a) collecting the proxy variables and (b) converting those proxy variables into estimates of household income and income components

Income-expenditure surveys are done in many developing countries on a regular basis, for example every three- to four years. Thus, one wishing to develop and utilize these income proxy methodologies would typically *not* need to collect a data set specifically for that purpose; work could focus on developing the models and the standard procedures for utilizing the models to obtain income estimates. Once these models and procedures are developed, various organizations can collect a much reduced set of simple proxy variables on a regular basis (for example, yearly), and easily produce estimates of household income and income components. These organizations do not need sophisticated research capabilities, but do need access either in-house or through consultants to data collection and management skills typical of monitoring & evaluation operations.

Two key issues would benefit from further research. First, how well do the models perform over time? The value of these approaches as cost effective monitoring tools is predicated

on the income estimates they generate being acceptably accurate over the course of several years (e.g., 2-4 years). If the models are robust over such a time period, then a rich set of monitoring information—household income and its structure—can be tracked regularly without the burdensome, complex, and costly work of collecting and processing income-expenditure data sets.⁴ In Mozambique, the lack of comparable data sets separated in time has not permitted testing the temporal durability of these models. A country with comparable income-expenditure data sets separated by 2-4 years would be an ideal candidate for such research.

Second, how can the models better deal with changing relative prices? Agriculture is a key component of income for most rural households in developing countries. Prices of agricultural commodities change every year, often in unexpected ways, and these price changes will affect income. Like the issue of temporal durability, developing an approach to deal effectively with changing relative prices requires comparable data sets separated in time (since relative prices will in all likelihood be different for each data set).

Section I of the paper provides a brief introduction. Section II reviews the work that was done to develop the models in Mozambique, and presents basic statistical results. Section III evaluates the performance of the models over space within the research area, and Section IV is a guide to NGOs on how to use the models—how to collect the proxy variables and develop the income estimates. In all these sections, much of the detail is in Annexes.

I. Introduction

This report outlines a method for estimating household income in rural areas of Mozambique using a proxy approach. It is based on collaborative work between Michigan State University and USAID-funded NGOs, and is meant for use by them in their areas of operation.

The development of such a methodology prompts two important questions. First, why focus on household income? Second, why use a proxy approach?

⁴ These models are based on objective measures of the *intensity* of a household's involvement in each economic activity, and on the *productive resources* the household had available to dedicate to those activities. These simple proxy variables are complemented by quantitative measures of the production of two key crops—maize and cotton. Thus, this approach should, in theory, be reasonably sensitive to changes in weather (proxied by the production of maize and cotton), in a household's portfolio of economic activities (proxied by the intensity variables), and in the quantity of productive resources available to the household (proxied by *production function variables*). Factors not accounted for in these models which could affect income include changing relative prices, and pest or other production problems which affect a crop other than maize or cotton. Changes in the productivity of the household's productive assets will also affect income; these are partially accounted for by the quantitative estimates of maize and cotton production, holding constant the household's productive assets. The actual success of the approach in controlling for all these factors is, of course, an empirical issue requiring further analysis.

An important overall development goal for Mozambique is the reduction of poverty and improvement in the incomes and well being of rural households. Thus, measurement of household income is a logical choice for monitoring the effects of policies and programs oriented towards accomplishing this goal. To be sure, there are other measures of household well being. For example, some economists have argued that welfare levels are more appropriately determined by measuring household consumption expenditures, in part because of the extensive data collection activities needed to accurately assess household income. But, since so much of consumption in Mozambique is from own production, accurately measuring consumption in practice may be no easier than measuring income.

Income is difficult to measure in rural settings of developing countries, in part because there are so many different sources of income. Households in Mozambique earn income from the production and sale of seven different food staples, such as maize or manioc, seven different cash crops, like cotton or tobacco, and 20 different fruits and vegetables. In addition, income is obtained from the production and sale of livestock, from fishing, from wage labor, and from any of over three dozen different microenterprise activities, such as the weaving of baskets or the production and sale of alcoholic beverages. Thus, surveys attempting to measure household income need to ask questions on all of these activities and collect quantitative information on each.

In addition to the sheer number of sources of income, each of these sources presents different methodological challenges. For example, to get information on income from the production of maize, one needs to know how much maize was produced. This involves getting the farmer to remember how many bags or cans of which size were obtained from the harvest as well as the state of the maize, dried or fresh, on the cob or in grain. Conversion factors are needed for the size of the bag or can, and density factors are needed for the state of the maize. While all this is doable for one or two crops, it becomes very time-consuming and expensive when done for the vast array of crops that are grown in Mozambique. The expense in human and other resources is beyond the capacity of all but dedicated research projects.

An income-proxy methodology provides the possibility of obtaining regular (for example, yearly) information on household income without performing cumbersome quantitative surveys each time. This report outlines the development and use of such a methodology.