



End of project evaluation

SENEGAL FOOD AND LIVELIHOOD ENHANCEMENT INITIATIVES (SFLEI)

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Thousands of projects have come through here but this there is no comparison, if we are the judges. We have nothing but our environment. Since we started working with FMNR [Farmer Managed Natural Regeneration] we have already started seeing the benefits that we have not seen with any other project. The type of benefits we see pushes me sometimes to leave my home and just walk through my field to appreciate the trees and environment. When things get to where they need to we will see more yields and the path will be clear. .

[Female Lead Farmer participant in the SFLEI project, Thiappy, June 2011]

World Vision Senegal

Fieldwork carried out 9th June 2011 to 23 June 2011

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iii. Affirmation

The document is produced by World Vision Australia (WVA) and World Vision Senegal (WVS). The data and information therein remains the property of the communities and individuals who participated in the evaluation. The findings in this evaluation are based on interpretation of the available data at the time. No data or findings in this report may be reproduced without written consent from WVS and WVA.

iv. Glossary/Acronyms and Abbreviations

Acronyms	Meaning
ADP	Area Development Program
CNRA	Agronomic National Research Centre
VDC	Village Development Committee
DME	Design Monitoring Evaluation
FBO	Faith Based Organisation
FMNR	Farmer Managed Natural Regeneration
IPM	Integrated Programming Model
ISRA	Agricultural Research Senegalese Institute
IDEN	National Education District Inspectorate
LEAP	Learning through Evaluation for Accountability and Planning
CBO	Community based organisation
NGO	Non Governmental Organization
RNA	Natural Assisted Regeneration
SFLEI	Senegal Food and Livelihood Enhancement Initiatives
SO	Support Office
TD	Transformational Development
TOR	Terms of Reference
WVA	World Vision Australia
WV	World Vision
WVS	World Vision Senegal

v. Introduction

The Senegal Food and Livelihood Enhancement Initiative (SFLEI) project is an initiative for the improvement of household level food security and incomes in Senegal. The project start and end dates were 1/11/2007 and 30/06/2011 respectively.

The design of the end of project evaluation was guided by a TOR developed by WVS with participation of the Technical Services, Forestry, Rural Development Department Service (SDDR) partners and community leaders. The evaluation took into consideration the log frame and indicators set out in the project design, the data collected at baseline, outcomes noted in the midterm evaluation, selected child wellbeing outcomes and a number of broader organizational objectives in the WV partnership.

The evaluation team included Carolyn Kaboré and Tony Rinaudo of the Food Climate Energy and Natural Resources group of World Vision Australia, Charles Bakhoun, Cheikh Tidiane Sow and Martin Nzale of World Vision Senegal and private consultants Amouzou Kokou and Francis Nuwame. Peter Weston assisted the data analysis and report writing.

At the time of the evaluation it was not known whether the SFLEI project would go into another phase or if it would be incorporated into standard ADP activities. Since this time a new project - *Beylene Sen Tol* has been approved and this will see the SFLEI activities extended to other ADPs.

The evaluation fieldwork took place from 4th June to 24th June 2011 and included a household survey (approximately 750 respondents) and key informant interviews and focus group discussions in the four project ADPs, East Kaolack, Ndiognick, Nguer and Thiappy. The approved budget for the project was approximately USD\$650,000. The total end of project evaluation budget was approximately USD\$36,000 including all local field costs and the international travel costs of the visiting members of the evaluation team.

The following persons made up the core evaluation team or contributed to the final report. Please contact Carolyn Kabore or Peter Weston at World Vision Australia, or Charles Bakhoun of World Vision Senegal, for any enquiries about this report.

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Summary of evaluation findings

The SFELI project set out to improve natural resource management to secure the long-term viability of semi-arid farming systems in central Senegal. The principle methodology was promotion and training in Farmer-Managed Natural Regeneration. This technique was complemented with tree-planting of fruit and leguminous trees, and short term food and cash crop support such as improved cereal seeds, establishment of market gardens, cassava plots and experimental crops such as rice. During the project's early years, food for work was applied to motivate farmers to establish FMNR and help them resist resorting to detrimental coping mechanisms like early harvest and tree chopping. To reduce the need for high volumes of firewood, the project also trialled fuel-saving technologies like fuel-efficient stoves and biogas on a small scale.

Through the work of SFLEI and its partners the number of hectares under FMNR expanded from 742ha in 2008 (6 months into the project) to 9,124ha. by 2011. This resulted in regeneration of an estimated 264,654 live trees in the project area. Households in the target area also planted 890,500 tree seedlings of which about 133,600 survived. Overall the project achieved an average tree density of 33 trees per hectare in FMNR areas, plus planted trees. Combined, the total number of new live trees generated by the project is 398,229. Given that tree density on crop lands at the start of the project in most areas was negligible, this is a major achievement.

Knowledge and practice of FMNR have improved due to the project. Feedback from key informants during FGDs highlighted a robust understanding of the function of trees in the farming system and the very positive experiences farmers are having with FMNR. Less than 10% of the population still believe a common misconception that trees on fields will shade out crops and compete for water, and that trees harbour birds that attack crops.

Project participants planted an average of 117 trees (including *Jatropha*) compared with an average of 33 in non project households. Tree planting was appreciated by farmers for introducing new species and replacing trees where no stumps remained, but they observed that unlike tree planting, benefits of FMNR far outweighed the costs to the farmer. In terms of cost to the project, the financial investment for planted trees was roughly USD\$2.22 per tree. In comparison, the financial investment for naturally regenerated trees was about USD\$1.44 per tree.

Since the baseline was done in 2008, farmer management of new shoots (thinning/protection of new shoots) has increased from 20% to 48%, the practice of tree pruning increased from 31% to 53% and 39% farmers mark their protected trees compared with 16% in 2008. The majority of farmers who use FMNR observed an increase in soil fertility (85%), less erosion (62%) and increased yields (59%). Other benefits cited were increased wildlife (35%), and increased access to firewood (30%) and timber (17%). Increased shade, fruits, rain and beautiful greenery were also mentioned by a few individuals. Survey results showed a project participants were also more likely to practice restricted grazing, which decreased animal damage to crops.

A number of traditional food security indicators were measured during the household survey but they didn't reveal any effect of the project, or of use of FMNR - on a household's vulnerability to food shortages. The survey data revealed a small increase in average millet yield from FMNR compared with non FMNR farms, but also showed that FMNR farms on average produced lower peanut yield than non FMNR farms. Unfortunately, (and despite the large sample size) the high level of variability and possible error in recalled estimates of crop yields, the practice of mixed cropping and intercropping, the multiple field locations and lack of data on actual areas sown to different crops, reduces the reliability of crop yield data. However, the potential of FMNR to improve food security in Central Kaffrine is well supported by research conducted at ISRA on impact of FMNR on millet yield (Section 5.1.7). In addition, the positive effect of *Faidherbia albida* and *Piliostigma* trees on cereal crop yields has been conclusively proven in studies elsewhere in Africa.

According to the results of the household survey, 62% of all respondents felt that income had increased in the last four years, while 78% of project direct participants said that income had increased. This demonstrates the contribution of SFLEI to improving household incomes through adoption of FMNR and providing access to accompanying agricultural activities.

In SFLEI there has been a very positive response by farmers to promotion of FMNR. The promotion of agricultural and forestry technologies in smallholder farming systems doesn't often result in this level of response – farmers tend to ignore new ideas because of perceived risks. But in this case the practice of managing trees in a cropped landscape is also a traditional practice - and there is perhaps less risk in going back to old ways, than in continuing on in the current system.

The efforts of the project and partners were perfectly timed with the recognition by farmers that they had to change what they were doing. The promotion of FMNR by World Vision and government forestry department strongly validated what farmers were wanting to do, and gave them courage to make a change. Prior to the promotion of FMNR farmers had to 'go it alone' and risk being viewed as a bad farmer.

The SFLEI project model also embodied the principles of community participation and farmer-to-farmer extension in the technology promotion process. The development of localised project networks that included *Conseil Rurale* (community based governance groups), *Service Eaux et Forets* (government Department of Water and Forests), schools and lead farmers as well as World Vision staff, are contributing to create systems that will enable World Vision to withdraw.

Project staff expressed a strong confidence that these groups are already leading the processes and can manage independently: particularly the *Conseils Rurales*. Farmers and officials testified to a new spirit of “*unified management of collective resources*” that did not exist before the project. A number of representatives from these organisations expressed that they could continue without World Vision.

To date the project has reached small groups of farmers in villages in each ADP. FMNR now seems to be embedded in the accepted wisdom of these farming communities and is likely to remain in practice and expand over time. The result of uptake of FMNR, the return of trees in crop land, is apparent in the project area and this demonstrates that outcomes are likely to be sustainable. However, the evaluation has also highlighted that there is much more work to be done and recommends a dedicated project to continue to bring other areas into a Region-wide FMNR-led on-farm environmental restoration movement.

I Executive Summary

This report presents the results of an end of phase evaluation of the Senegal Food and Livelihood Enhancement Initiative (SFLEI) project. SFLEI was designed to contribute to environmentally and socially sustainable improvements in food production and household income levels. The project ran from 2007 to 2011 and the approach included training and visits, use of community facilitators, work with local schools and engaging the government and local research partners. The evaluation results show that SFLEI has made an invaluable contribution to increased knowledge, skills and practice of Farmer Managed Natural Regeneration (FMNR) in the project areas and significant positive change in the way trees are valued and managed in local farming systems. Through the work of SFLEI and its partners the number of hectares under FMNR expanded from 742ha in 2008 (6 months into the project) to 9,124 ha. by 2011. This has resulted in natural regeneration of an estimated 264,654 FMNR trees in the project area, plus 133,575 live planted trees, totalling 398,229 additional trees in the project area.

The Senegal Food and Livelihood Enhancement Initiative

The SFLEI project commenced in World Vision Area Development Programs in Senegal in 2007 and ran until 2011. The project covered a large geographical area and 104,299 inhabitants and the total budget was US\$ 624 116.

The project goal was: *To contribute to sustainably increasing household revenue and production.*

Project outcome objectives were:

- Populations and local partners adopt and promote environment protection practices
- Households capacity to earn income and achieve food security is increased
- The project is well implemented and successfully managed

These outcomes would be realised through the achievement of the following project outputs:

- Populations, lead farmers and children trained in environment protection activities
- Farmers access new agricultural income sources
- Sustainable FMNR projects set up in each ADP

Evaluation objectives and methods

The evaluation was based on mixed methods using a Triangulation design. Three evaluative lenses were used for design and analysis and these were program achievements, quality of partnerships and sustainability of outcomes. Primary data were collected during evaluation fieldwork in June 2011 and secondary data were sourced from project documents. Quantitative data were collected using a household survey of 750 households with multistage cluster sampling and descriptive statistical analysis. Qualitative data included narratives collected from project, community government and other stakeholders and these were analysed against a framework of key evaluation questions.

This end of project evaluation presents evidence on the key themes of project outcomes, unanticipated outcomes, quality of partnerships and likely sustainability of achievements. The following sections explore the findings of the evaluation and highlights the strengths and challenges for the project going forward.

Project achievements - increased FMNR awareness, capacity and practice

The evaluation results show there is high awareness of the FMNR approach across the project community - 75% respondents were familiar with the term - and the proportion of respondents who could name three or more FMNR techniques had risen from 38% at baseline to 50% by the end of the project. The most frequently mentioned FMNR practices were protection of young shoots (73%), thinning of new shoots (54%), pruning branches (41%), marking trees (39%) and selection and care of seedlings (35%). Farmer knowledge about the benefits of FMNR was high with 84% stating it

improves soil fertility (84%), 69% stating it increases crop yield, 55% stating it attracts rainfall and 41% stating it reduces soil erosion (41%). The major constraints to FMNR mentioned were vandalism of trees (64%), the time and effort required to implement FMNR and protect trees (49%), a lack of knowledge of how to do FMNR (40%) and bushfires (22%).

At baseline the proportion of farmers who practiced FMNR in three ADPs was 73%. By the end of the project the proportion in the same three ADPs was 75%. While this gives the impression that there has been no change over time, in individual ADPs rates of practice increased while in others it fell. Part of the reason for this variation is inconsistency in what is interpreted as FMNR – some farmers may interpret this as simply having trees on fields, while others understand it as a specific combination of techniques including tree protection, marking, pruning and coppicing. This makes it difficult to precisely measure changes in practice over time.

The techniques applied by those who practice FMNR were explored in the both the baseline and end of project evaluation and the results show that application of most techniques has increased. For example the proportion of respondents who practiced thinning and protection of new shoots rose from 20%, to 48%. Benefits observed by farmers who practice FMNR include increased soil fertility (85%), decreased soil erosion (62%) and increased crop yields (59%). Other benefits cited were increased wildlife (35%) and increased access to firewood (30%) and timber (17%). Several respondents also mentioned increased shade as an important benefit because farmers were now able to rest in the shade on their fields. Increased access to fruits (especially *Ziziphus mauritania*), more rain and beautiful greenery were also mentioned by a couple of farmers.

In Niger farmers are using FMNR to transform barren landscape into vibrant agro-forestry farms. Lead farmers who participated in SFLEI training visits to Niger saw that tree species – which they considered to be weeds – could be grown into useful and productive trees. This made them realise the potential of ‘the underground forest’ on their fields back home. In Kaffrine farmers who practice FMNR are now leaving some of these previously rejected species on their fields. However, there is still widespread removal of potentially useful species by most farmers using burning (73%), cutting (45%) and digging (23%). The main species removed were *Nguera senegalensis* (65%), *Combretum glutinosum* (57%) and *Piliostigma reticulatum* (46%).

Key farmer informants commented on the difference between tree planting and FMNR as an approach to increasing tree numbers, stating that tree planting often failed while FMNR did not. However, a significant outcome of the SFLEI project was an increase in the number of trees planted in the project ADPs. Sixty percent of direct project participants planted an average of 117 trees per household compared with 33% of non project who planted an average of 33 trees per household. The promotion *Jatropha* hedges by the project accounts for the bulk of the differences in tree numbers planted, but the numbers planted were higher for all tree types for the project group. The most common tree types planted were *Eucalyptus* (33%), *Prosopis* (25%) and *Faidherbia albida* (18%). No evaluation data were collected on survival rates of the planted tree seedling.

The work of SFLEI has resulted in regeneration of an estimated 264,654 additional indigenous trees in the project area. Households in the target area also planted 890,500 tree seedlings of which about 133,600 survived. Combined, the project has introduced an additional 398,229 live trees into the target area. The estimated costs in terms of project dollars invested was about USD\$2.22 per planted tree and USD\$1.44 per naturally regenerated tree.

Unexpected outcomes

According to some community respondents the project had no unexpected or negative outcomes at all. However, others stated that women’s access to firewood has declined because they may not collect firewood in designated FMNR areas. So for women and children who collect the bulk of firewood for the household, the initial impact on FMNR can be negative and this was noted by both men and women respondents. They also stated that they thought the problem would be a short

term one, and they understood the need to protect trees. They were looking forward to a time when there was an abundance of trees, fruits and wood as a result of successful FMNR.

Some important technical outcomes that had not been previewed in the original project design were introduced in SFLEI and there was evidence of benefits to community. One particular success was trial of a rice crop in one ADP which provided benefits for women. Another promising intervention was introduction of Biogas Digesters to replace firewood for cooking. Farmers were very interested

Project achievements - transformed lives and landscapes

Over the last four years respondents have observed physical changes in their farming systems including an increase in woody tree numbers, decreased erosion, a decline in insect numbers and a decrease in livestock damage to crops. Overall the project achieved an average tree density of 33 indigenous trees per hectare in FMNR areas. Given that tree density on crop lands at the start of the project in most areas was negligible at around 4 per hectare, this is a major achievement.

According to key informants the food security situation today is better than it was four years ago – while shortages still occurred they were of a shorter duration. The data support this, with over half households enduring 7 months or more food insecurity in 2008 while in 2011 no families faced such lengthy food shortages. However, the extent and duration of the ‘hungry period’ is largely dictated by the growing season of the previous year and in this case a superior 2010 season largely accounts for the improved food security in 2011. This doesn’t mean there were no food security outcomes from the project, it just means these are heavily masked by the effects of season and agro-ecological resources, and almost impossible to identify using a household survey.

A potential factor in the improvement in household food security is likely to be an increase in income that has enabled families to purchase food. The SFLEI project promoted a range of ‘accompaniments’ designed to increase household income, many which were targeted to women. Also for those households where FMNR had been practiced for a number of years, access to pruned tree branches would decrease expenditure on firewood and potentially represent a new source of income. When respondents in the household survey were asked about household income over 60% said income had increased. When data were disaggregated, almost 80% project direct participants said that household income had increased while only 55% of the non project group thought this. Also 70% of women said income had increased compared with 61% men which possible reflects the project emphasis on women’s income generation activities. Any increase in cash income, particularly for women, is certain to increase access to food and to translate to positive nutritional outcomes for children.

In addition to transformation of farming systems and increasing income, the project has led to a fundamental mind-shift in how communities in the project area view their forest. Without question among those whom the project has reached there has been a change from individualistic exploitation of communal tree resources to unified management of a precious asset. Community key informants were able to articulate the approach to protection of tree resources and describe how community participated in the design of local bylaws. They highlighted the strength of the partnership with government services. One key informant stated they would have increased their efforts long before now if they had known the importance of FMNR and *Faidherbia albida*, and this comment highlights a sense of responsibility for making the required changes.

The SFLEI project worked with a number of primary schools to introduce the idea of FMNR to children – principally through training their teachers. As a result school children learned about FMNR and visited examples locally. During the evaluation children explained that if their parents keep on cutting down all the trees, they would not be able to have any children themselves when they grew up. They expressed a desire for change and demonstrated clear understanding of the importance of achieving this change to ensure their future wellbeing.

Lead farmers have self organised to develop a strategic approach to negotiating new social values around trees within their communities and with nomadic livestock herders who access their lands. For example nomadic herders must approach the local chief to request permission to enter village

lands. FMNR farmers used this opportunity to explain the rules regarding protection of trees to the visitors. Given the existing competition for resources between sedentary and nomadic farmers in fragile Sahelian ecosystem, this is an important outcome.

Partnership outcomes

Quality of partnerships between local stakeholders is paramount to program success and the continuation of benefits beyond the life of the project. Key partners for the SFLEI project were lead farmers and traditional and faith leaders, community FMNR facilitators and the government department of *Eaux et Forêt* (Water and Forestry). The evaluation found that community partners were able to describe their participation in the design and implementation of the project and were aware of the roles and responsibilities of each of the stakeholders. This demonstrates that the systems and processes required for a robust partnership are present and functional. Under the auspices of the SFLEI project the partnership between the community and the *Eaux et Forêt* department has progressed to the point that community was going to take a formal role in protection of FMNR trees and were working with the department to develop local rules and regulations. This is a dramatic change on the previous relationship where farmers viewed agents of *Eaux et Forêt* as feared administrators of the rules governing trees and wood collection.

Project staff described a high level of ownership by community of the SFLEI project especially among the community based *Rural Councils*. This was supported in feedback from community participants who described having a role in the project from the outset. They also described the roles of the *Rural Councils* and partners *Eaux et Forêt*. The response from the major partner *Eaux et Forêt* also confirmed a high level of ownership both by community and by the *Eaux et Forêt* leadership. The relationship between SFLEI and *Eaux et Forêt* was heading in the right direction – key informants from this department saw *Eaux et Forêt* as taking the lead role in promotion and support of FMNR and a reduced emphasis on WV as an extensionist of this approach.

Sustainable outcomes

Sustainability was evaluated in terms of outcomes for sustainability indicators included in the project design and in terms of steps taken towards transition. Community, partner and project key informants expressed the view that the SFLEI project is likely to achieve sustainable results in terms of area under FMNR. However, they also said there was a strong need for the project to continue for at least another four years and preferably ten to get to a stage where there would no longer be a risk of returning to the damaging and exploitative practices of today. Some key informants felt they needed to be supported long enough to enable children to become advocates for FMNR. This highlights the importance of addressing intergenerational elements of behaviour change in the successful restoration of farming landscapes in the region.

When asked specifically whether there would be sustainable outcomes from SFLEI one farmer gave the example of his continued use of health practices from a project that had ended some time ago – and he felt that in the case of FMNR, sustainable change was even *more likely* because aside from technical knowledge the only resources required came from the community themselves. Farmers were committed to keep on trying with FMNR by themselves, but they worried that withdrawal of support for FMNR would result in a big step backwards for the community.

Feedback from the major partner *Eaux et Forêt* stated that results of the promotion and uptake of FMNR are evident in the project area and this in itself demonstrates that outcomes are very likely to be sustainable. However, reform to the local laws governing wood cutting was required to ensure that FMNR would be sustained as a practice. At present farmers who want to sell the produce from an FMNR tree need special permission and this was a significant constraint.

Transition was discussed with the major partner *Eaux et Forêt* and the response was that it is already occurring. Commenting on sustainability they stated that their department would soon be the leading partner with the community, while the role of NGOs would reduce over time.

Self reliance in food production was included in the project design as one indicator of sustainability. On reflection this was ambitious because self reliance in food production hinges on great many factors, not just on uptake of FMNR. Certainly there will be an increase in capacity to produce more food once FMNR is well established, crop yields increase and tree products become a source of income. But this is likely to take 5-10 years.

Robust social networks were another sustainability indicator in the project design and at this stage the FMNR networks are mainly supported by the SFLEI project and government partners. However the foundations have been laid for formation of community led networks and moving forward, CBOs will be supported to do outreach and become effective agents of change within and outside their communities. This is included in the project design for a new FMNR project *Beylene Sen Tol*, which is going to be implemented in 2012.

Reduced vulnerability and improved disaster coping systems was an important indicator of project sustainability. A successful mature FMNR farmed plot provides fruit and leaves for human consumption and fodder for livestock consumption during periods of drought when crops typically fail, thus there is reduced vulnerability. However the majority of the trees in the SFLEI area are still young - another 5-10 years with good FMNR techniques will be needed to achieve this indicator.

All parents expressed a desire for their children to go to school and when asked whether a future in farming was desirable, some felt that well managed farms could be profitable and farming was increasingly viewed as the most secure means of feeding the family. These views differed somewhat from those of children. When primary school children were asked whether they intended to become farmers and the majority said they would not choose to do this – because the life was too difficult, farming made almost no money and it was a last resort in terms of career choices. These attitudes may change with the restoration of useful trees in species on farms and the return of viable farming systems.

Child participation

A key driver to successful and sustainable community development is active participation by children, as well as parents and local educators. In terms of inclusion of children, the SFLEI project has achieved very positive results. Children's knowledge and capacity building have been supported through teacher training in schools and FMNR has been incorporated into children's school curriculum and field trips. However, there is an identified need for additional FMNR outreach activities in order to include the (significant) proportion of children who are not in school.

When teachers were asked to comment on the participation of children in the project, they suggested that, just as adult farmers have been strongly influenced by the visits to FMNR regions in Niger, children would also benefit from participation in these visits. Teachers also felt their own participation in the project could be more meaningful and emphasised the importance of teachers as change agents in community.

Child wellbeing

To contribute to World Visions commitment to monitoring child wellbeing, questions about school attendance and numbers of meals served to children were included in the household survey. In ADPs where the SFLEI project is located there has been improvement in the proportion of children who attend primary school. For example in one ADP in 2006 only 13% of children were attending primary school and when the survey was done in 2011 this proportion had increased to 40%. In another ADP the rates had increased from 42% to 60%. Children in the project area consume an average of 3.1 meals per day in the hungry season and 3.2 meals per day in periods of regular food availability. The quality of foods consumed and the number of meals served to children did not change much between regular food availability and food shortage periods. This suggests there are effective coping mechanisms for maintaining food supply to children at this time – and this may be underpinned the project contribution to increased income.

Cross cutting themes

Gender

The gender outcomes of the SFLEI project have been positive according to feedback from direct project beneficiaries. The obvious intention of the project staff to include women as lead farmers was beneficial in many ways, such as instilling a sense of pride and expanding opportunities for women. When lead farmers were asked explicitly whether women's position within the community had been improved as a result of the project – in other words had there been a shift in the balance of power between men and women – women in one ADP said they felt supported and included and they were taking the responsibility for tree protection seriously. One female project participant said that due to the project women had been given access to land and they now are able to prune FMNR trees, whereas before all tree cutting was prohibited. This was in contrast to the comments from other women who stated that they were now unable to harvest wood in FMNR protected areas, so their situation had worsened. However, there was recognition by all respondents that once trees had returned to the landscape the firewood situation would improve for everybody. On balance, the approach taken in the SFLEI project has improved the situation for women directly involved in the project but there will need to be continued efforts to address gender issues across the community.

Disability

Overall 14% of respondents said there was one or more children in the household who had a disability, but this varied between ADPs. East Kaolack, Nguer and Thiappy recorded approximately 10% while in Ndiognick the value was 3 times higher at 30%. In terms of the project approach, the evaluation highlighted that the initial decrease in access to firewood due to protection of trees in FMNR areas may have a particularly adverse effect on the disabled - if this means they are needing to travel further to look for firewood. In future the project should directly engage with disabled community members to assist these groups with uptake of FMNR and ensure that their access to wood does not become more difficult.

Environment

In the project region most agricultural land is severely degraded and the successful promotion of FMNR is restoring vegetation cover and productivity to these lands. Therefore this project approach fully delivers on this cross cutting theme. A question remaining in terms of the project contribution towards environment is what level of resources will be needed to scale up the success from 'some areas' to the majority of farmland in the region.

Peace building

Where there has been good community engagement, the SFLEI project is effectively contributing to minimising conflict between the sedentary and nomadic herders, between farmers and government forestry agents, and between farmers who practice FMNR and those who don't.

Protection (including child protection)

While there were no 'child protection' activities in the project there have nevertheless been positive outcomes in this area. Teaching FMNR in schools will stimulate children - who do much of the farm work – to question traditional practices such as slashing and burning fields prior to sowing. Cessation of this practice will reduce child labour and avoid burns injuries and smoke inhalation. Also the generation of wood from FMNR tree pruning may reduce the need for children to go far from home to fetch firewood.

Strengths of SFLEI

Behaviour change model: a multi-faceted communication strategy that promoted genuine dialogue at and between many sub-groups in the project area: farmers from different locations, government services, *Conseils Rurales (rural councils)*, school children and teachers, religious leaders and *griots* (traditional story tellers or orators), radio programs, promotional caravans and theatre, exchange visits in and outside Senegal, initial material incentives, and engaging women as well as men promoters.

Timing of the project – The project concept emerged at a time when community recognised the link between poverty and the environment and could already see the potential of FMNR. The pre-existing interest in FMNR was a key factor in the high level of engagement with the project.

Training visits to Niger – ‘Seeing is believing’ and farmers believe other farmers, extensionists believe other extensionists etc. This was a crucial project activity.

Training of trainers – Training lead farmers in FMNR and this was a key feature of SFLEI which community key informants said was not present in many other projects. It was viewed as a key strength.

Reducing risks to farmers - The project provided food assistance to project participants during food shortage which meant they were able to wait for crops to mature before harvesting and did not have to consume or sell their seed.

Using farmers’ existing resources - Unlike many agricultural interventions the practice of FMNR does not rely on access to assets and resources that farmers do not have. This was seen as a key strength by community respondents.

Investing in partnerships – Investment in developing partnerships between WVS, *Eaux et Forêts* and community members has underpinned the outcomes of the project.

Recruiting women in FMNR – Women’s role in collection of firewood means that they are a crucial change agent for FMNR.

Development of bylaws – Local bylaws that govern FMNR has been pivotal to uptake of the practice.

FMNR facilitators - FMNR facilitators provided both technical and moral support to farmers who decided to try FMNR and was much valued.

Local FMNR trials and research – Project support of FMNR trials conducted by ISRA showed conclusive evidence of increase millet yield, which corroborates observations by FMNR farmers that millet yields were increasing.

Technical challenges

FMNR spread and quality of practice – There is still limited practice of FMNR within the project region and an urgent need to scale up adoption. In addition fieldwork revealed that where FMNR was being applied, often the techniques were not optimal and did not maximise the regrowth potential of coppiced shoots. Many farmers practising FMNR did not mark trees and they pruned regrowth too hard leaving trees spindly and vulnerable to breaking.

Prevalence of burning - Observation of preparation of farmland during the evaluation highlighted a serious threat to the success of FMNR in the project area. The vast majority of farmers clear tree, shrub and grass regrowth from their fields just prior to sowing and they burn all of the collected organic matter. Future FMNR project designs for this region MUST address this issue.

Removal of potentially useful trees - Almost all respondents (93%) in the households surveyed said they removed trees from their crop land and many of the species removed are valuable FMNR

species that have helped transform desiccated landscapes in Niger into viable farming systems. The FMNR outreach in Kaffrine needs to include material (e.g. short mobile phone film clips) that shows how these tree species are contributing to farming systems in Niger.

Regulations for tree and timber harvest - At this point, farmers still need special permission from *Service Eaux et Forêts* to harvest and sell regrowth timber from their own fields. This is a sensitive issue, given the Service's historical role in policing tree-cutting. FMNR contacts in Niger (Maradi and Zinder regions) who overcame this challenge some years ago, may be able to provide guidance to World Vision Senegal and *Service Eaux et Forêts* to make this transition.

Reduced access to firewood – the fact that FMNR initially reduced access to firewood was highlighted by community and lead farmer key informants, both women and men. This was also highlighted in the survey results – in disaggregated data for women, and in some ADPs where the majority of respondents said access to firewood had decreased in the last 4 years. The gender dependent patterns around firewood must be taken into consideration in the development of training, management and the development of local bylaws governing access to trees and wood. Accompanying measures that enable women to use less firewood, earn more income and replace wood as the major fuel source for household needs will be the key to success in the project region. Future project design will be informed by the valuable lessons from SFLEI.

Scale of the problem in Thiappy - the current approach to FMNR and natural resource management being applied in Thiappy ADP may be insufficient in view of the scale of desertification and previous removal of most tree stumps in this area. FMNR alone will not be enough to restore environmental health and fertility to farmland. Future approaches must include tree planting and land and soil restoration and soil and water conservation methods suitable to the agroecology and farming systems of the area. Examples from elsewhere in the Sahel include support for community managed tree seedling generation, live hedges with multipurpose trees, *Zai* and half moon sowing pits with mulching and improved compost, infiltration dykes, and contour bunds with vegetation to slow runoff in heavy rains.

Energy systems - Overall improved stoves were present in about 20% households which is encouraging, but half of this group also still used the traditional open fire as well. Further support for promotion of improved stoves in the project area would be highly beneficial. There was much community interest in biogas digesters but this system has not been implemented in more than a few households and is dependent on farmer resources (land and oxen) and requires technical supervision.

Livestock management - Although camping livestock do deposit valuable nutrients below the tree canopy area, heavy pressure from grazing livestock can also result in ringbarking of trees, breaking branches and trunks and destruction of seedlings. Restricted grazing has increased through the project but just over a quarter (28%) of farmers in the project area practice restricted grazing (Figure 58). Future promotion of FMNR needs to support uptake of restricted grazing especially in the early years of FMNR when trees and seedlings are very vulnerable.

FMNR influence on local crop production - increased yields in millet (supported by the ISRA field trials) contrasts with reduced ground nut (peanut) and maize yields. Whole farm trials and additional research on crop effects in local FMNR system are urgently needed to quantify these changes at field level and in terms of food security outcomes.

Tree density and species mix - The project achieved an average tree density of 33 trees per hectare but the optimum tree density and mix of species for local farming systems is not yet known. Additional work with lead farmers and with local research institutions is needed.

Social challenges

The role of Food for work and other incentives in uptake of FMNR - Early in its life cycle, the project was able to take advantage of a food-for-work program to reward farmers for

implementing FMNR on their fields. This phased out quickly, being replaced by the accompanying food production assistance. In isolation, we cannot be clear from this project whether the food for work program was a major catalyst for farmer adoption of an idea as novel as FMNR. If circumstances permit (e.g. no major food shortages) future FMNR outreach needs to be done without this component to establish the real uptake of this practice.

Children outside education system - Children who don't go to school or who drop-out of school often go back to the family farm and they represent a large segment of the farmers of tomorrow. The current project design doesn't directly engage this group.

School children and farming - Currently the SFLEI project is engaging school children through training teachers in FMNR and this is being incorporated into school curriculum and fieldwork. However the majority of school children in the evaluation FGDs expressed negative views of farming – they considered this as an occupation of last resort. This needs to change to inspire in them a vision of viable and profitable, treed farming systems.

Teachers as agents of change – although the SFLEI project is training teachers in FMNR and this has been included in the school activities, there was potential to leverage their capacity beyond the classroom. Teachers may be able to have a formal role in promotion and monitoring of FMNR in local communities and include children outside the school system. This type of partnership under the right conditions has great potential – but will take time and resources to scope out and develop.

Government's role as major agent of change - *Eaux et forêts* is preparing for a lead role in the promotion of FMNR in Kaffrine but is currently not well resourced. It is not the WV's role to fill this resource gap, but WV can be a leading advocate to ensure that Government resource allocation to *Eaux et Forêt* is adequate for the community services it needs to provide.

Recommendations for FMNR programming in Senegal

Build on the strengths of the SFLEI project model – FMNR training and visits to established FMNR landscapes and inclusion of all relevant change agents. Agents of change include lead men and women farmers, community facilitators/*animateurs*, traditional and faith leaders, story tellers, agricultural and forestry agents, local teachers and local research partners working in NRM. The project approach model also endorses *farmer-to-farmer* extension and the *train-the-trainer* approach. Use of incentives that stimulate uptake of FMNR and reduce risks to farmers is also effective.

Promote best-practice FMNR in the current project ADPs – The evaluation revealed the dominance of poor practices where for example FMNR trees are incorrectly pruned, are not marked and are still being harvested for wood despite being marked. Also removal of tree regrowth by burning fields is a widespread detrimental practice. Ignoring the poor practices will not achieve the results anticipated by farmers and may result in their abandoning FMNR.

Incorporate wood saving technologies into project design – Ideally the next phase of the project will be linked with promotion of locally appropriate and cost effective wood saving stoves to women and feasibility studies on biogas digesters for households with sufficient capacity to take up this technology.

Promote complementary soil and water harvesting techniques - For arid zones with few surviving live tree stumps, such as Thiappy ADP (Fatick Region), experiment with and introduce additional NRM techniques that complement FMNR. We recommend including the

use of multi-purpose leguminous trees to hedge in fields (e.g. Farmer-Managed Agroforestry System (F-MAFS)¹ and *zai* or *demi-lunes* sowing techniques).

Continue linking FMNR research on crop yields to FMNR projects – Local rainfed crop production is entirely dependent on seasonal conditions and on the diverse practices of farmers, who are balancing risks and opportunities with their scarce resources. Effects of FMNR on crop yield are marginal compared to the effects of the weather. It is difficult to show a contribution of FMNR by relying on farmer recall of cropping inputs and outputs, as is typically done in project evaluation. Also it is expensive and impractical to directly measure crop inputs and outputs on a statistically representative number of FMNR and non FMNR farms. In the case of SFLEI crop yield trials by ISRA were absolutely invaluable – the evidence of increased millet yield in FMNR plots compared with non FMNR plots provided a valuable proxy for concluding that farmers who practice effective FMNR will get a better millet yields. The evaluation survey data supported the idea that millet yields were greater on average for FMNR users than for non-users, but the opposite was true for peanut production. Additional field trials are needed to determine whether increased millet yield is associated with decreased peanut production and if so, whether this is a favourable outcome for farmers.

Link FMNR projects into the wealth of research on *F. albida* in Africa – in some parts of Africa farmers view this tree as a ‘miracle tree’ and there is no doubt as to its potential to restore the soil for improved crop yields – optimise tree density and management of this species this has been the topic of research in various institutions including ICRAF. Projects need to be informed by the results of this and other research on potentially useful tree species for Sahelian farming systems.

Target education partners – The SFLEI project has made an excellent start by working with local schools and teachers and Imams to promote the benefits of FMNR. Teachers and children, given appropriate support and incentives, can be effective actors in the struggle to change the way trees are valued on farms. Making teachers formal partners with a specified role in the project may be an option to explore. For example, they may be contracted to do additional FMNR outreach activities with children who are not in school.

Bring nomadic herders formally into the partnership – currently sedentary farmers try to ensure that the nomadic herders are informed about protected FMNR trees and areas. Finding a way to formalise their role in the protection of trees under the auspices of the project is worth exploring.

Advocate for a national approach endorsing and incentivising FMNR – e.g. using modern and traditional forms of outreach. Signage, advertising on radio and TV, newspaper, farmer visits, competitions and prizes, theatre. Advocate for development of bylaws to change the conditions around the rights to sale of pruned wood for FMNR farmers. Advocate for *Eaux et Forêt* for a major investment in FMNR given that they will take on the major role going forward.

Expand accompanying measures - Plan an expansion of accompanying measures that enabled women to use less firewood (e.g. improved stoves), earn more income to purchase

¹ F-MAFS was also developed by SIM in Niger, emphasising the use of hardy Australian acacias with edible, highly nutritious seeds for human consumption, rich leaves for fodder, as well as their wind-shielding, anti-erosive and nitrogen fixing and firewood providing properties.

firewood (e.g. small ruminant raising) and affordable technologies to replace wood as the major fuel source for cooking. Future project design and planning can be informed by experimentation in this SFLEI project.

Community based organisations - build more capacity at the level of community by organising community based organisations (CBOs) responsible for FMNR outreach, liaison with local partners and progress monitoring in each village location.

New learning approaches - among farmers and children, develop learning approaches that move beyond 'see and copy' into valuing and knowing how to research and conduct their own trials in agriculture. E.g. where to seek help and advice in the community, more widely in Senegal and in literature; and how to conduct and assess trials of new techniques or genetic stock without risking the farm.

Establish a community-located FMNR learning centre(s) - with Kaffrine now the lead location in Senegal for FMNR, it is appropriate to establish bases of experiential learning that bring in other farmers, officials and NGO staff from around Senegal and the wider West Africa and World Vision staff and participants from other ADPs. The facilities may be managed by local farming women and men, and lessons run by either or a combination of local community, WV and Waters and Forests Service. Such centres could form an additional stream of revenue generation into these communities. Exchange visits under an extension project may provide initial experience to learn how to refine the learning centre model.

Future research investment

Scale of change - How big must a FMNR/NRM project be? A change in mind-set that challenges conventional practices (such as promoting trees on crop-land) probably requires a certain 'economy of scale' in project size. Community-wide movements generate faster adoption of new ideas than isolated innovators, who, by definition, go against a community's accepted wisdom.

The point at which the uptake and practice of FMNR reaches a 'critical mass' and becomes entrenched in local farming systems would be a useful topic for additional farming systems studies. In addition a historical study of farmers in Niger describing how they overcame the problems and prejudices associated with FMNR such as those identified in the SFLEI project would be useful. Their stories would have real currency among farmers and extension staff in Senegal about the potential of FMNR.

Faith as an agent of change - The project heavily engaged with Muslim and Christian leaders in the project areas, to motivate them as important change agents in the community. Project monitoring documents suggest they became very active in raising their congregations' consciousness about the spiritual obligation to be stewards of God's gifts of Creation. The effect they had on catalysing farmer households' commitment to environmental management approaches was not explored in the evaluation but is well worth exploring.

Effects on staple crop production - Whilst the ISRA field trials demonstrated that FMNR fields in the project produced more millet per hectare than non-FMNR fields, this research did not quantify the multiple nutrient and moisture effects. These include a reduction soil moisture evaporation due to shade, contribution of organic matter from leaf and berry drop and from livestock manure and urine deposits. Agroforestry and Conservation Agriculture research in Africa has quantified the effects of trees in agriculture including for species such as *F. albida*. An in-depth literature search and a formal literature review on this subject will complement the field trials within WV projects and is warranted in 2012.

Lessons Learned from the Evaluation Process

Evaluation reporting – this was a well resourced evaluation with a budget that enabled the hire of good local consultants to support qualitative and quantitative data collection. However the majority of analysis and all reporting was done by WVA evaluation lead. Due to many competing work tasks and the time consuming nature of data coding and analysis – there was a long delay in publication of the report. In retrospect additional budget to engage a consultant for the analysis and reporting would have been preferable.

Depth and reporting - It is almost impossible to incorporate transparent credible evidence and fulfil all of the LEAP priority areas and keep a report short, accessible and useful. There is no question that evaluators need to be accountable for their work and findings and so there are no shortcuts. However, each of these in-depth studies **MUST** be accompanied by a short, high quality summary tailored to different audiences – research and academic, donor, supporter and programmers in NOs and in SOs. This needs to be available in English and French and in the local languages to ensure access by farmers, CBOs and FBOs.

Pictorial evidence - Sometimes the simplest forms of evidence have the most impact on a report audience. In the case of FMNR – digital photographs taken at baseline should be GPS tagged and kept in project records. This needs to be repeated annually with a short interview with the landholder recorded to find out what has happened to the field in the previous year.

Budget for mapping services and satellite images - For more formal evidence it may be possible in some cases to obtain high resolution satellite imagery for areas with and without FMNR in the project region, and in some cases there will be ways to interpret these images that show an increase in tree density over time, and to link this information with Geographical Information Systems that also contain cropping data. This will be expensive but could be minimised by strategic partnering with research and education institutions, and formally linking with those who do this work in the region such as Mr Gray Tappin who works for the US geological survey.

2 Introduction

World Vision Senegal ex-post evaluations carried out four years after transitioning out of Area Development Programs in the northern region showed that apart from the physical infrastructure (boreholes, buildings, etc.), there was little evidence of sustainable outcomes. The environment and natural resources had reached such an advanced stage of degradation that farming communities had moved away. A crucial learning from this experience was that the establishment of health, water and education infrastructure will not prevent temporary or permanent rural exodus in times of severe food and livelihood insecurity, and that community development interventions need to focus on arresting and reversing the degradation of natural resources and on increasing household income. The Senegal Food and Livelihood Enhancement project was designed with these lessons in mind - to contribute to environmentally and socially sustainable improvement in household income and food production.

In 2007 the SFLEI project commenced in Thiappy ADP in Fatick, Nguer and East Kaolack ADPs in Kaffrine and later in the Ndiognick ADP – which altogether have a total population of more than 104,299 inhabitants. The total project budget was US\$ 624 116 and it was implemented from 2007 to 2011.

The project goal was: *To contribute to sustainably increasing household revenue and production.*

Project outcome objectives included the following:

- Populations and local partners adopt and promote environment protection practices
- Households capacity to earn income and achieve food security is increased
- The project is well implemented and successfully managed

These outcomes were expected to be realised through the achievement of the following project outputs:

- Populations, lead farmers and children trained in environment protection activities
- Farmers access new agricultural income sources
- Sustainable FMNR projects set up in each ADP

The SFLEI project was managed during the first two years by the base manager and the final two years by a team of WVS ADP staff including a project coordinator, a driver and an accountant. The intention was that - once the project approach was proven to be successful - it would be integrated and supported as an ongoing ADP activity.

3 Evaluation purpose, objectives and KEQs

The evaluation purpose and objectives were developed during a facilitated workshop led by the SFLEI Project Manager and attended by 70 stakeholders including WVS staff, lead farmers from each ADP, students, community facilitators and animators, staff of government *Eaux et Forêt* and agriculture and livestock department and others. The result of this important activity was generation of about 50 questions. These were grouped into six domains; efficiency, partnership, sustainability, impact, participation and FMNR adoption².

² The evaluation Terms of Reference document will be provided as a separate document

As suggested in LEAP, evaluations should have one and only one purpose. Trying to evaluate multiple dimensions of a program such as effectiveness, efficiency, equity, impact, adoption etc – risks spreading evaluation resources too thinly. To do justice to any single one of these dimensions requires evaluators to set tight boundaries, use a specific design and methods and carry out data collection during one short period of fieldwork. For the evaluation of the SFLEI project - given the intention to expand the project model to other ADPs it was decided that the evaluation purpose would be to prioritise recommendations for the Beysatol, a project located in Kaffrine that includes promotion of FMNR and which is due to end FY12.

The statements of evaluation purpose and objectives outlined in the TOR and the many questions posed by key stakeholders during the inception activities were treated as learning needs and classed into groups. Each fell naturally into one of three results themes; project logic, partnerships and sustainability.

3.1 Project logic

Testing the project logic seeks evidence to determine whether the project model was robust – did promotion of environment protection activities, new agricultural income sources and FMNR projects contribute to more sustainable livelihoods and increased wellbeing of children and their families? KEQs that guided the evaluation of project logic included the following:

- Does improving environmental management and creating income generating opportunities lead to more food and livelihoods security and increased well being?
- To what extent have project outcomes contributed to raising community awareness, building capacity, positive practice change and improved social, economic and environmental conditions?
- What were the unanticipated consequences or outcomes?

3.2 Partnerships

In this report all project stakeholders (direct and indirect beneficiaries, local service providers, project and donors) are considered as partners. The short term and longer term success of SLFEI project depends on the existence of robust and effective partnerships. This part of the evaluation sought to explore the nature and quality of partnerships in terms of equity, capacity, mutuality, alignment and networking. KEQs that guided the evaluation of partnerships were:

- Does the project approach encompass partners' knowledge and participation in project design and implementation and effective feedback and communication?
- Has participation by partners translated into their taking responsibility for project activities and outcomes?
- Have all community partners, particularly the most vulnerable groups benefited in appropriate ways?
- Are local partners equipped with skills and information to maintain the momentum of positive after the project ends?

3.3 Sustainability

What is the likelihood that project social, economic and environmental benefits will continue in the future? To answer this questions requires consideration of evidence from many different aspects of the project including those described above (project logic and partnerships, and those outlines below this section, integration and cross cutting themes).

The focus for this section of the evaluation was to explore the extent to which local partners have taken on roles and responsibilities in the project and to explore the knowledge and attitude of the *farmers of the future* i.e. children in the project area. In addition, this section briefly reflects on how the project has responded to elements of sustainability outlined in the project design document (page 20). KEQs that guided the evaluation of this sustainability were:

- What evidence is there of transition of responsibility to local partners?
- What is the knowledge and attitude of future farmers – primary school children?
- To what extent have indicators of sustainability outlined in the project design been met? Sustainability outcomes outlined include:

4 Methodology

A mixed methods approach (i.e. quantitative and qualitative) was used. The analytical approach is known as the *Triangulation Design*. The purpose of data triangulation is to obtain different and complementary data around the same topic and to bring together the differing strengths and *non-overlapping* weaknesses of quantitative and qualitative methodologies.

Primary quantitative and qualitative data were collected during the evaluation fieldwork and secondary data was sourced in project documents. Quantitative data were collected from key informants from an appropriate sample of households in each of the four project ADPs. Qualitative data were collected from project, community government and other stakeholders in each ADP.

4.1 Quantitative methods - Household survey

The evaluation included a broadscale survey of 752 households from within the project ADPs. The draft survey tool was designed by the evaluation leader and was refined by the evaluation team over two days of collaborative work at the WVS national office in Dakar. A statistics consultant was appointed to modify the survey tool to suit use of CSPro for data entry, to manage data entry systems and processes and produce a summary analysis³. The type of survey was a paper based questionnaire (see Appendix 2) administered face to face by trained enumerators.

4.1.1 Sample size and selection for household survey

The sample size was calculation using the LEAP recommended formula and 95% confidence and 5% sampling error with a design effect and 50% prevalence to give the largest sample size.

Calculation of sample size

$$n = \frac{Z^2 (p)(q)}{d^2}$$

Where:

n = sample size

Z = statistical certainty, related to the error risk, equals 1.96 for an error risk of 5% (for a 95% Confidence interval)

p = estimated prevalence of indicator in the population, expressed as a fraction of 1 (where prevalence is unknown 50% is used to give the largest sample size)

q = (1-p), proportion of sample not presenting with that indicator, expressed as a fraction of 1

³ Statistician Amazou Kokou is based in Dakar and was contracted to assist with the survey work. The software used for data entry was CSPro - produced by the US Census bureau and is available as a free download from their website <http://www.census.gov/population/international/software/cspro/>

d = desired precision or margin of error (% sampling error), expressed as a fraction of 1 (5% sampling error is acceptable).

Therefore, the sample size is

$$n = \frac{1.962 (0.5*0.5)}{0.052}$$

$$= \frac{3.84 * 0.25}{0.0025}$$

$$n=384$$

For a 30 cluster multistage sampling approach the design effect is assumed to equal 2 – thus doubling the sample size calculated using the above formula.

Therefore, n=768

Sample selection used a 30 cluster multistage sampling technique. For a sample size of 768 households, this equates to 26 households per cluster (768/30). Sample size was proportional to population size in each ADP and the communities for the survey were systematically collected using a complete list of communities for each ADP. The sample interval was the total number of households divided by 30. Clusters were selected starting at a random number (last 3 digits of a USD\$20 note). Individual householder were selected by enumerators using starting at the midpoint of a village and spinning a pencil to indicate a direction, then surveying each household in a straight line in that direction, and continuing in this way until the number of households is reached. The final list is shown in Appendix 1. In five communities the total number of households was less than 26 and in these cases all households were surveyed and with no replacement. Therefore the final sample size was predicted to be about 740. The actual number of completed household surveys was 752 (Table 1).

Table 1 Representation of household survey relevant to population size

	Population	Number clusters	Total households @26hh/cluster	Proportion total population surveyed	Representation of the ADP population as a proportion of the total population*
Thiappy	1031	3	78	10%	8.5%
Thiappy zone 6	1468	3	78	10%	12%
Ndiognick	2809	7	182	23%	23%
Nguer	3856	10	260	33%	32%
East Kaolack	3025	7	182	23%	23%
	*12189	30	780		

4.1.2 Survey enumeration and data entry

The data collection was done by 40 trained women and men enumerators recruited by WV Senegal. Enumerator training was based in Kaffrine and led by the WVS DME specialist and the evaluation leader over three days (including pilot and revision of the tool). Enumerators were provided with a guide to each survey question written in French and with local translations (see Appendix 2).

Supervisors worked with teams of enumerators and were responsible for quality and for ensuring that protocol was followed - all questions were completed by every enumerator and all survey forms were submitted to the statistics consultant who oversaw a data entry teams in each of the ADPs. Data entry used CPro data input masks (Figure 1).

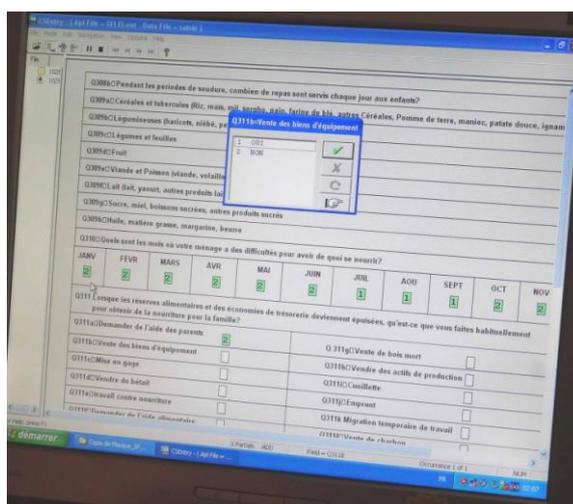


Figure 1 CSPro data input software

4.1.3 Survey data analyses

Calculation of descriptive statistics including proportions (categorical data) and averages (numerical data) from the cleaned set of survey data for all groups and for each ADP sub group was done by the statistics consultant using CSPro. These tables are shown in Appendix I. A full raw data set was exported to a Microsoft excel file and sent to the evaluation leader for further manipulation.

Crosstabs and bivariate analysis, interpretation and reporting was done by the evaluation leader including comparison of disaggregated data for male and female heads of household, project and non project participants, user and non users of FNMR and ADPs. Both MS excel and SPSS were used for this work.

4.2 Qualitative methods

Qualitative data collection included focus group discussion and interviews with key informants in the project area. A local consultant was appointed to train and coordinate qualitative data collection in the FGDs in liaison with the lead evaluator.

4.2.1 Focused group discussions

Focused group discussions were undertaken in the ADPs with groups of women farmers, men farmers and with primary school children. The selection of participants for the FGDS was guided by project staff. Facilitators for the FGDS were recruited from each ADP by the project staff and included personnel from partner agencies and tertiary qualified undergraduates. Questions and protocol for FGDs were developed by the evaluation team (see Appendix 3). The consultant facilitator adapted the question guides to French and local languages and facilitated a two day training workshop in Kaffrine with the evaluation leader and FGD facilitators. Each FGD team included four persons, two to facilitate and two to record notes. These were handwritten and then typed up in French, then translated into English and imported into Nvivo for coding by theme and KEQ.

4.2.2 Key informant interviews

Key informant interview guides were developed by the evaluation leader and further refined by the evaluation team (see Appendix 3). Key informants were selected for their significant role and insights into the project implementation and outcomes and this group included individual project staff and government partners, and groups of lead farmers from Thiappy and Ndiognick ADPs. Interviews with individuals were done in English and French and were recorded and later typed into English transcripts for coding. Interviews with farmers were done in local language and French with real time

translation to English – notes were recorded by hand and later typed up for coding. Coding for theme and KEQ was done using Nvivo.

4.2.3 Evaluation recommendations workshop

The purpose of the recommendations workshop at the close of fieldwork was to present the preliminary results of the evaluation to relevant stakeholders and to discuss and agree on the recommendations that would be incorporated into the evaluation. The workshop was held at Kaffrine base on 22nd June and was attended by ADP and project staff, and government partners such as Livestock and *Eaux et Foret* department. A PowerPoint presentation was given by the evaluation leader based on partial data entry for from the household survey and partial analysis of the qualitative data. Unfortunately there were no community partners present at this meeting which was an oversight in planning. To address this the Project Manager reported back to community in the following week describing the content of the preliminary findings to them.

4.3 Secondary data

Secondary data and contextual information were found in the SFLEI project design document, the baseline report done in 2008, the midterm review done in 2009 and from TDI reports for Nguer and East Kaolack ADPs done in 2007 and 2006 respectively. Data and information were also available for a field study done at ISRA and from the work done on other FMNR projects.

4.4 Ethics

The tools, treatment and storage of data, analysis and subsequent reporting were guided by ethical principles and behaviour to ensure adherence to the principle of **do no harm** to participants or project stakeholders. Principles were discussed by the evaluation team and during training with enumerators and facilitators. A guide for verbal informed consent was provided for household surveys and for FGDs. FGDs done with children included collection of drawings and all names used were pseudonyms. All representatives of WV (including consultants, volunteers, and partners involved in the evaluation work) complied with WVS's child protection policy.

4.5 Cross cutting themes

The SFLEI project design document elaborates on two of the six cross cutting themes – gender and environment. These were given special focus in this evaluation. Feedback is also provided for disability in Section 5.1.2 and for disability, protection and peace building in Section 5.5.

4.6 Child well-being outcomes

Indicators of child well being that were measured and reported in this evaluation include school enrolment (Section 5.1.1) and aspects of food security such as number meals and variety foods served to children (Section 5.1.8).

4.7 Sustainability

LEAP requires all end of project evaluations include a study of sustainability as it relates to the sustainability table in the project design document. The design document did not include this table but outlined some of the aspects that would indicate sustainable outcomes. These are explored in Section 5.5.

4.8 Limitations

The evaluation was very well organised and managed by WVS staff, and experienced no serious limitations other than those normally faced in evaluation of development programs ⁴. One limitation in this evaluation – which again is a common problem – was the lack of quality in the data from FGDs. Successful use of FGDs is a known challenge area for development program evaluations due to the fact that most facilitators available for this work have little understanding of social research methods and the intentions of the use of the method. For the SFLEI evaluation, with this in mind, two days was expended on training and it included exploration of the basic theories underlying qualitative approaches and practical sessions on interviewing, listening and recording skills. For the actual fieldwork the FGD facilitators worked in teams of four and were given the scope to develop their own approaches to collecting the desired information. However, with some exceptions, the feedback recorded by the facilitators was not of sufficient quality for in-depth qualitative analysis.

Project monitoring reports indicate that the imams and pastors of local religious congregations in the project area played a significant role in raising the population's appreciation and optimism for restoring the environment. With the limited time available, this evaluation did not include measurement of the impact on objectives of engagement with religious leaders and personal faith. The absence of discussion in this report does not imply a lack of importance of this dynamic, and recommends its inclusion in future evaluations.

4.9 Fieldwork schedule

Activity	Location	Time period	Number days
Planning, meeting WVS staff and consultants, other key persons	Dakar	Monday 6th and Tuesday 7th June	2
Travel to Kaffrine	Kaffrine	Wednesday 8th June	1
Planning and enumerator training and pilot of survey tools.	Kaffrine	Thurs 9th June, Friday 10th June and Saturday 11th June	3
Qualitative training		Monday 13th to Tuesday 14th	2
Survey data collection	Kaffrine	Monday 13th to Monday 20th June	6-8 days
Collection qualitative data		Wednesday 15th to Monday 20th	6 days
Survey data entry	Kaffrine	Starting Wed 15th June	10 days
Return to Dakar (Tony)		Friday 17th June	1 day
Preliminary analysis	Kaffrine	Tuesday 21st June	10 days
Recommendations workshop	Kaffrine	Wednesday 22nd June	1 day
Return to Dakar (Carolyn)		Thursday 23rd June	1 day

5 Findings

Findings from the SFLEI evaluation are presented in four major sections as follows:

⁴ There are a number of constraints that are always present for project evaluation in development setting and these were worked around as much as possible. Such constraints include language translation and interpretation barriers, potential for response bias, lack of experience of enumerators and facilitators, short time frames for testing tools and for training data collectors, the necessity to undertake quantitative and qualitative data collection simultaneously rather than in stages so that the results of one can inform the other.

- Description of the context of communities and farming systems (section 5.1)
- Evaluation findings on project logic (section 5.2)
- Evaluation findings on partnerships (section 5.4)
- Evaluation findings on sustainability (section 5.5)

5.1 Communities and farming systems

The baseline survey for SFLEI covered 560 household in the ADPs of Thiappy, East Kaolack and Nguer. The end of project evaluation covered 752 households in these ADPs and in the additional ADP of Ndiognick which was brought into the SFLEI project after the baseline. Proportional representation of ADPs in the baseline and end of project evaluation is shown in Table 2.

Table 2 Sample size in ADPs and representation in total sample size

ADP	Baseline (2008) N=560	Eop evaluation (2011) N=752
Thiappy	29%	34%
East Kaolack	24%	18%
Nguer	47%	28%
Ndiognick	NA	20%
Total	100%	100%

The total number of households surveyed at the end of project evaluation was 752 and the average age of head of household respondents was 51 years. There was a range of 73 years with the youngest head of household aged 18 and the oldest 91 years.

Ave. age (years)	SD	Lower bound	Upper bound
50.9	15.3	49.8	52.0

In the household survey age, gender and number of each occupant in each household was recorded and the total population size for the 752 surveyed households was 11,313.

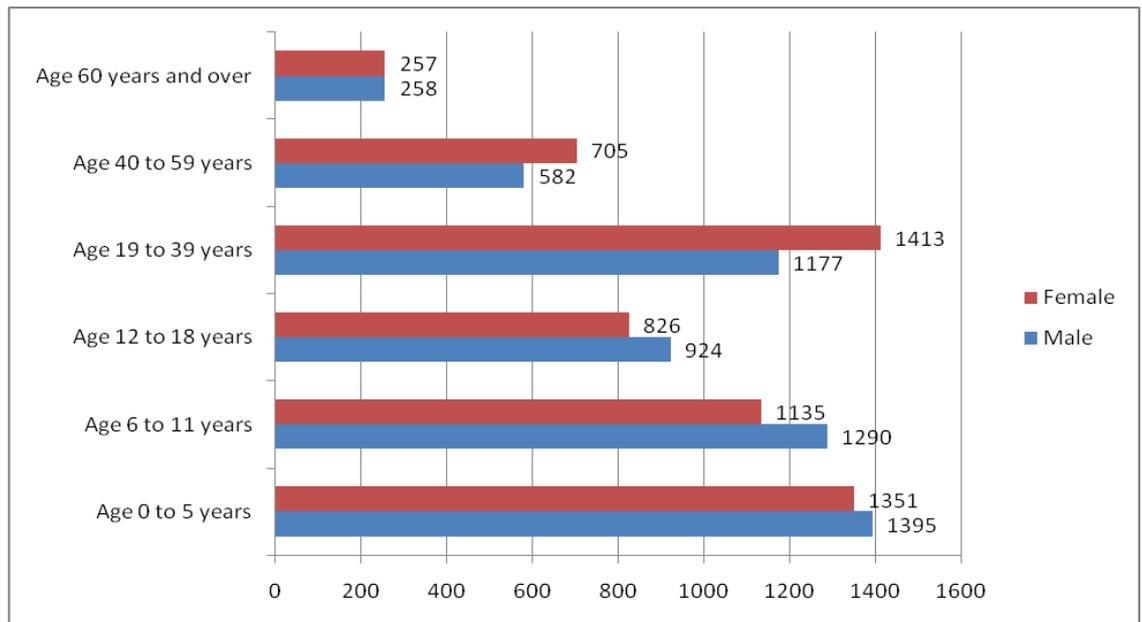


Figure 2 Total representation by age and gender in surveyed households

The population in the SFLEI project area is young - 61% (6921) is aged from zero to 18 years (Figure 3).

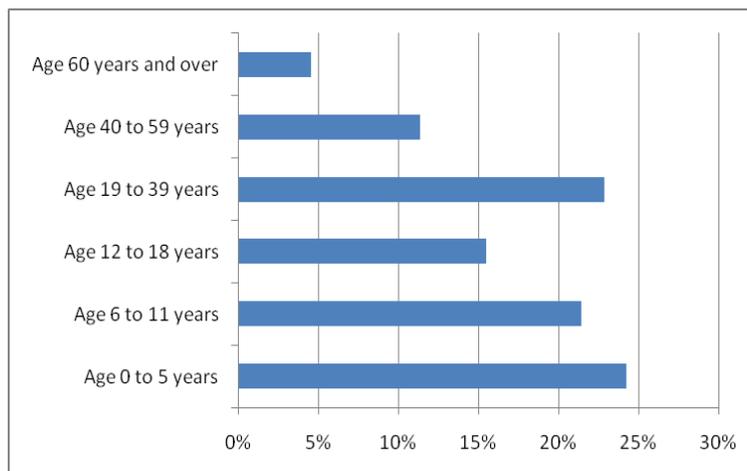


Figure 3 Distribution by age groups of population in project area

The gender of the head of the households surveyed was predominantly male (92%) which reflects the social conditions in the project region – women headed households are relatively rare. The ratio of male to female head of households was not available in the baseline study but results of TDI surveys in 2006 noted a very small proportion (0.5%) of female headed households in East Kaolack while in Nguer the proportion was 12%. According to one TDI report the low prevalence of female headed households is a reflection of ‘relative stability of households in the area’ given that the only reason women were left to head the family alone was due to divorce, widowhood or immigration by the husband (E.Kaolack TDI report, page 20).

According to the WVA project database the total number of direct project beneficiaries was 3300 men, women and children and the indirection beneficiary population size was 15500⁵. According to the records provided by project staff in June 2011, the number of households in the project ADPs totalled approximately 14400 and the average number of occupants was about 10 persons per household⁶. The average number of occupants per household according to age and gender groups is shown in Figure 4.

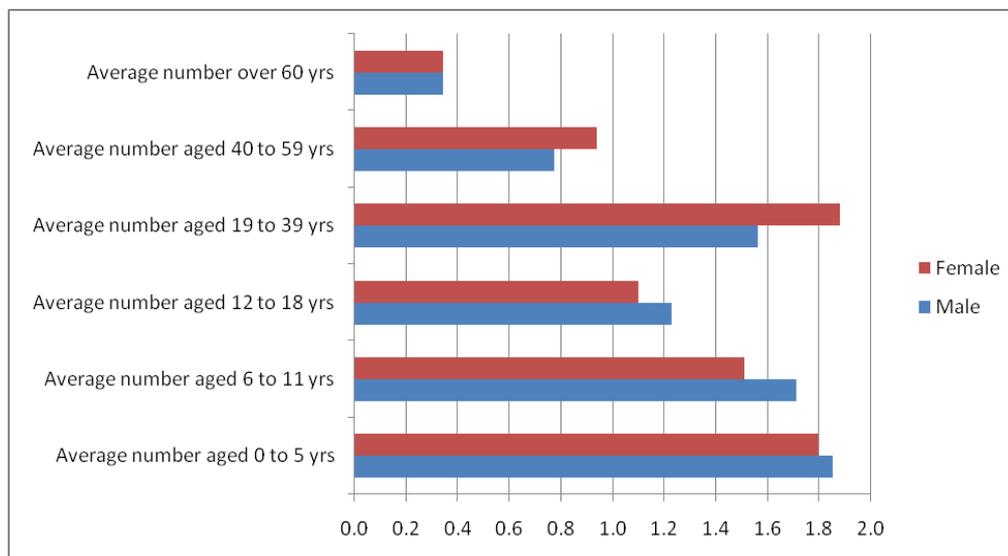


Figure 4 Average number of occupants per household by age and gender

When TDI surveys were done in East Kaolack and Nguer 3-4 years ago, the average number of occupants per household was 12.5 and 10.7 respectively. In the end of project survey the average family size across the 4 projects ADPs is approximately 15 persons and ranges from 2 to over 90 persons belonging to a single household.

	Ave	SD	Upper bound	Lower bound
Average persons per household (N=751)	15.1	9.2	14.4	15.7

Average family size ranged in the different ADPs from 13 to 18 persons with Nguer tending to having smaller family sizes and E. Kaolack tending to have larger family sizes (Figure 5).

⁵ Presumably the project records are referring to the number of households rather than the number of individuals

⁶ Based on data provided for calculation of sample size and selection - average number occupants per household in Thiappy (13.2), Ndiognick (8.0) and Nguer (8.4) only

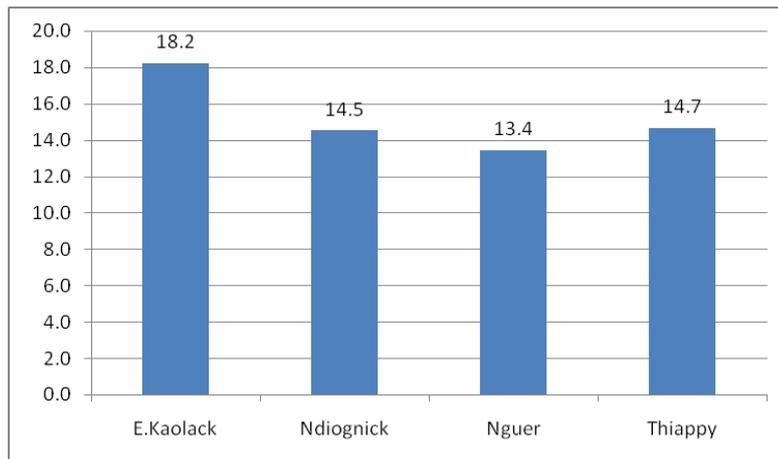


Figure 5 Average family size in project ADPs

East Kaolack has the highest average number of occupants per household at 18 and this is a large increase in family size compared to the data from the TDI survey. This is important to note because pressure on resources rises as family size increases while access to agricultural land and other assets does not.

The major ethnic groups present in the project area are Wolof (53%), Sérere (31%) and Peulh (9%). (Figure 6).

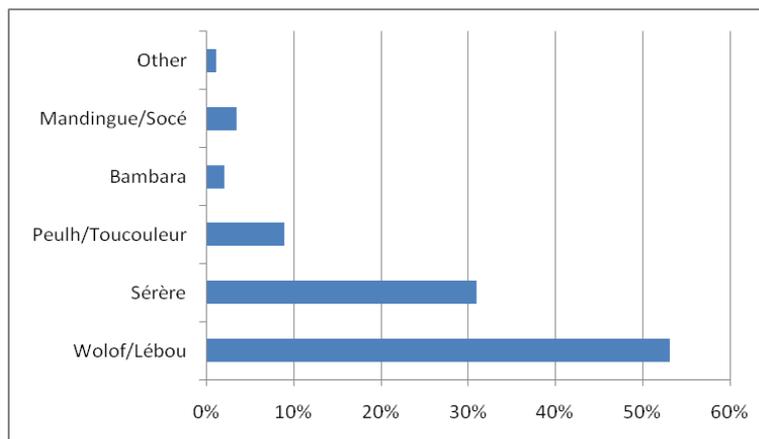


Figure 6 Representation of major ethnic groups in SEFLEI project area

Education characteristics of heads of households in the project area reflect the dominance of the Islamic faith – 57% of the whole survey group were literate in Arabic while about 28% were recorded as illiterate. When data are disaggregated by gender there are stark differences in levels of literacy between women and men, with just over 50% of women recorded as illiterate compared with 26% of men, and three times higher rate of literacy in Arabic among men compared with women (Figure 7). This has implications for achieving gender equity given that participation in project activities and selection for leadership roles often favour those who can read and write. Gender is further discussed in Section 5.5.6.

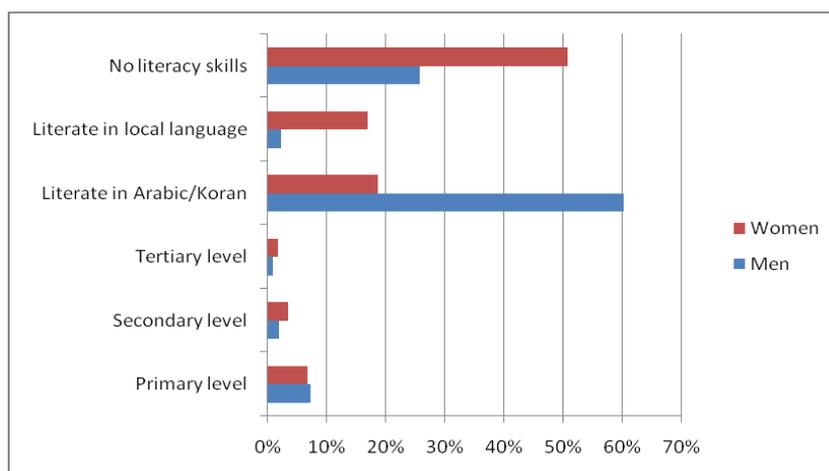


Figure 7 Literacy and education of women compared with men heads of household

When education levels are compared between the ADPs the pattern for Nguer, Ndiognick and East Kaolack are similar with all having 20% or less population with no literacy skills. The level of literacy in Thiappy is much lower, with 50% of respondents indicating that the head of the household was not literate.

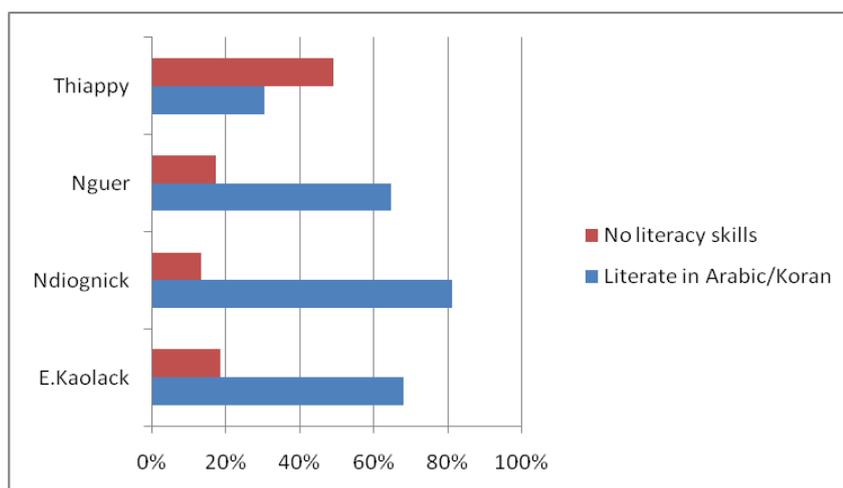


Figure 8 Literacy levels in project ADPs

The levels of participation in training in areas relevant to the project is discussed in Section 5.1.4.

5.1.1 Child wellbeing – school attendance for primary and secondary school aged children

The 2010 gross enrolment rate for primary schools in Senegal is reported to be 84%, but World Bank group indicators show a primary school attendance rate of 58% (58% for male and 59% for female) and a completion rate of 57% of the enrolled students by 2009⁷. Fewer children go on to secondary school. A major factor in the low attendance rates to primary and secondary school in Senegal is the importance of the Islamic faith and prevalence of religious schools. Particularly in rural

⁷ Source: World Development Indicators database 2010, The World Bank Group

<http://data.worldbank.org/indicator/>

areas, knowledge of the Koran and literacy in Arabic are viewed as more important than participation in mainstream education.

The proportion of children who were attending school was explored in the household survey based on the total number of children present in all households who were attending school as a proportion of the total number of school age children present in the surveyed households. It would seem that school attendance in the project area is similar to the national school attendance rate for Senegal. From the household survey there was a total of 3842 children aged 6-18 years and of these, 1928 were enrolled in school – an overall attendance rate of 51%. The rate for primary school children only (aged 6-12 years) was 53% and for youth in secondary school was 42%.

Rates of enrolment vary widely between the different ADPs with stronger enrolment rates for Thiappy and weaker levels of enrolment in E.Kaolack especially for secondary school age children (Figure 9). The proportion of high school age children enrolled in Thiappy is higher than that for primary school which would not be expected. Local factors such as high outmigration of youth from households may partly account for this.

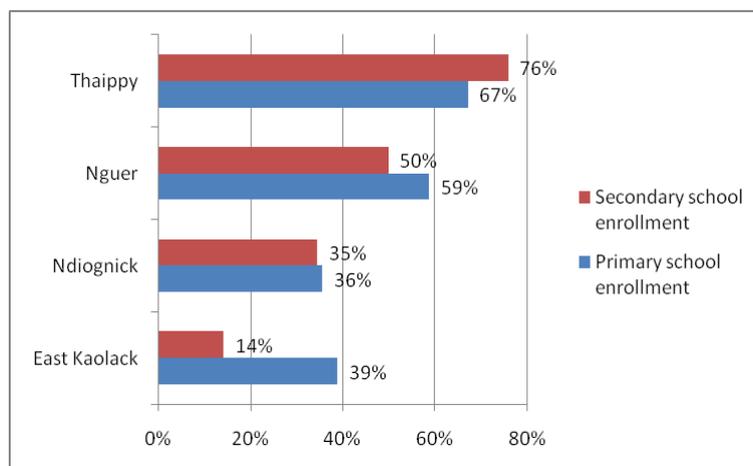


Figure 9 Enrolment rates in primary and secondary school

In East Kaolack TDI survey carried out in 2006, it was found that the enrolment rate for children aged 6-11 years was approximately 13% and for 12-17 year olds approximately 11%. Today the level of enrolment for primary school is three times higher at 40% which is a remarkable improvement. The rates of enrolment for Nguer in the 2007 TDI report were 42% for 6-11 year olds and 41% for 12 to 17 year olds. Today almost 60% of primary school age children and 50% of secondary school age children go to school which represents a significant improvement.

When TDI values are compared with those in 2011 it is evident that since there has been considerable improvement in access to primary schools and parents' ability and/or desire to enrol children in primary school. There has been less improvement for secondary school enrolment rates.

When the numbers of children of school age present per household and the number attending school per household are averaged across the whole survey group, on average there are 1.72 boys present and 0.95 attending primary school (ave. proportion boys enrolled per household 55%). For girls the average number present per household is 1.51 and 0.99 are enrolled in primary school (ave. proportion girls enrolled per household is 66%). For secondary school age boys there are 1.23 present per household and an average of 0.35 enrolled (ave. proportion enrolled is 28%) and for secondary school age girls there is an average of 1.10 girls present and an average of 0.27 enrolled (ave. proportion enrolled is 25%). These patterns reflect those in the project area where enrolment rates for girls is higher than boys in primary school and enrolment rates for boys is higher than for girls in secondary school.

When the proportion of households where one more children were present who were not going to primary school was compared between ADPs the problem seemed more prevalent in Ndiognick and East Kaolack than in the other ADPs (Figure 10).

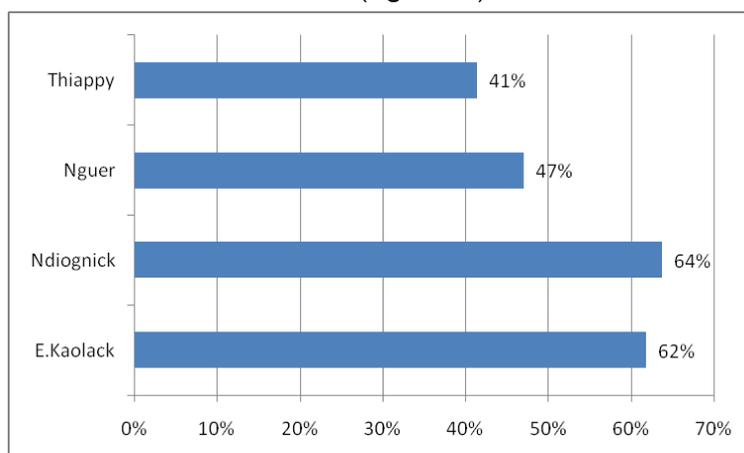


Figure 10 Proportion surveyed household where one or more children were not attending primary school

5.1.2 Children with a disability

Overall 14% of respondents said there was one or more children in the household who had a disability, but this varied quite a bit between the different ADPs – with Ndiognick skewing the average upwards. East Kaolack, Nguer and Thiappy recorded approximately 10% households where a child with a disability was present, while in Ndiognick the value was 3 times higher at 30%.

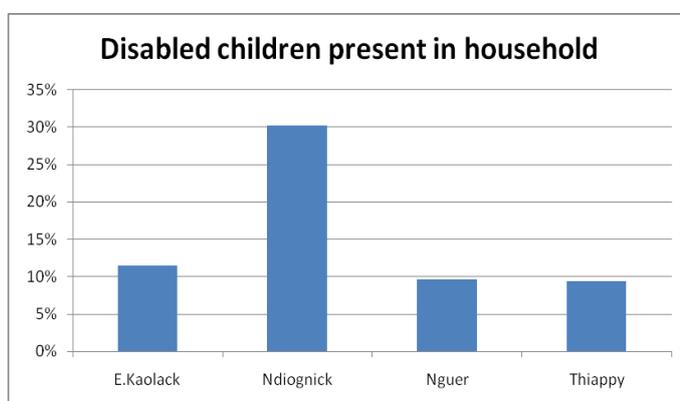


Figure 11 Proportion households with children with a disability

The unexpected result for Ndiognick may be an artefact of the survey question delivery in this ADP – or may be the reality. This should be verified by the ADP staff and if found to be true, there needs to be follow up with local disability support services. Disability is one of WVs cross cutting themes and is discussed further in section 5.5.7.

5.1.3 Occupation of head of household

The 2011 end of project evaluation explored the main occupation of the head of the households surveyed and comparing the results with the baseline survey, it would seem there has been a reduction in the proportion of respondents who practiced agriculture plus another income generating activity (Table 3).

Table 3 Livelihoods of households in the project area

	2008 Baseline	2011 End of project evaluation
Agriculture only	28%	53%
Agriculture and another activity	70%	41%
Non agricultural livelihood	2%	5%
Livestock raising only	NA	1%
Total	100%	100%

Given that the project aimed to increase income generating activities it could have been expected that more families would have diversified incomes during the lifetime of the project. However the data are difficult to interpret because the baseline year 2008 was a strong drought year in Senegal, during which, significant volumes of food aid were mobilised in rural areas. It may be that households who rely primarily on farming were forced to find supplementary income due to heavy crop losses at this time. Diversification of production reduces vulnerability by spreading risk. But a contraction away from non-farm incomes may indicate a greater confidence in farming to deliver adequate income.

The survey data suggest a significant decline in the proportion of families who have diversified, but this sample includes project and non project participants. When project participants and non-participants are compared, 60% of project participants compared with 38% of non project households have diversified incomes – which suggests that the project has had a positive effect.

5.1.4 Levels of agriculture and forestry related training in households

In the project area, which has a long history of deforestation and soil degradation and the associate food shortages, it is likely that farmer training has been offered by government and non government agencies. Respondents were asked if the head of the household had participated in such training and overall the participation rates were between 10 to 20%. The only exception was FMNR training where about 25% heads of households had done training – and this is a direct outcome of the project. Lead farmers trained through the project had an obligation to train other farmers.

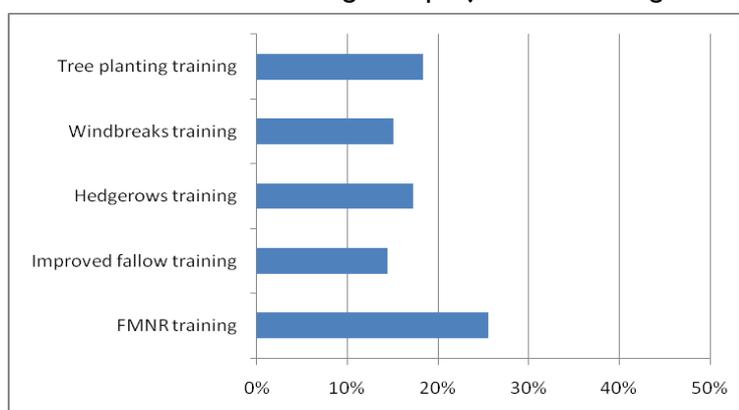


Figure 12 Participation in training types by head of household

5.1.5 Access to agricultural land

In the household survey tool land areas were recorded in either hectares or corde – for analysis in this report only the values recorded in hectares were included used in calculations. The average areas of agricultural land available to households in the different ADPs was approximately 12ha in East Kaolack, 11ha in Ndiognick, 11ha in Nguer and 15ha in Thiappy (Table 4).

Table 4 Average agricultural land area available to households in the SFLEI ADPs

	Ave. area (ha)	Upper bound	Lower bound
E.Kaolack	11.9	13.6	10.2
Ndiognick	10.8	12.9	8.7
Nguer	11.0	14.3	7.8
Thiappy	14.8	19.3	10.4

Almost all households (94%) owned some agricultural land and the average area owned by this group was 10 hectares (8.3 to 11.7, 95%CI). When access to borrowed and leased land was included 96% (706) households had access to land and the average area available was 12 hectares (10.6 to 14.2, 95%CI). However land areas available to households ranged from a minimum of 0.2ha to a maximum of 400ha (SD=24.4 ha). The pattern of distribution by size groups is shown in Figure 13.

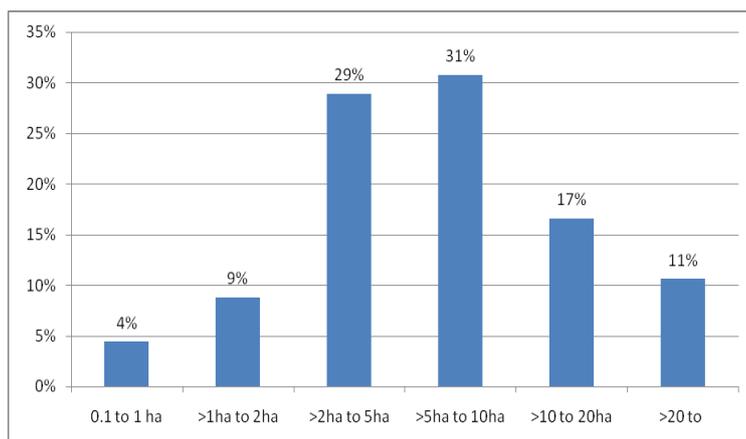


Figure 13 Distribution of access to agricultural land sizes in project area

While the average area of land available was 12 hectares, 42% of surveyed households have access to 5 or less hectares. However, compared with farm sizes in other areas of the Sahel, farmers in the Kaffrine region are not overly constrained by access to adequate areas of farm land. According to the survey data the average number of persons per hectare of agricultural land was 3.5 but the majority of households had 1-2 persons per hectare (Figure 14).

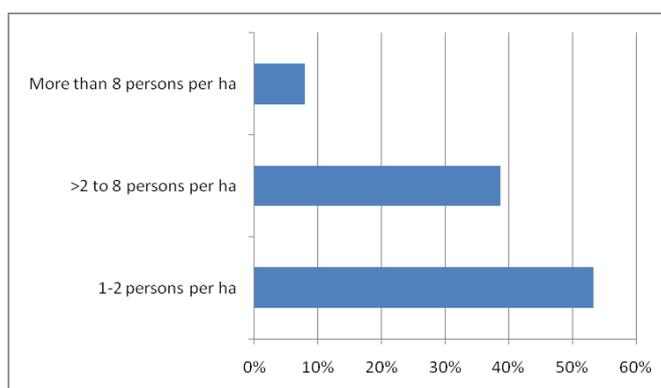


Figure 14 Persons per area agricultural land

The availability of these areas of agricultural land to project communities means there is much scope to develop integrated crop, livestock and agroforestry farming systems and low risk of displacing cropping to increase timber and fuel wood tree density – important prerequisites for the success of this project approach in raising production beyond subsistence levels.

5.1.6 Women's access to land

According to results of the household survey only 51% of all adult women had access to their own farm plot; so a significant number of adult women are not able to grow their own crops in Kaffrine region. Advocating for women to get access to land was one of the key strategies of the SFLEI project. There is a need for this advocacy to continue in order for all women have access to their own parcels.

When land areas available to women headed households were compared with the areas available to male headed households, both groups had access to an average of about 12 hectares but there was a tendency towards much higher variation for women.

	Ave. area (ha)	Upper bound	Lower bound
Men (N=661)	12.2	14.1	10.3
Women (N=56)	12.2	17.2	7.1

5.1.7 Crop production

Exploration of crop type production patterns at baseline showed that millet and peanuts were the most important crops in local food and economic systems. This pattern has not changed except that the proportion of farmers growing peanuts has increased from 81% to 93% of households between 2008 and 2011 (Table 5).

Table 5 Crop types cultivated in the project area

	2008	2011
Millet cultivated by households	99%	99%
Peanut cultivated by households	81%	93%
Beans	42%	26%
Maize	41%	42%
Sorghum	24.5%	19%
Sesame	6%	2%
Watermelon	16%	4%
Hibiscus	12%	9%

The values in Table 5 suggest a downward trend in proportion of farmers producing other crop types especially beans, watermelon and sesame. However the numbers are too small to make any reliable judgement about the trend.

The values in Table 6 show that the proportion of households that grow millet for household consumption only has increased from 77% to 86%. In 2008 13% respondents said they produced millet for sale only while in 2011 no respondents did this with millet. Peanuts are the most important cash crop with 63% of respondents growing this crop for both sale and household consumption.

Table 6 Uses of millet and peanuts in the project area

	2008	2011
Millet produced for household consumption only	77%	86%
Millet produced for sale only	13%	0%
Millet produced for both sale and household consumption	10%	14%
Peanut produced for household consumption only	<i>Not measured</i>	26%
Peanut produced for sale only	<i>Not measured</i>	11%
Peanut produced for both sale and household consumption	<i>Not measured</i>	63%

Crop yields in small holder and subsistence farming systems are notoriously difficult to measure using a household survey tool which relies on respondent recall of volumes of crop harvested in the past seasons or in an 'average season'. However, these recalled values are indicative of the situation and do help to reveal patterns of farmer success and vulnerability in the surveyed areas, and can be useful

to help compare between different groups. Other aspects of cropping such as inputs applied and sowing methods can also be useful to explore.

The most important crops in the project area are millet, peanut, maize and beans and the average number of kilos per household produced annually by all survey respondents and for male and female headed households separately is show in Figure 15.

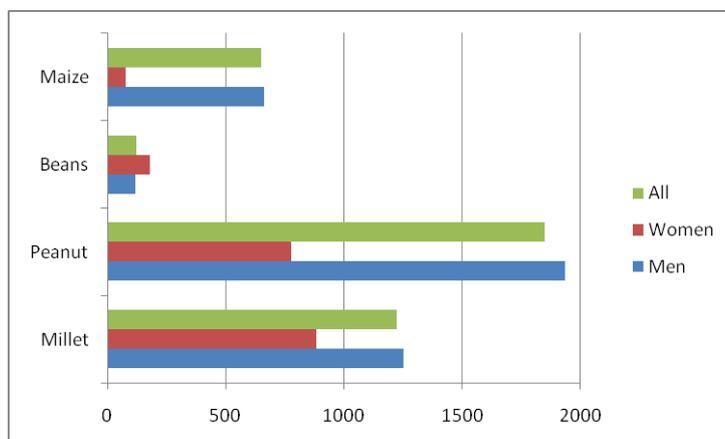


Figure 15 Crop production levels in project area

The average crop production for the three major crop types was higher for male headed households especially for peanuts. Given that average area available for women heads of household was similar to that of men (the average was about 10 hectares for both), it would seem that there is more intensive crop production in male headed households. This is likely the outcome of larger family size in male headed households - where average family size is 15 persons compared to 10.5 for women.

Larger family size increases food needs but also increases labour availability for cropping. Food stress in male households did seem higher, with an average of 2.5 meals compared with 2.9 meals usually served to adults on a daily basis and (difference significant $P = <.001$).

When the same crop yield data were compared between the different ADPs there were marked differences for households in different ADPs (Figure 16).

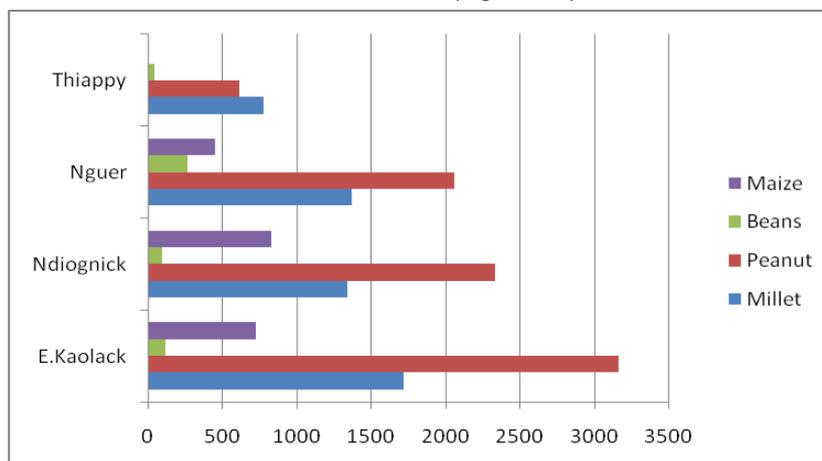


Figure 16 Average crop production (kg/ha) in the project ADPs

The average annual household production of millet and peanut is highest in East Kaolack. However, when divided by land area available to the household, the difference only relates to larger field size, not greater productivity per hectare. Also when the millet and peanut production is divided by the number of persons per household, the values for E.Kaolack do not stand out. Millet production in Thiappy is highest both for kg per hectare farmland and kg per person (Table 7).

Table 7 Millet and peanut production by land area and persons per household

	Kg millet per ha	Kg millet per person	Kg peanut per ha	Kg peanut per person
E.Kaolack	291	97	326	154
Ndiognick	159	96	282	170
Nguer	265	123	316	162
Thiappy	437	131	323	98

When average total kg crops grown annually was compared for respondents who use FMNR and those who don't, the annual average production of millet was slightly higher in FMNR respondent group but the difference was not significant. Production of peanuts was higher in the group who didn't use FMNR and this difference was significant at the 95% level (Figure 17).

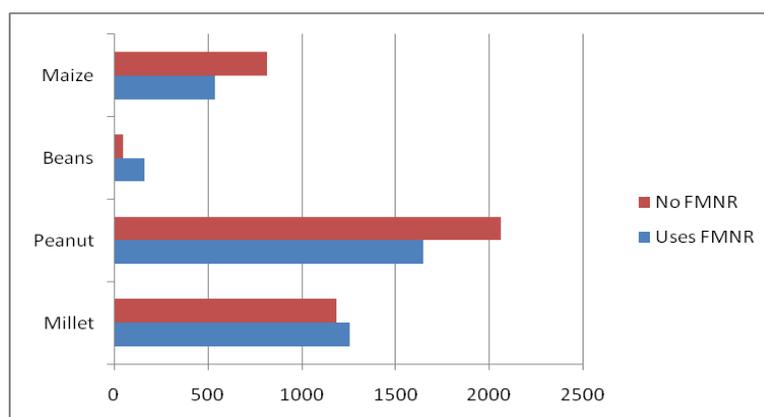


Figure 17 Average total crops produced for FMNR and non FMRN households

When the total kilograms of millet grown per hectare of land accessed in each group was compared, the FMNR group produced 238kg/ha while the non FMNR group produced 194kg and this difference was small but significant at the 95% level.

When millet production was compared on average kg per capita basis the values were 99kg and 79kg for the FMNR users and non users respectively, but the difference was not significant. However, on balance it would seem that whether due to the effects of the trees on fields and potentially other changes associated with involvement with the project, FMNR has good outcomes for the most important staple food crop, millet. This is consistent with the findings of ISRA where field trials with FMNR demonstrate very positive impact on crop yields. The study, conducted during the 2011 season, found that FMNR had a very significant effect in improving the weight of millet heads, number of millet heads per hectare and overall quantity of millet produced per hectare, as demonstrated in Figure 18 and Figure 19.

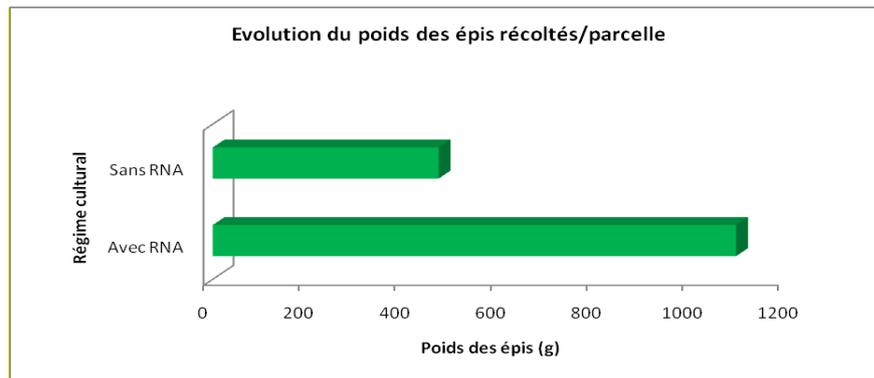


Figure 18 Average weight of millet heads with and without FMNR⁸

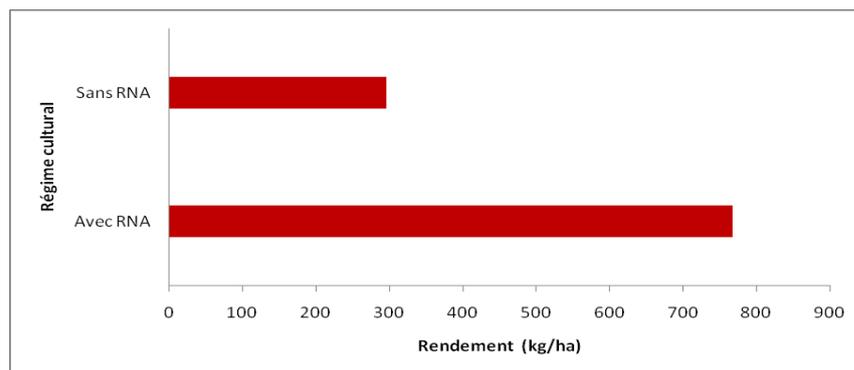


Figure 19 Average harvest of millet grains per hectare harvested with and without FMNR⁹

On balance it would seem that whether due to the effects of the trees on fields and potentially other changes associated with involvement with the project, FMNR has good outcomes for the most important staple food crop, millet. However, data for peanut production suggesting lower average production on FMNR farms is an area for further research.

The qualitative component of the evaluation explored the perceived effect of the practice of FMNR on crop production and found that key informants did not highlight this aspect. In short, opinions were primarily positive. Responses revolved around the role of trees in stabilising the soil and limiting effects of wind on soil and manure losses, which leads to improved crop outcomes and a reduction in months of hunger.

Facilitator: Are there better crop yields?

Respondent: We cannot measure the difference but the soil is more stable so the crops are now getting to grow rather than being blown away. The wind also blows away manure – it can all end up on someone else's farm. [Kongheul farmers]

Reported challenges with FMNR were around an initial reduction of available firewood when regrowth is first protected and not yet matured; the time it takes for trees to grow, and the fact that FMNR does not produce food trees unless accompanied by supplementary tree plantings.

⁸ Ndour B, Sarr A, Mbaye A, Projets Beysatol/SFLEI: *Rapport d'Activités, Institut Senegalais de Recherche Agricoles*, Decembre 2010, p.14

⁹ Ndour B, Sarr A, Mbaye A, Projets Beysatol/SFLEI: *Rapport d'Activités, Institut Senegalais de Recherche Agricoles*, Decembre 2010, p.15

At this stage further research by ISRA on impact of FMNR on local farming systems would be very useful. In particular a study of all aspects of crop management by farmers who use FMNR compared with those who don't is needed in addition to yield trials.

5.1.8 Food security

In the project area – a combination of climate, rainfall, soils and farming practices and scarce natural resources leads to annual periodic episodes of food shortage – known as the hungry season – when the majority of families struggle to obtain adequate nourishment. The hungry season in Kaffrine strikes in the wet seasons, July to September, which is also the crop growing season. Food shortages usually ease in October with harvest of early maturing food types and by November most families have harvested and stored grains which usually last until towards the end of May. The proportion of surveyed households who experience food shortages during each month of the year is shown in Figure 20.

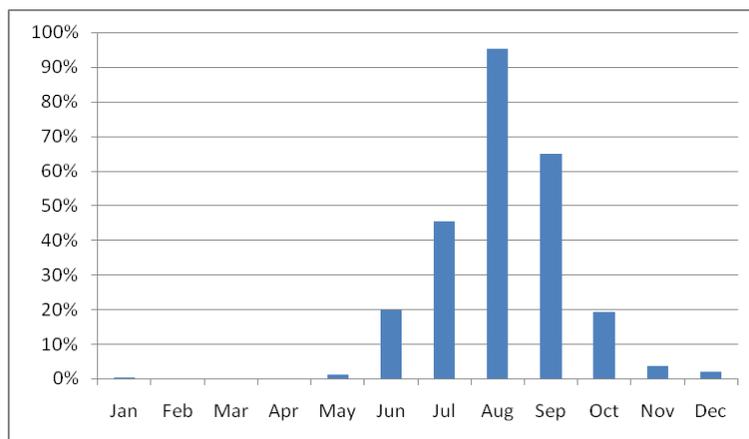


Figure 20 Distribution of food shortage months in SFLEI project area

When the baseline was done in 2008 respondents were asked for how many months their harvested crops lasted and 7 out of 10 said they lasted for only about six months. In the 2011 survey the total number of months of food shortage for each household was calculated and the values were compared with those at the baseline (Figure 21)

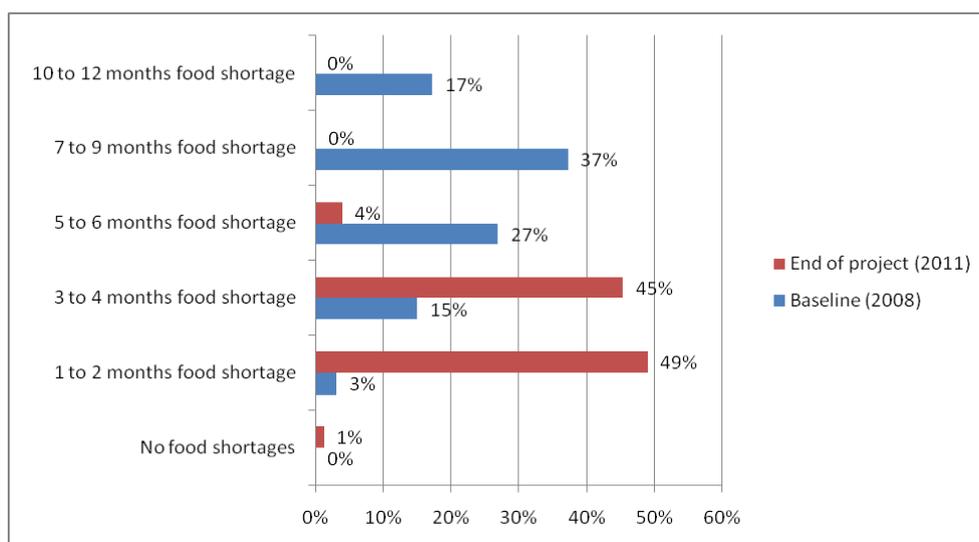


Figure 21 Pattern of months food shortage in the project area in 2008 and 2011

Source: Baseline values Figure 4, page 15 SFLEI baseline report 2008

As can be seen in Figure 21 the food shortage situation in 2011 seems to have markedly improved compared to 2008. No families endured seven or more months food shortage in 2011 survey, compared with 53% of the surveyed group in 2008. The extent and duration of the hungry period is largely dictated by the rainfall pattern during the growing season of the previous year. The baseline year of 2008 was a particularly difficult year in Senegal, climatically. So it is likely that a major part of the reduction in hunger months is a factor of short term weather variation. Still, the 2011 survey asked about the *months they usually had trouble getting enough food to eat* so their responses should have been general and not just related to 2010.

During FGDs in community participants were asked about the effects of FMNR on food security. Responses varied from group to group and from person to person. For example the following was recorded in a FGD with men:

Respondent 1: We found that FMNR has created prosperity in the village.

Respondent 2: I am in the FMNR for two years and I have improved my [crop] performance.

Respondent 3: I'm not in the FMNR, but I plant trees. But to increase significantly the yields [using trees]... takes years.

Respondent 4: The impact of FMNR towards food security is not very significant...It would be better to diversify the tree population through the introduction of other species such as mango...and cashew.

So while there was agreement that FMNR does increase crop yield some farmers felt it took too long, one thought impact on food security was not significant and that the trees promoted should include food trees. In a FGD with a group of women there was more optimism regarding the potential of FMNR to increase food security. When asked about the effect of FMNR on food security they gave the following responses:

Respondent 1: Improving the diet (consumption of fruit picked from the wild)

Respondent 2: Improved economic conditions (selling the fruits of harvest)

Respondent 3: Increased yields of millet and household incomes.

Respondent 4: The improvement of living conditions, due to the consumption and marketing of fruit picked from the wild (Baobab, jujube, tamarind, ALOM, and Soumipi Dimba).

Respondent 5: Yes, there is plenty of opportunity to feed the family and maintain children with higher yields and harvests. So we can say that there is an improvement...

One male respondent in an FGD explained that while food shortages still occurred, the situation had improved since before the project started.

Cereal production has actually increased, but the lack of land and [increasing] family size are the problem. However, we can provide cereal stock for an additional two to three months compared to before. [FGD men]

This view was supported by a female respondent in another FGD, who said that the hungry season had shortened.

The increase in production helped shorten the lean period...We note two to three more months of coverage compared to the situation prior to FMNR. [FGD Women]

To further explore food security in the household survey all respondents were asked about the number of meals and the types of foods consumed, and about the number of meals usually served to children and adults in times of adequate food supply and during times of food shortage. There wasn't much difference between the two periods - Figure 22 shows the food type responses for food shortage period and for periods of normal food supply.

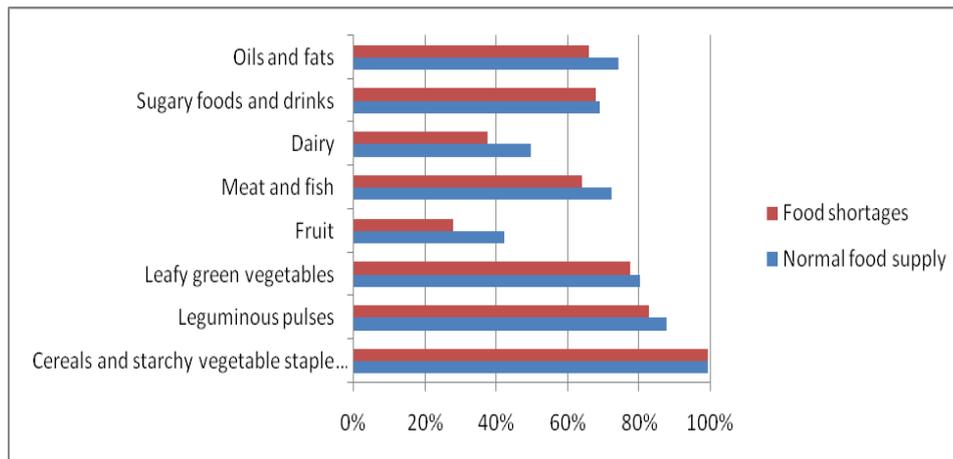


Figure 22 Food types consumed during food shortages

What the data do show is that only cereals, legumes and leafy vegetables are consumed by 70% households during both lean and good times which means that the quality of diet in terms of protein and vitamin and mineral content is poor in most households. Also the incidence of iron and protein deficiency would be high in the 30% households where meat is not consumed.

The average number of meals served to children was about three and this is a good number – although four to five small meals per day is recommended for infants. For adults the pattern is towards consumption of only two main meals per day. When the average number of meals consumed for adults and children was compared for lean and good food supply periods there was little difference (Figure 23).

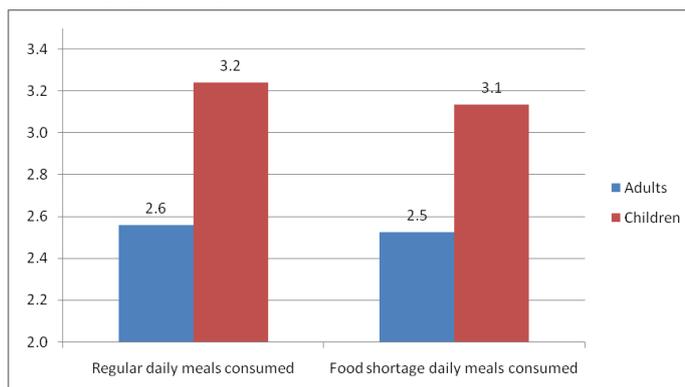


Figure 23 Average number meals consumed daily by children and adults

Given that the quality of foods consumed and the number of meals served do not drastically change during the food shortage periods, it would seem that households in the project area do have effective coping mechanisms for maintaining food supply in this period. This is explored in the following section.

5.1.9 Coping mechanisms

Respondents were asked how they coped when food supplies and money to buy food ran out and there was a broad range of responses. The top three coping mechanisms mentioned were borrowing money (51%), undertaking small business enterprise (43%) and selling cattle (37%) (Table 8).

Table 8 Coping responses to food shortage

Coping mechanism	Proportion
Borrow money	51%
Small business	43%
Sell cattle	37%
Ask parents for help	21%
Go to Dakar	18%
Temporary migration	16%
Daily work	15%
Pledge/Pawn goods	13%
Work for Food	9%
Sale of possessions	7%
Sale of produce	7%
Seek food aide	6%
Sell farming assets	6%
Forage for wild foods	5%
Sell firewood	2%
Sell charcoal	2%
Driver	2%
Cereal bank	1%
Brick making	1%
Credit/Savings	1%

Only a few households mentioned very negative coping responses such as sale of possessions and farming assets, foraging for wild foods and selling wood and charcoal. Sale of firewood and charcoal are particularly damaging to the local environment, resulting in damage and theft of trees and can be viewed as a threat to the success of FMNR in a locality. So the low prevalence of this as a coping mechanism is good.

According to feedback during FGDs with men, pledging of assets was a key response to food shortage and the Food for Work initiative of the project directly decreased the reliance on this negative coping mechanism.

Food distributed to the population as part of the food for work initiative enables communities to have access to food during the most critical lean periods of the year. Consequently less poor farmer feel the need to pledge their farming implements in return for food during the lean period [FGD men].

5.1.10 Water supply

The situation for water supply seems good in the project area with the majority of households being able to collect water from a safe water supply within 30 minutes Figure 24.

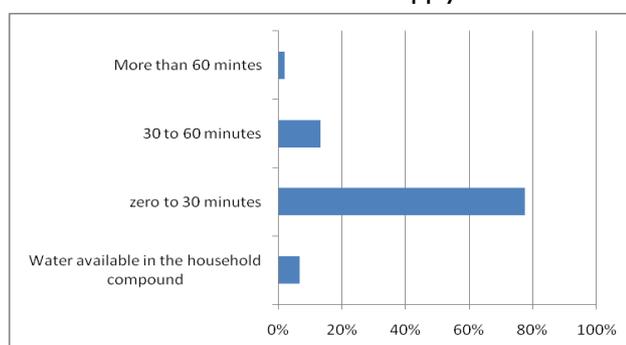


Figure 24 Collection times for water in project area

According to the results of the household survey, over 50% households have a tap in the household while about 37% can access a public tap (Figure 25).

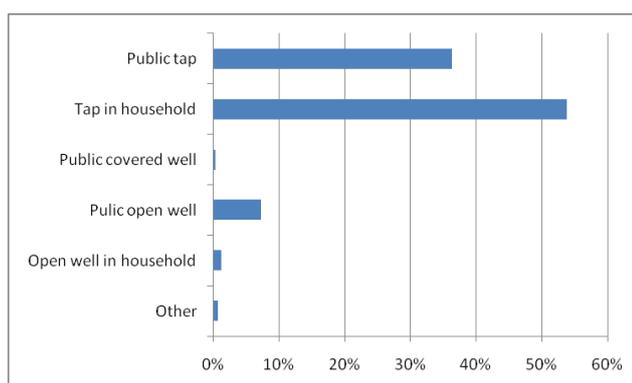


Figure 25 Water sources in the project area

Water supply for domestic purposes in these communities appears to be secure for about 90% of respondents which is an excellent situation. When asked whether there was adequate water supply for non-household needs, the results for livestock were also good with over 70% respondents feeling they have enough water for their animals. However for watering trees, vegetable gardens and developing microenterprises the majority of respondents felt that water supply was not adequate (Figure 26).

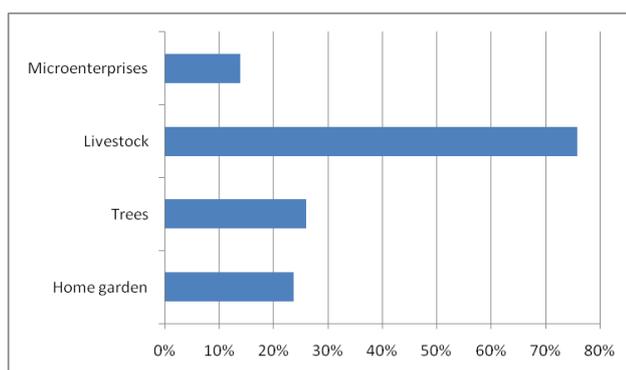


Figure 26 Opinions about adequacy of water supply for non-domestic uses

Given the fact that most households did have access to piped water – presumably this was not limited - the actual volume of water may not be the issue and it is more likely that the labour and materials needed to transport water to gardens and trees were major limitations.

5.2 Project contribution to positive change

Of the 752 respondents in the survey 72% (539) were aware of the SFLEI and or Beysatol projects and 30% (225) were direct project participants. The project ultimately aimed to reduce vulnerability to food shortage and to increase child wellbeing for families in the project community. Given the complexity of the project setting and the limits of this project evaluation it isn't possible to obtain scientifically valid evidence of sustained improvement in food security and child wellbeing¹⁰. Indeed the 'bluntness' of evaluation tools relative to the volume of agroecological and socioeconomic 'noise' makes it impossible to measure project contribution to change at this level. However, the evaluation

¹⁰ This would require control of multiple variables and random assignment of the project intervention which is not feasible.

work allows us to make confident judgements about the contribution of the SFLEI project to improved knowledge, capacity and practice and improved socioeconomic and environmental conditions.

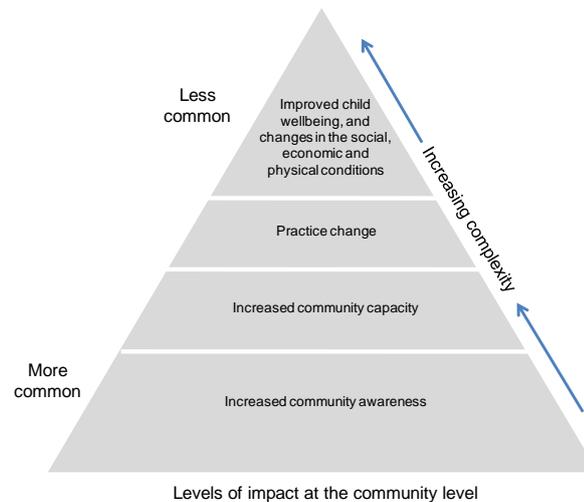


Figure 27 Unifying framework for a hierarchy of results reported in program evaluations¹¹

Using this framework project outcomes can be characterised into four broad levels or platforms:

- **Increased community awareness:** demonstrated improvement in stakeholder knowledge about issues and opportunities.
- **Increased community capacity:** demonstrated improvement in community, partner and stakeholder capacity to actively respond to issues and opportunities.
- **Practice and behavioural change:** where stakeholder actions and response to issues and opportunities reflect actual practice change. This relies on awareness and capacity built, and the desire by the majority of people to change
- **Improved child well-being and changes in social, environmental, physical, economic conditions:** an identified reduction in vulnerability or increase in resilience in the program area and target communities.

The shape of the unifying framework is triangular because in the spectrum of projects there will be more achieving outcomes in terms of awareness raised and few achieving the strived for sustainable changes in community wellbeing. Yet this is the level that we must always work towards.

The outcomes of the SFLEI project as demonstrated by the work of this evaluation are discussed according to the above hierarchies.

5.2.1 Awareness raised

Awareness of FMNR was measured in the household survey and 75% percent of all respondents said they were aware of the practice. Gender disaggregation of this data highlighted that there was

¹¹ This unifying framework was developed by WVA in 2009 to classify the outcomes of programs according to evidence reported in their end of project evaluation.

slightly lower awareness among women compared with men. Sixty five percent of respondents who were not project participants were aware of the practice while in the group who don't use FMNR, just over half were aware of the practice. (Table 9).

Table 9 Awareness of FMNR in different sub groups

Sub group	Aware of FMNR	Sub group	Aware of FMNR
Men	76%	Women	69%
Project	100%	Non project	65%
Uses FMNR	100%	No FMNR	51%

Judging by these values, the lack of awareness of what FMNR is, presents an obstacle for 25% of the community while other factors prevent uptake by another 25%. When levels of awareness of FMNR were compared among the different ADPs, awareness was 80% or higher in E.Kaolack, Ndiognick and Nguer. However, in Thiappy only 59% of respondents were aware of FMNR (Figure 28).

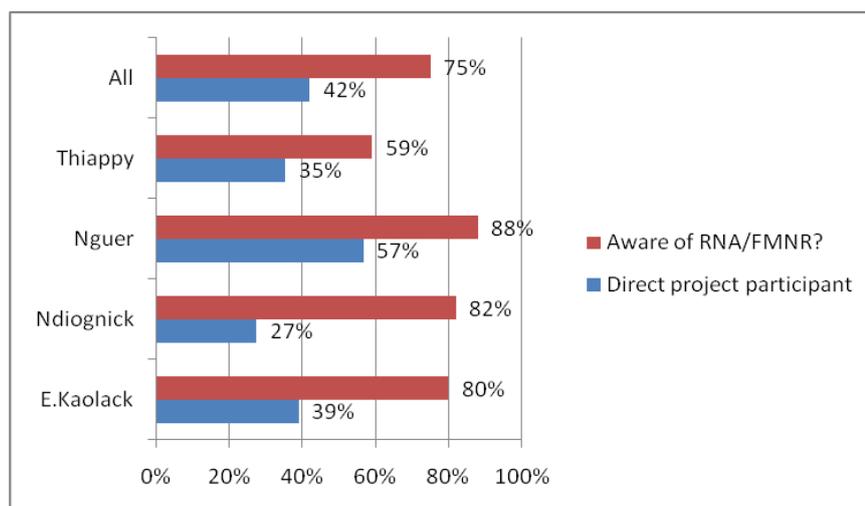


Figure 28 Awareness of and participation in the SFLEI project in the project ADPs

The lower proportion of Thiappy respondents who were direct project participants (35%) corresponds with the low proportion who are aware of FMNR (59%). In Ndiognick this is not the case. Here, knowledge of FMNR is 82% while only 27% were direct participants in the project. Promotion and awareness of FMNR commenced only in the final year of the project.

5.2.2 Knowledge and capacity built

This section explores the level and quality of knowledge of FMRN across the project community and explores the role of the project in this. It is likely that there has been training offered by various government and non government agents working in the project area prior to and during the last four years. The proportion of *heads of household* who had participated in five types of training relevant to the project is shown in Figure 29.

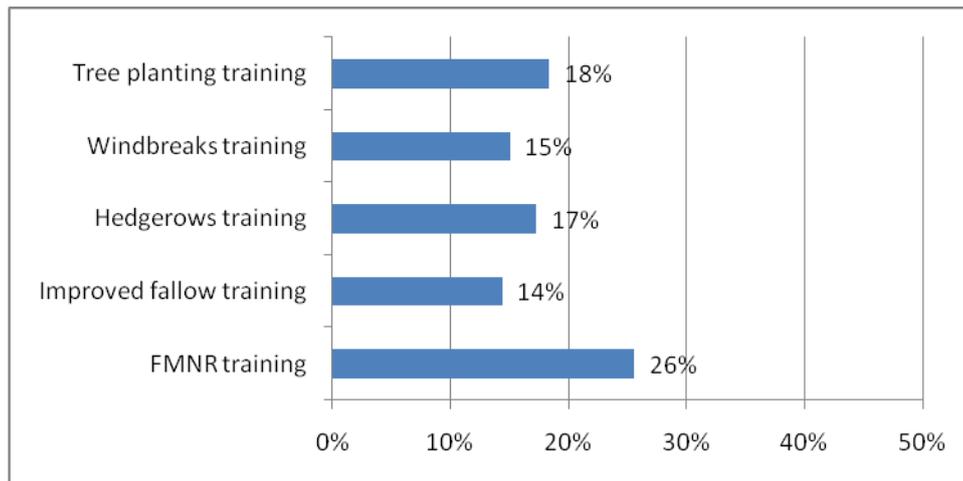


Figure 29 Training rates of heads of household in the project area

To explore the contribution of the project to the level of skills training, the proportion of heads of household who had participated in various training types is compared with those in the non project group in Figure 30.

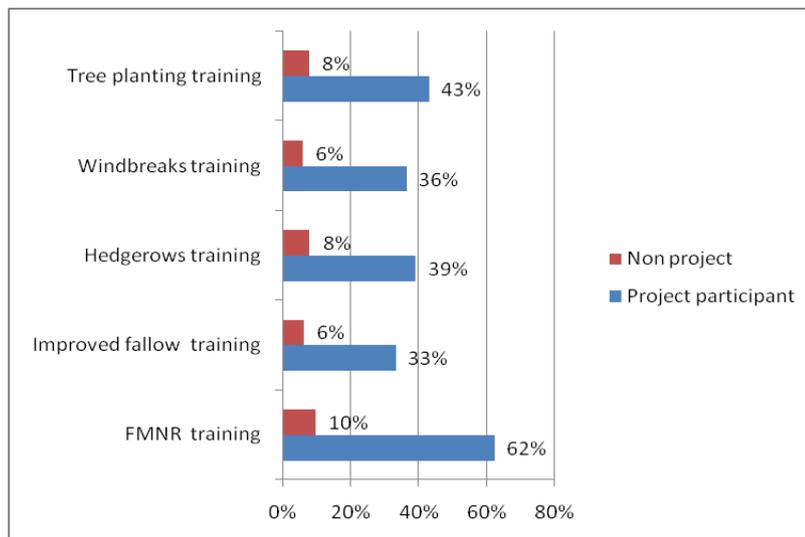


Figure 30 Levels of training of direct project participants compared with non participants

There are large differences for all types of training between the two groups and one that stands out training in FMNR where 62% of direct project participants had this training compared with only 10% in the non project group. Given the much higher rates of exposure to training in the project participant group, it can be concluded that the project is responsible for most of the training offered in the project area. It is also likely that there has been spill over from project participants to non participants given that a requirement for those who participated in training was to train other members of their community outside their immediate family. This topic was explored with key informants and according to their feedback this was a successful element of the project design.

Q. How many people have you trained since coming back from Niger (question to female lead farmer)

I trained six people after coming back from Niger. If you ask me today how many people I have trained, they would fill this room (about 20). [Thiappy female lead farmer]

The level of knowledge of FMNR was explored by asking respondents who were aware of FMNR to list the activities carried out for this practice. The activities mentioned and the response rates are shown in Figure 31.

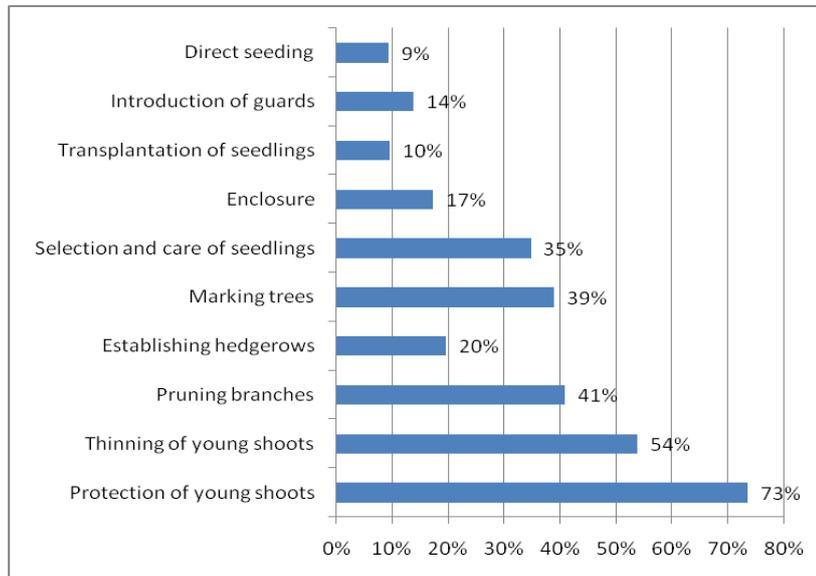


Figure 31 Proportion of respondents who mentioned various FMNR techniques

The most frequently mentioned techniques were protection of young shoots (73%), thinning of new shoots (54%), pruning branches (41%), marking trees (39%) and selection and care of seedlings (35%). To explore the effect of the project on levels of knowledge about FMNR techniques the proportions of respondents who mentioned selected techniques in the project and non project groups are compared in Figure 32.

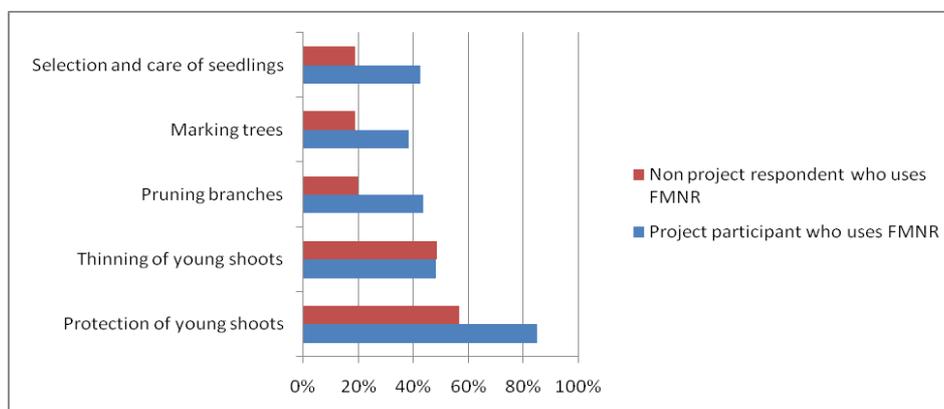


Figure 32 Impact of project on knowledge of FMNR techniques

There were clear increases in knowledge of FMNR techniques for the group of FMNR users who were direct participants of the project, with the exception of the technique ‘thinning of young shoots’ where about half of the respondents in each group mentioned this.

As would be expected the average number of FMNR techniques mentioned in the project group was significantly higher than in the non project group. The average number of FMNR techniques

mentioned by project participants was 4.0 compared with 2.5 in the non project group and the difference was significant ($P < 0.001$)¹².

When the baseline for this project was done in 2008, about 38% of respondents could mention at least three FMNR practices (note the values exclude Ndiognick which was not in the project at the time). This may be due to WVA and WVS introducing a very small-scale FMNR pilot project in Nguer in 2005. When similar data were collected in this evaluation (2011) the proportion of respondents who could mention three or more practices had risen to about 51%. Therefore in the four years of implementation knowledge of the technique has risen 13% across the community in the project area (Figure 33).

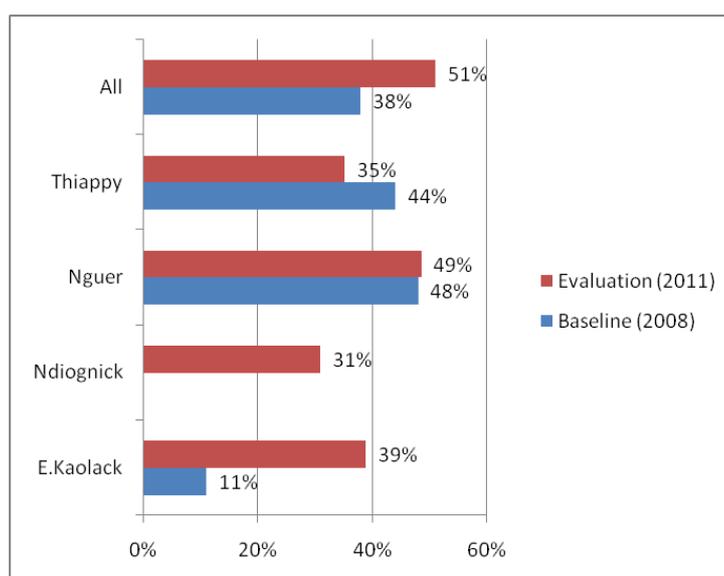


Figure 33 Knowledge of three or more FMNR techniques

Interestingly the levels of knowledge varied quite a bit at the ADP level and this would reflect the timing of roll out of project activities in the different locations and the levels of knowledge that existed at the start. In ADP subgroups, the level of knowledge of FMNR techniques was highest in Nguer and Thiappy at the baseline in 2008 and this pattern has not changed in 2011. However, the level of knowledge of FMNR techniques has declined Thiappy and has not changed in Nguer. In East Kaolack the proportion has risen from just over 10% to 38% and is currently just over 30% in Ndiognick.

The decrease in FMNR knowledge levels in Thiappy over the last four years reinforces a comment made by a participant during the recommendations workshop – we can't assume that because we have made gains in an area that the levels of knowledge will be maintained over time. There needs to be ongoing support in the long term. The tipping point at which the uptake and practice of FMNR becomes entrenched in local farming systems and investment can scale back is an area that would be an interesting topic for adoption studies by ISRA or a post graduate student.

Respondents who knew about FMNR were also asked what the benefits were and what the constraints were. Across the community, the most prevalent beliefs are that FMNR improves soil fertility (84%), increased crop yields (69%), attracts rainfall (55%) and controls erosion (41%).

¹² Student's T-test, 2 tailed, equal variance not assumed.

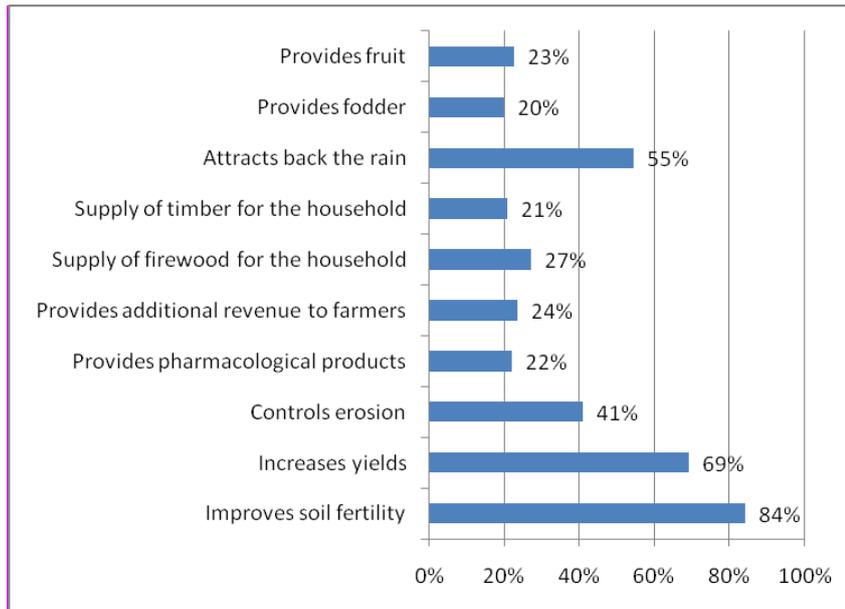


Figure 34 Community beliefs about the benefits of FMNR

Figure 35 shows data on beliefs about benefits of FMNR disaggregated for respondents who use FMNR and those who don't. As expected the knowledge of benefits of FMNR is considerably higher for those who use FMNR than for those who don't, but interestingly the patterns overall for the different benefits is similar between the two groups.

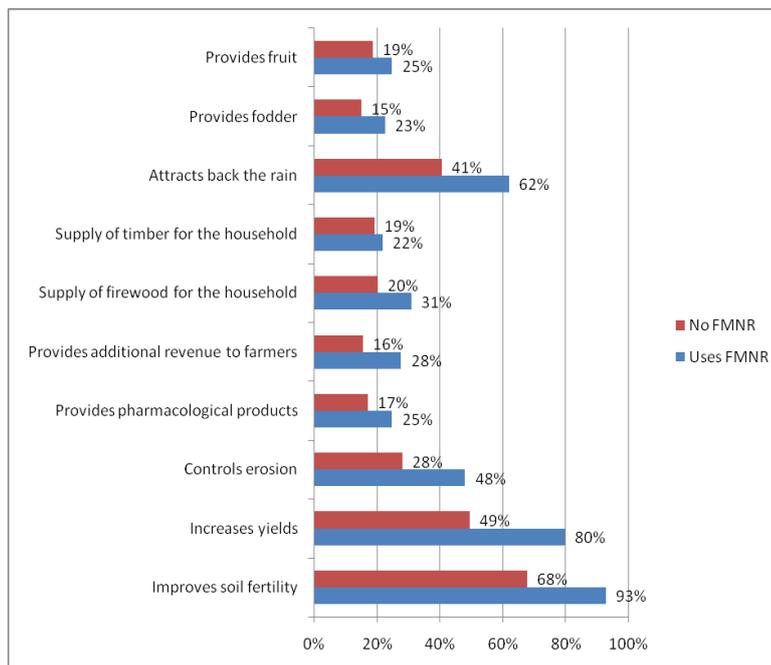


Figure 35 Benefits of FMNR according to FMNR users and non users

Improved soil fertility, increased yields and attracting back the rain were benefits cited by 60% or more of the respondents who use FMNR. In the group of farmers who don't use FMNR, the same three benefits were cited by 40% or more respondents. This suggests that it is not a lack of knowledge of the benefits that is preventing these farmers from taking up FMNR.

When the number of benefits and constraints mentioned by project and non project participants was compared, the project group demonstrated significantly better levels but the non project respondents were not too far behind.

Response category	Project participant	Non participant
Ave. Number FMNR benefits mentioned	4.9	3.4
Ave. Number FMNR constraints mentioned	2.5	1.4

That FMNR is beneficial seems to be generally well known across the community. Anecdotally farmers who are aware of the benefits resist taking up FMNR for various reasons – some of the reasons would be well founded, but the perceived impact is often overstated. Some perceived constraints are imagined and not borne out by practical experience. In the household survey the respondents who knew about FMNR were asked what the constraints were and the responses are shown in Table 10.

Table 10 Constraints of FMNR mentioned by respondents who were aware of the technique

Constraint mentioned	Proportion (N=567)
Vandalism of trees/actions of nomadic herders	64%
Time and effort required/ Protection of trees required	49%
Lack of knowledge about FMNR techniques/ Misunderstanding of FMNR	40%
Bush fire	22%
Makes it difficult to use mechanisation for sowing	13%
Returns take too long	11%
Harbours birds	9%
Theft of trees and wood	9%
Plants harbour insects/termites	8%
State will take back the land	7%
Excessive shading reduces yield	7%
Competition with crops	6%
Land shortage	4%
Illegal to cut trees	3%
Water shortage	1%

The major constraints to FMNR cited were: problem of vandalism of trees (64%); the time and effort required to implement FMNR and protect trees (49%); a lack of knowledge (40%); and bushfires (22%). These are real issues that have been faced and overcome by the majority of farmers in Niger where FMNR has transformed the landscape. Other issues mentioned such as trees harbouring pests and shading out crops may not be serious limitations when the FMNR system is successfully adapted (i.e. selection of appropriate species). It would be useful to do study farmers in Niger to find out how they overcome these problems and prejudices. Their stories would have real currency among the farmers in Senegal who still harbour doubts about the potential of FMNR.

It was anticipated that respondents who don't use FMNR would have very different ideas about the constraints, compared to those who do use the technique. However the response patterns were quite similar, although awareness of each of the problems is generally higher in the FMNR user group. The notable exception was the proportion of respondents in the non FMNR (62%) who say lack of knowledge is a constraint compared with 29% in the FMNR user group.

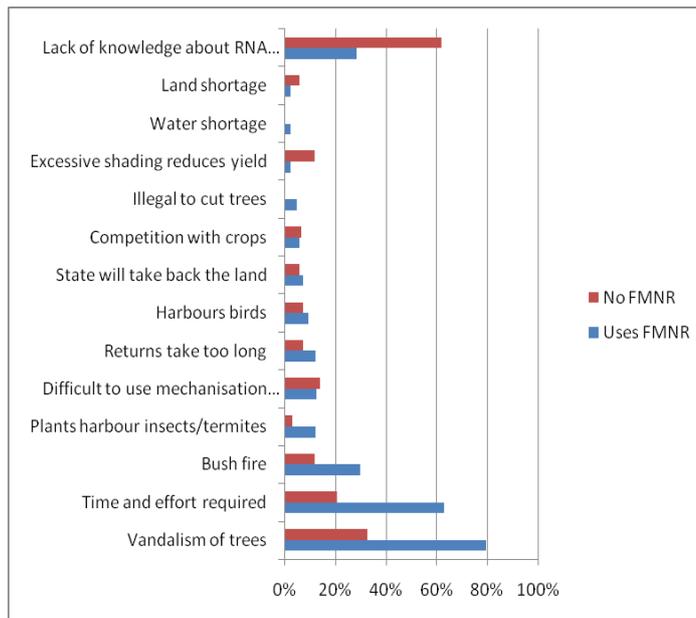


Figure 36 Constraints to FMNR mentioned by users and non users of this practice

According to the survey data potentially 55% of households across the project area lack adequate technical knowledge of FMNR (this includes those who are aware of FMNR but say lack of knowledge is a constraint plus those who are not aware of FMNR at all). Therefore we conclude that lack of knowledge about this practice remains a significant barrier to uptake of FMNR in the project area. Greater access to FMNR training is needed and plans for inclusion of FMNR programming within ongoing ADP activities cannot come too soon. The next section explores uptake of FMNR and associated practices across the project community and compares this with the situation at baseline.

5.2.3 Practice change in FMNR

There is no question that FMNR is much more effective than the traditionally promoted tree planting only.

In terms of reforestation FMNR, it's in my opinion the most critical element in assuring the reestablishment of trees (wooded land). It is even not comparable to ...replanting with FMNR. In my opinion there is no grounds for comparison whatsoever. [Departmental Forestry Officer]

I have worked in another area for 6 years and when I came here I heard about FMNR. I wondered what it was. I heard about an Australian funded project. This was the first time I saw trees growing that was human assisted. I saw this regenerated area and I understood that it was better than reforestation. I went to Niger and I saw how many hectares had been rehabilitated through FMNR. Now I think there is no need to have nurseries anymore, let's just promote FMNR. [Kongheul Forestry agent]

Throughout the project lifetime, the monitoring framework tracked the number of hectares where FMNR is practised according to the methods promoted by the project. After the first year, 742 hectares were covered. By the end of project, 9126 hectares were covered in the SFLEI area¹³ (the total under the broader 'Beysatol' project is much greater still). That represents an average annual increase of 252% per year through the lifetime of the project. The cumulative increase in area under FMNR over time is shown in Figure 37.

¹³ SFLEI Final annual monitoring report, Indicator tracking table.

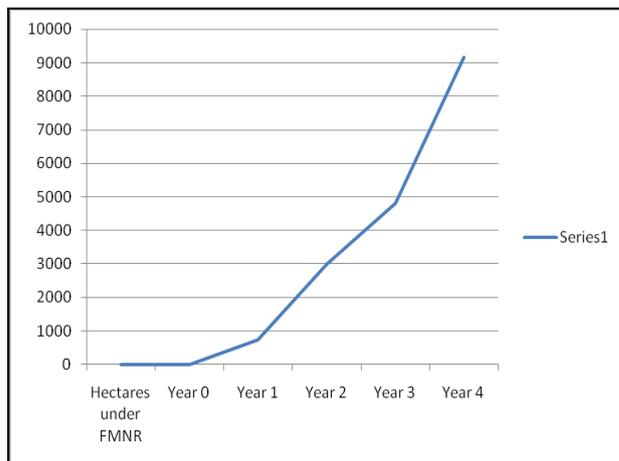


Figure 37 Increase in hectares under FMNR in project area over four years

The value of FMNR was not disputed in any FGDs. Historically there has been promotion of a range of useful tree species in farming. For example the Ministry of Environment and Protection of Nature and *Eaux et Forêt* Department promoted *Faidherbia albida* in 2001, 2002 and in 2009 and 2010. *F. albida* seemed to increase crop growth and yield – farmers came to this realisation on their own and started to protect these trees. Research helped to quantify the benefits and the SFLEI and Beysatol projects renewed and expanded interest in the benefits of this tree.

The FMNR started almost back in the 1980s and 1990s... there was a big social awareness raising on the basis of Faidherbia albida. This observation made by the population, the authorities and science researchers (ISRA), highlighted that plants that were planted around this tree...were impressive and everybody now agrees that Kad results in higher yields.... The farmers decided to do that under their own initiative... When Beysatol was introduced it opened people's eyes once again to the fact that when you produce crops around the Kad tree, because of the composition of the leaves and the evolution of soil organisms, this simply increases the yields....Beysatol ... has enabled us to discover that there are possibilities here that we have a tendency to neglect. [Departmental Forestry Officer]

However from the perspective of the Department of *Eaux et Forêt* the level of uptake of FMNR overall is weak. More work is needed, not only to help more farmers take up the idea but to ensure that those who have tried it in the last 3 years do not give up, and the techniques used are the most suitable and effective. There is also more work needed for the other species and forestry agents see themselves as having the major role in taking the work forward.

The level of adoption [of FMNR] exists but it is still weak. I think we need additional accompanying measures there is a whole gamut of silvicultural spp that we can take into consideration, that should be included in the FMNR because these are things that are relevant to the farmer's landscape..... It's very important to accompany [them]..... the Eaux et Forêt will be able to ensure the monitoring of the project, in such a way as to ensure the progress of the outcomes. I said earlier on that in terms of the partnership, as the project progresses, it has to be the state services. [Departmental Forestry Officer]

All 2011 survey respondents were asked if they practiced FMNR and 67% said they did. At the time of the baseline in 2008 the use of FMNR across three ADPs was measured to be 73% of all respondents. This was the “rate of farmers who deliberately maintain naturally grown trees” (Baseline 2008).

The SFLEI project baseline authors noted that “With regard to the results of FMNR practice (72.7% of farmers), it is noticeable that these do not reflect reality.” and “field observations do not provide any evidence testifying [to] this percentage” (Baseline pg. 20). They suggest that the high response rate was more likely due to a misunderstanding of the question or an inappropriate phrasing of the question during survey enumeration. With a small number of trees existing even in non-FMNR fields, one can speculate about how the question was interpreted at baseline.

With the baseline report declaring that the survey responses did not correlate to observation of the interviewees' actual fields, comparison between baseline and the end-of-project survey serves little purpose, but is declared in the following paragraphs for transparency.

The baseline rates ranged from over 90% in Thiappy to just over 60% in E.Kaolack (Figure 38). The rates of practice of FMNR in 2011 overall have declined due to the drops in Thiappy (91% down to 73%) and E.Kaolack 62% down to 55%). However the uptake in Nguer has increased from 66% in 2008 to 89% in 2011. Part of the difference in overall values between baseline and end of project practice rates for FMNR will also be accounted for by the inclusion of the fourth ADP of Ndiognick in 2011 – which was not present in the 2008 survey, and the uptake in this ADP is still only a third of farmers.

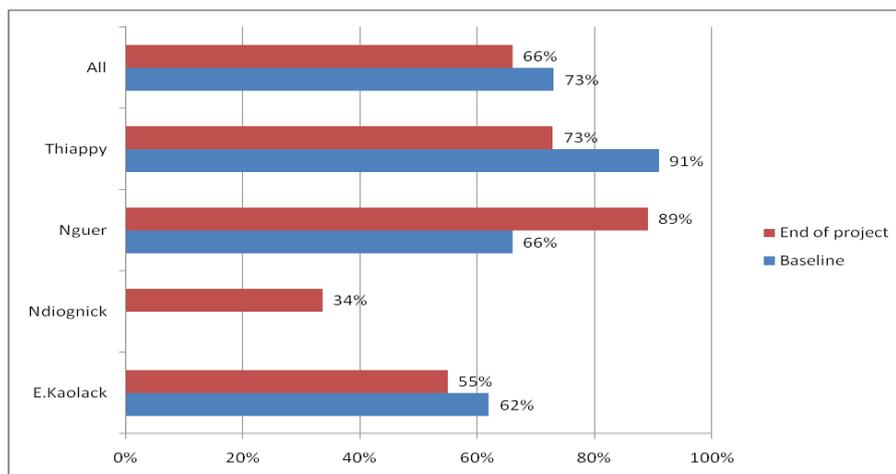


Figure 38 Proportion respondents who say they use FMNR - pre and post project

This is a strong possibility since a similar issue presented during an evaluation in Ethiopia in 2010 – where many farmers claimed to practice FMNR on their croplands but with little physical evidence¹⁴. It was likely that the approach to questioning during the survey did not distinguish between traditional tree management practices – where for example certain trees are left on or planted on fields by landholders, and the application of more formal FMNR methods such as selecting and marking trees, selective pruning and coppicing, and systematic production of firewood and timber poles as a cash crop. There are both local variations and overlap between traditional and FMNR practices in any community of farmers, and farmers tend to adapt rather than adopt promoted technologies. Therefore it is tricky to establish the real rates of uptake of the practice due to the project intervention.

Twenty two percent of survey respondents who used FMNR said they practiced FMNR before the project started in 2007. Of the remaining 293 respondents who took up FMNR during the life of the project, 24% started using the technique in 2008, 47% took up the technique in 2009, 23% started in 2010 and 6% had started in 2011 (Figure 39).

¹⁴ Kabore C., Woods P., Tofu A, Tefera H. (2010) *Humbo Community Reforestation Project, Mid-term Evaluation, Report*. World Vision Australia.

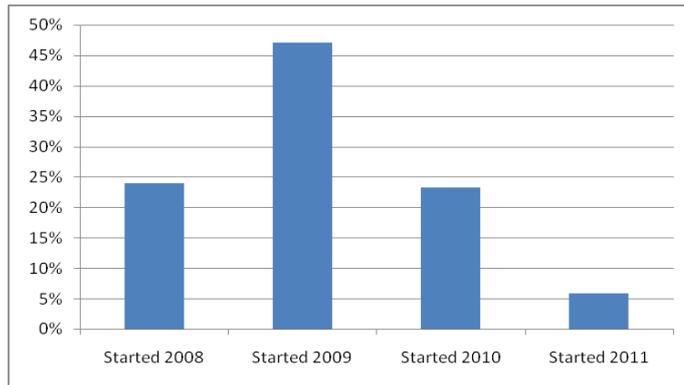


Figure 39 Uptake of FMNR since the project started

The pattern of uptake of FMNR promotion by the SFLEI project is consistent with Rogers (2003, p.11) *Diffusion of Innovation* where three phases and groups are identified - the 'Early Adopters' who tend to be the first to try something new, a larger group of adopters in the 'Take-off' phase, followed by 'Late Adopters' who tend to wait and see the results of others before trying something themselves. Of course other factors would also influence the pattern of uptake, such as the prevalence of the technology use prior to the promotion by the project and the phases and locations of the project implementation. To explore the possible effect of the project itself on adoption, the take up year of project and non project users of FMNR are compared in Figure 40.

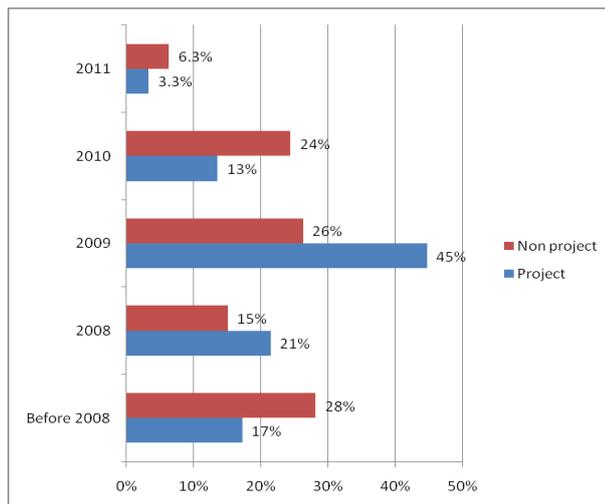


Figure 40 Year of uptake of FMNR in project and non project groups

The positive influence of project exposure by the second year (2009) is clear, when 45% of the project group started using FMNR compared with 26% of the non project group. It is interesting that a fairly large group (28%) of non-project participants were already doing FMNR before the project started.

Because FMNR is a suite of complementary techniques, exploring the timing of the uptake of FMNR is one element of adoption story – equally important is the quantifying quality and consistency of the practice. To explore this further the levels of practice of FMNR techniques at the baseline in 2008 and at the end of project evaluation in 2011 are compared in Table II.

Table II Practice of tree management techniques at baseline and end of project

Tree management techniques	Baseline (2008)	Evaluation (2011)	Difference
Thinning of young shoots/Protection of new shoots	20%	48%	+28%

Pruning trees	31%	53%	+21%
Quickset hedge	16%	-	-
Marking trees	16%	39%	+23%
Protection of naturally regenerated seedlings	-	23%	-
Selection and management of shoots and seedlings	19%	22%	+3%
Mis en defens	73%		-
Transplantation of naturally regenerated seedlings	10%	10%	-
Setting of stakes	15%		-
Direct seeding	23%	13%	-10%
Surveillance of field often	-	3%	-
Protect from burning/avoid burning near trees	-	3%	-
Do not cut down trees	-	2%	-
Protect trees	-	1%	-

The design of the survey question about tree management differed slightly between the 2008 baseline survey and end of project survey – therefore not all of the response categories have pre and post measurements. However the data clearly show significant increases in the practice of management of new shoots (thinning/protection of new shoots) which has increased from 20% to 48%, pruning trees is now done by 53% farmers compared to 31% in 2008, and 39% farmers mark their protected trees compared with 16% in 2008. There has been some decline in the practice of direct seeding, which was used by 23% respondents in 2008 and now used by only 13%.

Respondents who used FMNR were asked what changes they had observed on their own farm land since they started practicing the technique. An increase in soil fertility (85%), less erosion (62%) and increased yields (59%) were the three major benefits identified (Figure 41).

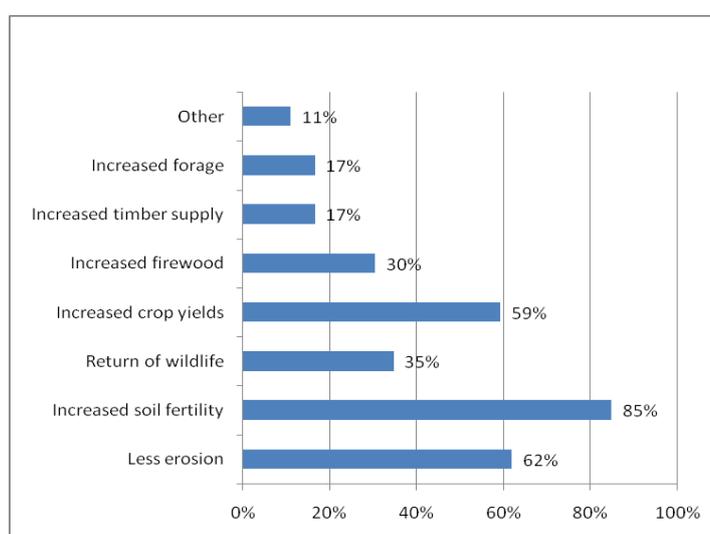


Figure 41 Observed benefits of FMNR

Other benefits cited were increased wildlife (35%), and increased access to firewood (30%) and timber (17%). Seven respondents (about 2%) also mentioned increased shade as an important benefit. Increased fruits, more rain and beautiful greenery were also mentioned by a few individuals. Feedback from key informants during FGDs highlights a robust understanding of the function of trees in the farming system and the very positive experiences farmers are having with FMNR.

The FMNR has enabled the recovery of land previously unsuitable for agriculture due to effective measures to control gully erosion through the maintenance of trees on the plots and the introduction of live-hedges.... Falling leaves contribute strongly to the organic enrichment of the soils, which contribute

towards improved yields similar to when chemical fertilizers are used on a small scale. Since shade is now available, we tend to spend much more time in the plots. Wind erosion is also reduced as a result of the different tree planting and protection initiatives. [FGD men]

Without protection from trees the soil is exposed to wind erosion and the projection of the ground stops the sun overheating the soil. We see that the soils have started re-living gradually and we are starting to think they will obtain its former fertility. [Lead Farmer Kongheul]

Increased availability of the fruit of *Ziziphus* was mentioned by several key informants. This is likely to become a significant nutritional benefit of FMNR to children as the trees mature, and is also a potential source of income.

*Even women and children can benefit in the short term by collecting fruit. With *Ziziphus Mauritania* you can eat it but with a bit of luck you can sell it and get some pennies. [Lead Farmer Kongheul]*

The following section explores the impact of the application of FMNR on crop production and food security at the household level.

5.2.4 Changes in social, environmental, physical and economic conditions

Successful uptake of FMNR in a locality will lead to rapid physical changes to the landscape and to farming outputs. For example trees being left on crop land and farmer management of these trees will provide firewood from pruned branches which will reduce the volume of firewood purchased in households and may eventually produce firewood that can be sold thus trees become a 'cash crop'. The tree fodder and the shade offered by larger trees attracts livestock to browse and camp around trees, and livestock urine and manure deposits increase soil fertility under the tree canopy. Leaf litter also contributes organic matter and nutrients which improves soil condition and moisture retention. Better soil fertility and moisture retention means better crop growth which reduces the amount of money required to purchase staple foods during the hungry season – another potential saving at the household level. Such benefits from well established and good FMNR practices have been demonstrated across large areas of Niger and technically proven in monitored plots in Senegal. In 2010 the Senegal Institute for Agricultural Research (ISRA) compared crop yields in the project area where soil and seasonal conditions were the same but FMNR was applied on one plot and not on another. As reported in Section 5.1.7, the results were clear – FMNR on cropped fields led to a dramatic increase in yields of the staple crop millet (Box 1).

Box 1. Field trials for millet with and without FMNR

Millet was tested in a farmed plots with and without FMNR. The experimental design was two farmed plots in a single block without repetition. Each plot had a surface of approximately one hectare, and six quadrants were randomly selected in each and measured for average height of plants, length and circumference of ears, number of tillers and number ears per plant, weight of ears, weight of the grains and weight of 1000 grains. From these measurements the productive tillering and the output in kg/ha were calculated.

The height of the millet plants, the number of ears per plant and the weight of ears were significantly higher in the FMNR plot compared with the control plot. Productive tillering with FMNR was higher than without FMNR and the difference was statistically significant. The conclusion was that the number of ears produced by millet plants increased as vegetation cover increased. The species types and threshold for tree density and optimal crop production continue to be explored by ISRA. (ISRA 2011).

5.2.5 Local change observed

This evaluation explored changes observed by community since the ADP introduced the SFLEI FMNR project in 2007. This was done in FGDs – where farmers were asked to reflect on the changes, and in the household survey where respondents were asked a number of specific questions about the types of changes that would be expected. This included prevalence of woody trees, availability of firewood, decreases in soil erosion, weeds and insects and increase in household income.

In the household survey respondents had a choice of answering ‘increased’, ‘decreased’ or ‘no change’. On a *majority rules* basis where there was a clear margin of difference between groups, respondents observed that there were more woody trees (52%), less erosion (51%), less insects (53%), less livestock damage to crops (44%) and more household income (62%) over the last four years. However, the results were not conclusive for access to firewood where 40% said it had increased and 41% said it had decreased and for weeds where 40% said they had decreased while 39% said weeds had increased.

Access to firewood may initially decline in the early stages of FMNR, since residents are excluded from collecting firewood on surrounding arable lands and in designated FMNR areas. There is a time lag between starting FMNR and having adequate tree growth to prune and provide the required volumes of wood for household consumption. So for women and children who collect firewood for the household, the initial impact on FMNR can be negative. In fact, when data were disaggregated by gender, the majority of women observed both a decrease in the amount of firewood and in the number of woody trees (Figure 43).

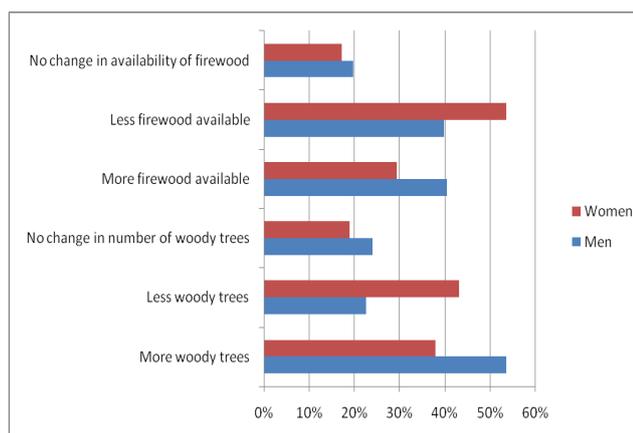


Figure 42 Women’s and men’s opinion on changes in wood trees and firewood in last four years

When data were disaggregated for respondents who use FMNR and those who don’t, the majority (65%) of those who practice FMNR have observed an increase in woody tree numbers while about 39% of the no FMNR group through this. For availability of firewood, 50% of FMNR users said it had increased while about 36% of non users thought this Figure 43.

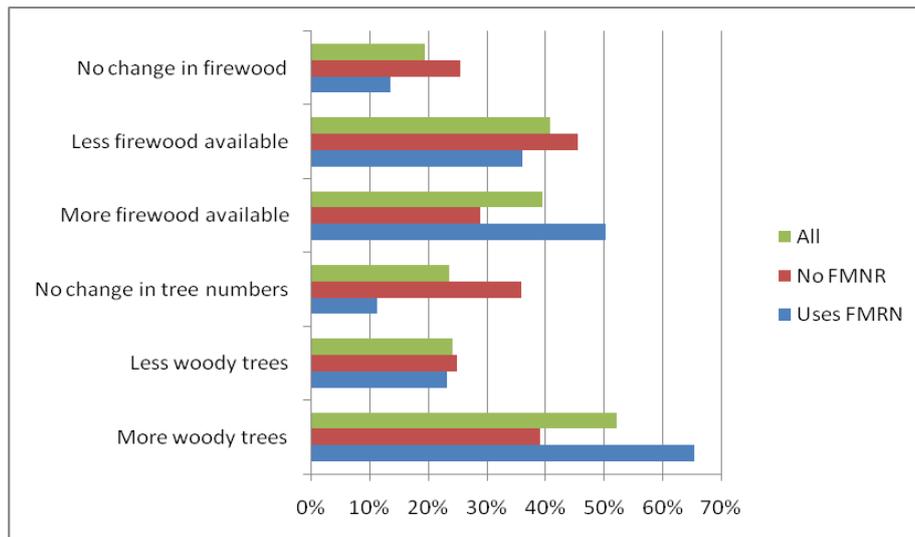


Figure 43 Changes in number of woody trees in the last four years

This data is only indicative of what people – chosen at random – have observed about the changes in their localities but it suggests that those who practice FMNR see evidence of increasing tree numbers and hence access to wood is increasing in their own localities. Interestingly when data for this question were disaggregated by ADP 70% of respondents in Thiappy and 42% in East Kaolack observed there was less firewood available now than four years ago (Figure 44).

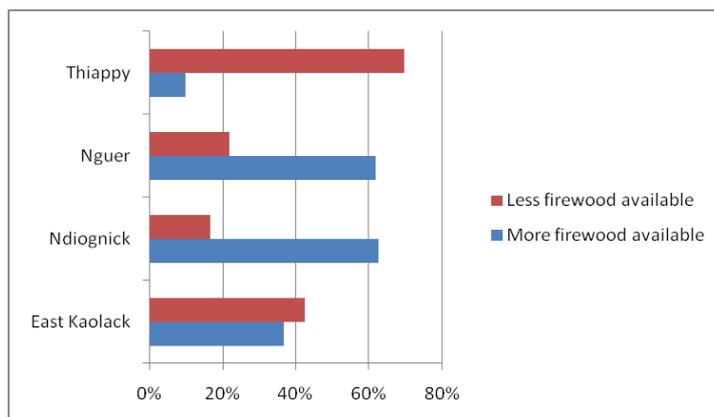


Figure 44 Opinions about changes in firewood availability in the last four years

The situation in Thiappy is clearly very different from that in the other ADPs. The area has seen such decimation of mature tree cover and removal of tree roots that the regeneration is predominantly from spontaneous seedling growth and these trees take much longer to establish than shoots sprouting from mature root systems. FMNR fields in Thiappy had a good number of young *Faidherbia albida* trees present but visually they didn't make much of an impact (Figure 45).



Figure 45 Young Faidherbia albida trees in an FMNR field in Thiappy

Increasing tree density may help to increase infiltration of rainfall and decrease runoff. The majority of respondents (52%) thought that the level of erosion had decreased in the last three and of the group who used FMNR 66% had observed this change (Figure 46).

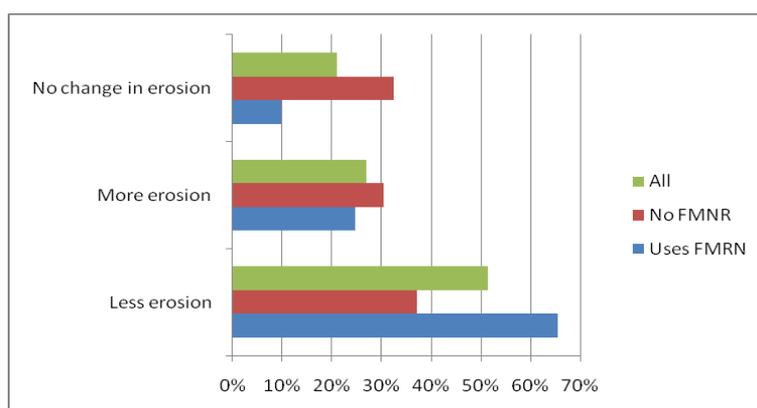


Figure 46 Changes in erosion in last four years

Another benefit of increased density of nitrogen fixing trees such as Faidherbia albida is increased soil fertility through increasing available nitrogen to crops – and leaf fall from trees left on fields can form a layer of mulch that has a dampening effect on weed growth. Good soil fertility leads to healthy cereal plants which are then resistant to a common parasitic weed – striga (*Striga hermonthica*). Respondents were asked what changes there had been in the prevalence of weeds in the last four years and the results were inconclusive (39% said weeds increased, 40% weeds reduced). Of the group of respondents who used FMNR 42% felt that weeds had reduced while 39% said there were more weeds.

Another positive outcome from improving fertility and moisture conditions for cereal crops is an increase in plant resistance to damage from insect pests. Overall a majority of respondents said that there were fewer insects now than four years ago. This observation was quite similar between those who practice FMNR and those who don't (Figure 47).

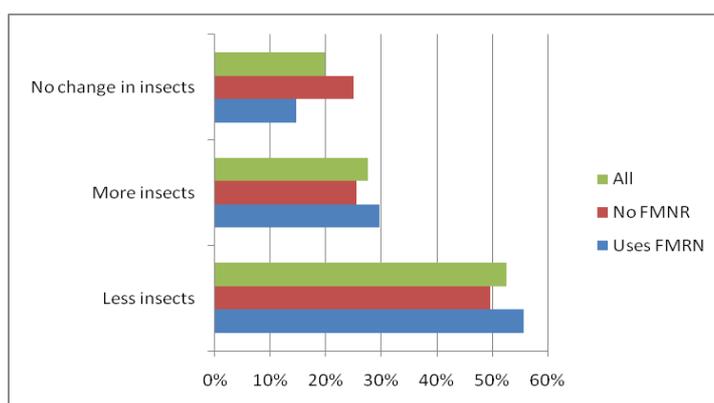


Figure 47 Changes in insect numbers in last four years

5.2.6 Trees

Important uses of trees in the project area are as a source of wood for cooking fires, timber for building and craft, fruit for humans, fodder for livestock, herbal medical and veterinary remedies. Tree also stabilise soils, reduce wind erosion, and the leaf drop provides soil cover and nutrients. Additional benefits noted by farmers who practiced FMNR was enhanced crop growth (for *F. albida*) and attracting livestock to browse and camp in the shade, which in turn delivers manure and urine to the area. The shade offered by trees also enabled farmers to rest out of the sun while working their fields. The farmers who had visited Niger in particular could envision a forested landscape, one that was both productive and beautiful.

The type of benefits we see pushes me sometimes to leave my home and just walk through my field to appreciate the trees and environment. [Thiappy female lead farmer]

Every tree is a blessing. If one tree can bring so much, imagine how much benefit there will be with many.....[Kongheul male lead farmer]

The evaluation sought to identify evidence of change around trees since the project started. During the baseline in 2008 respondents were asked what trees they had and the most prevalent species were *Faidherbia albida* (Kadd), *Adonsonia digitata* (Baobab) and *Balanitex aethiopicum* (Soump) (Table 12).

Table 12 Common tree types in the project area

Botanical name	Local name	Proportion
<i>Faidherbia albida</i>	Kadd	45%
<i>Adonsonia digitata</i>	Baobab	34%
<i>Balanitex aethiopicum</i>	Soump	28%
<i>Azadirachta indica</i>	Neem	24%
<i>Piliostigma réticulatum</i>	Nguisguis	23%
<i>Combretum glutinosum</i>	Ratt	16%
	Nguediane	15%
<i>Guiera senegalensis</i>	Nguer	14%
	Tamarinier	11%
<i>Ziziphus mauritania</i>	Jjubier	10%

The role of trees was explored in the evaluation through inclusion of questions about tree husbandry in the household survey, discussion of the value of trees with key informants and visiting farmers fields where FMNR was practiced and fields where it was not practiced. All respondents in the household survey were asked if they had planted and removed any trees in the last four years. The responses to these questions were based on respondent recall.

Less than half of the respondents (n=309, 41% of all households surveyed) said they had planted trees in the last 4 years. For this group of respondents the most common tree types planted were Eucalyptus (33%), Prosopis (25%) and Faidherbia albida (18%). The tree types planted and the proportion respondents who planted them are shown in Figure 48.

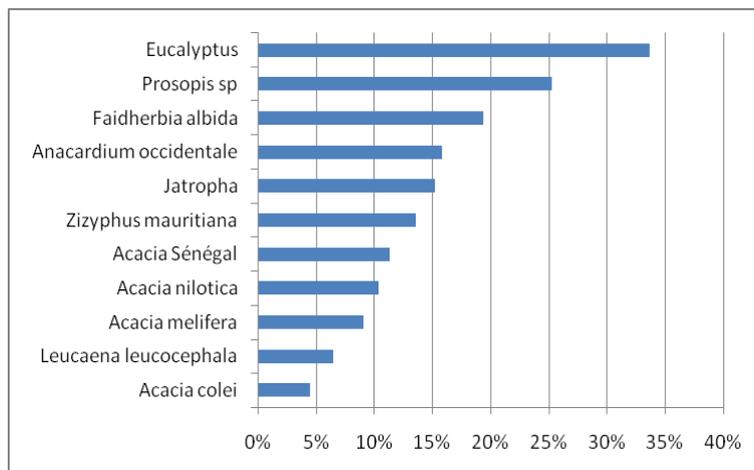


Figure 48 Tree types planted by respondents in project area in last 4 years

In terms of the average numbers of each of these types of tree planted, Jatropha, A.melifera, Eucalyptus and Prosopis were the most numerous as can be seen in Figure 49.

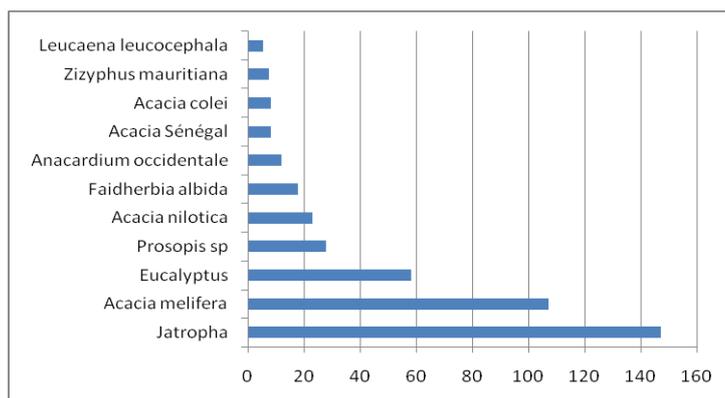


Figure 49 Species type and average number planted in households in last 4 years

When data for trees planted were disaggregated, 60% project participants compared to 33% non participants planted trees in the last four years. In addition, the total average number of trees per household for the project group was 117 which is more than three times that of non project households.

	Total respondents	Total number trees planted	Average number trees planted
Project participant	134	15704	117
Non project	175	5853	33

The promotion of Jatropha hedges by the project accounts for the bulk of the differences but the tree numbers planted were higher for all tree types mentioned (Figure 50).

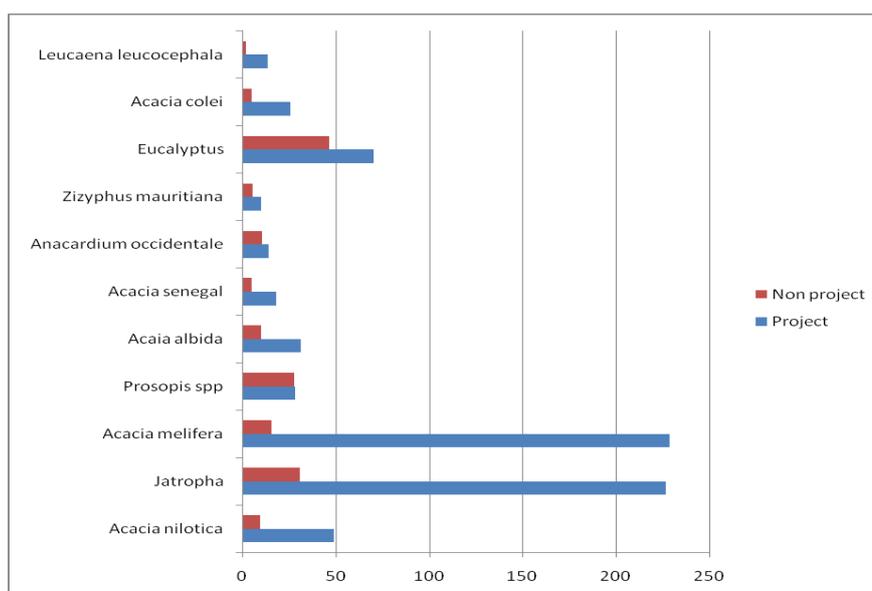


Figure 50 Comparison of average number of trees planted by project and non project respondents

The average number of trees planted for the different respondent groups is shown in Table 13. Extrapolating meaning from these figures, it can be said that training in FMNR and being a direct project participant have been a major positive factors in increasing tree numbers planted in the project area and this is most likely due to access to tree seedlings via the project and to knowledge built in the role and value of trees in the farming system.

Table 13 Number trees planted by different subgroups

Sub group	Ave. trees planted per household	Difference significant*
FMNR trained	126	Yes ($P=0.026$)
Not trained	44	
FMNR used	92	Yes ($P=0.008$)
FMNR not used	35	
Project	117	Yes ($P=0.014$)
Non project	44	
Male	74	Yes ($P > 0.001$)
Female	15	

* 2 tailed, equal variance not assumed.

The valuable economic role of trees in the farming systems was evident in feedback from one lead farmer who has a woodlot and seed collection systems that provide cash for children's needs.

The benefit of an environmental project to children is immeasurable and I am a witness and an example to the fact. There was a project here called PAGRAIM. And it dealt with trees, you fenced in a space and you planted trees in a space. I was a beneficiary and my trees are still growing. Each year during the opening of the school year, I simply sell seeds from my trees and with that I resolved 100% of the needs of my children. Acacia milifera and Acacia laeta. These are used for living hedges – once it is established it has very wicked thorns. [Thiappy lead farmer]

Farmers also highlighted the difference between tree planting and FMNR as an approach to getting trees back, stating that the former very often failed while the latter brought benefits in the short term.

Observation of preparation of farmland during the evaluation highlighted a serious threat to the success of FMNR in the project area and hence to the success of the project. The vast majority of

farmers clear tree, shrub and grass regrowth from their fields just prior to sowing, and they burn all of the precious organic matter collected. This is done to facilitate mechanised sowing and to use ash as a fertiliser for their crops.

Respondents in the household survey were asked whether they removed trees from farm land and the majority (93%) did so by a combination of slashing, cutting and burning. The most common trees removed from farm land were *Nguera senegalensis* (65%), *Combretum glutinosum* (57%) and *Piliostigma reticulatum* (46%). (Figure 51)

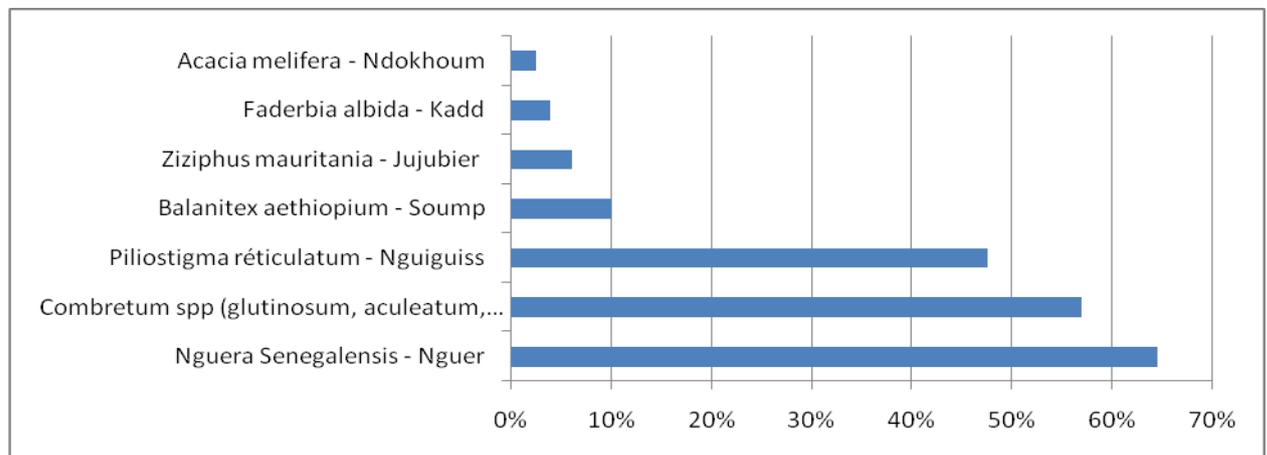


Figure 51 Tree types removed from agricultural land

Tree species currently removed by farmers in the project area are valuable FMNR species that have helped transform similar smallholder farms and decimated landscapes in Niger into vibrant forested farming systems. As explained by one key informant, unless people had seen these tree types reach their full potential, such as in mature FMNR regions of Niger, they would continue to believe that such species were detrimental.

.... From the exchange visits to Niger one woman [lead farmer] explained that the size of the Nguer tree was tree size, not shrubs like here. When once travelling on public transport someone told me about his experience that these shrubs cannot become a tree – therefore you must cut it. People are very sceptical that these shrubs can become trees. We need pictures. How do we overcome these very strong prejudices and doubts. [Teacher, Kaffrine]

A minority of farmers were also taking out highly valuable species such as *Ziziphus mauritania* which provides forage and fruit and *Faidherbia albida* which promotes crop growth. Comments from participants in FGDs suggested that some were responding to the FMNR message and were leaving beneficial species on their field.

Early on, I made the FMNR with the tree species called "Nguiguiss." Today my trees are able to provide shade and my returns are better. I use the bark as material to make rope. I never had this opportunity before. [FGD men Ndiognick]

The tree types mentioned and the proportion of farmers who mentioned each type removed were similar for all sub groups – it would be expected that the practice of leaving favourable tree species would be more prevalent in the direct project participant and FMNR user groups but this was not the case.

Respondents were asked how trees were removed and the majority (73%) said they used burning, while 46% used slashing, 45% used cutting and 23% mentioned grubbing stumps (digging them out). These data were disaggregated to into the gender, project and FMNR user groups to see whether the project had succeeded in eliminating burning and digging, the two most damaging practices for tree removal. Burning kills off young trees and new shoots and releases carbon while destroying organic matter and removing stumps eliminates potential for natural revegetation.

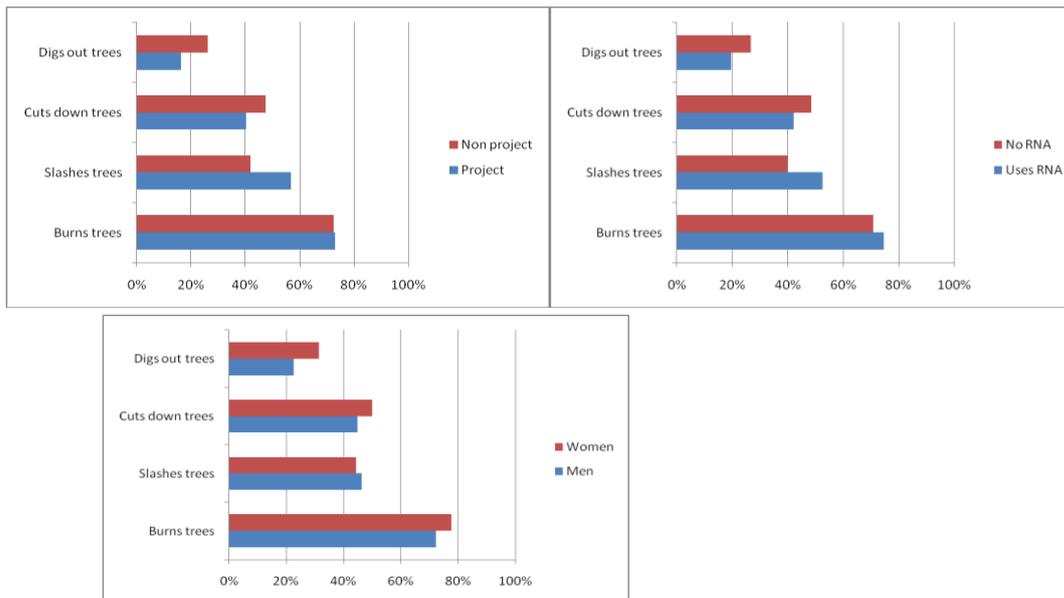


Figure 52 Prevalence of tree removal methods for respondents who removed trees

As can be seen in Figure 52, the tendency to use burning to remove trees was similar for all sub groups while the tendency to dig stumps out was lower in project than in non project group, and lower in FMNR users compared with non users which is encouraging.

Observation during the evaluation fieldwork was that the work of clearing and burning on fields was being carried out by men or male youths. Interestingly though the data suggest that women tend to use burning and digging to remove trees more than men. The role of trees as an energy source is discussed in the next section.

5.2.7 Household energy systems

Of particular importance to this project are the energy systems in most households given the links between reliance of firewood and widespread deforestation. In the SFLEI area almost all households (90%) use wood for their cooking fires (Figure 53). For the FMNR efforts to succeed in bringing back trees there needs to be promotion of alternative fuel cooking systems in the project area. Biogas systems hold promise in the project area according to key informants but they were present in only 7 (1%) of the surveyed households.

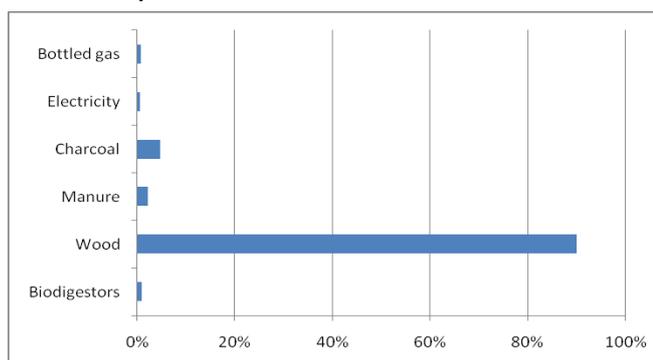


Figure 53 Types of fuel used for cooking

The efficiency of energy systems for cooking are also an important consideration and in the project area almost 80% of households use traditional open fires. Open fire systems are very inefficient in terms of firewood consumed for heat generated and there are significant health and safety risks for those present in the room – women and children. Overall improved stoves were present in about

20% households which is encouraging, but half of this group also still used the traditional open fire as well (Figure 54). Further support for promotion of improved stoves in the project area would be highly beneficial.

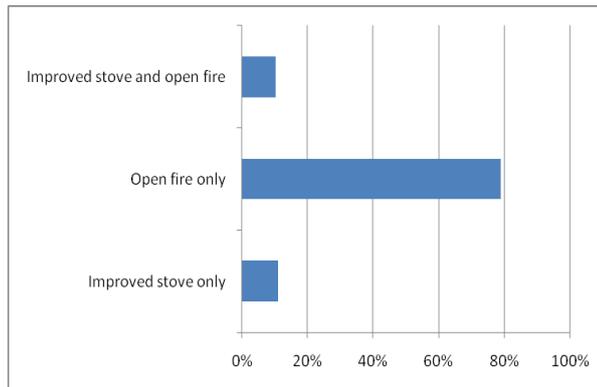


Figure 54 Household cooking systems

One of the most important outcomes of successful FMNR is the change in patterns around collection of firewood that women source for the household. When tree resources are not managed, branches and even whole trees will be taken from communal land and agricultural land at a rate that leaves the surrounding landscape totally denuded of tree and shrub vegetation. This is the situation in much of the project area aside from some protected trees such as Baobab and Mango.

With the promotion of FMNR in the project area it could be expected the proportion of households who collect firewood from the communal land should be declining and this does seem to be the case. While no baseline values are available, if we assume that the communal land was the main source of wood for most households at the start of the project it has now dropped to less than 60%. Almost a third of respondents sourced firewood from a *zone de parcours*, or a designated area, which is likely an outcome of the project (Figure 55).

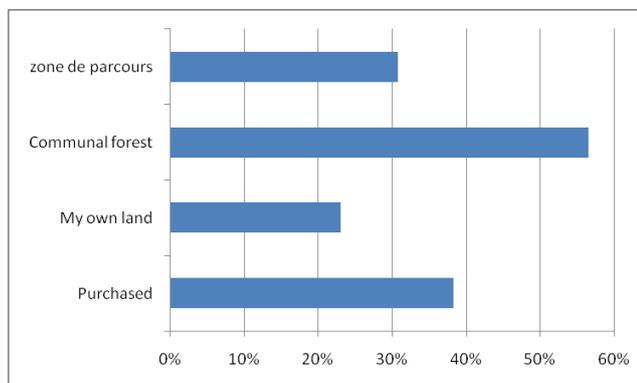


Figure 55 Sources of wood for cooking

Interestingly 38% respondents said they purchased wood which means that there is a thriving fire wood industry and wood is economically valuable. This is important for the success of FMNR when farmers begin to view managing trees as a cash crop.

When the data for sources of firewood were disaggregated by gender there were some important differences. About twice as many male respondents 24% sourced wood from their own land compared with 12% women. Also almost twice the number of women (61%) purchased firewood compared with men (36%) as can be seen in Figure 56.

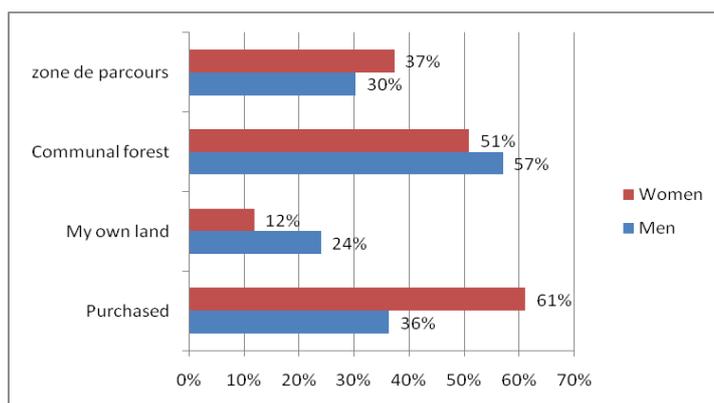


Figure 56 Women's and men's sources of firewood

The message in the data - that many women purchase firewood - was supported by feedback during FGDs. When asked whether there had been changes in women's chores since the project began the response was that a lack of firewood has compelled women to buy it.

Question: Is there any... change in the four years in the women's chores?

Yes, the unavailability of fuel wood has compelled women to buy it. [FGD with women]

The gender dependent patterns around securing firewood must be taken into consideration in the development of training, management and the development of local bylaws governing access to trees and wood.

The FGDs with men in the different ADPs did explore access to wood and there were contrasting views. When asked directly about the change in supply of firewood, some participants pointed out that women had more limited access to firewood as a result of FMNR.

.... since there is now restricted access to the trees the women have trouble finding wood in the beginning. So one of the challenges is to find short term solutions so that people are not tempted to steal wood from the trees. [Thiappy lead male farmer]

Today the research for fuel wood is quite difficult. Because the forest is now protected and cutting trees is forbidden. Earlier the access to the forest was not restricted and we could cut wood in a chaotic manner. Now we know that without the trees the soil will become poor, and the rainfall will reduce....There are difficulties in finding firewood but the advantages of restricting access to wood outnumber the inconvenience...[FGD with women]

Respondents were also careful to point out that this was a timing issue – initially wood availability in FMNR area declines but eventually they would be able to prune branches from fields close by.

Women need just small branches for cooking and they use it in their home. At the moment they still have to go looking for firewood but in five years....[Farmers Kongheul]

In one project area the responses from FGDs to the question about changes observed as a response to protecting trees stated that women's time previously spent collecting wood had reduced and they now had more time for other activities.

The changes are clearly visible, women no longer seek the dead wood in a disorganized manner because the project has taught them good methods of pruning trees...[FGD men]

The chores of fetching firewood have decreased sharply for women thereby enabling them to engage in other activities. The project has organized vigilance committees (a committee for men and another for Women) this ensures that there is no excessive and uncontrolled cutting. WV provided training and support. [FGD men]

The above comments from men seem to gloss over the fact that there is a struggle for women initially in the transition from having free access to the surrounding shrubs and trees during the dry season to no longer having access until such time as the FMNR trees are pruned and coppiced. In

addition the experiences for women farmers participating in the project and practicing FMNR on their fields is likely to be very different to those of the wives of farmers practicing FMNR. Gender effects of the project are discussed in Section 5.5.6.

Finally respondents were asked about sources of energy for lighting in their households and the most prevalent was the use of torches (over 80%). Only a few households were using renewable energy such as solar lighting and promotion of such technology needs to be supported (Figure 57).

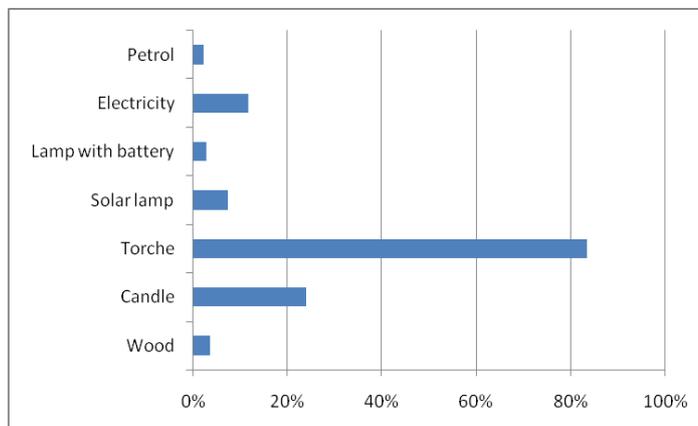


Figure 57 Sources of energy for light in households

5.2.8 Role of livestock

When FMNR trees are mature, they bring the added benefit of attracting grazing animals outside the growing season. Their manure and urine bring valuable fertility to the soil. However, a major initial challenge to increasing density and quality of tree cover through FMNR is the impact of livestock. Cattle, goats, donkey and sheep can browse immature trees to the point that no leaves are left, they ringbark trees and break the main stems of immature trees. Nomadic farmers may also cut branches and whole trees down so as to make the leaves accessible to their livestock.

Livestock do significant damage to cereal crops if they are not kept off farmed fields during the growing season. The scale of livestock damage to crops in the project area is potentially large given the tendency for unrestricted grazing and the existence of nomadic Peul farmers with large herds.

Hard won benefits of improved crop yields resulting from FMNR will be quickly negated by uncontrolled grazing. Therefore an important part of promotion of FMNR needs is restricted grazing – where livestock are kept away from vulnerable crops and trees. Just over a quarter (28%) of all respondents in the project area use restricted grazing (Figure 58). When data for project direct participants and non project participants were disaggregated, the proportion was much higher in the project group (41%) – demonstrating a positive response to promotion of restricted grazing.

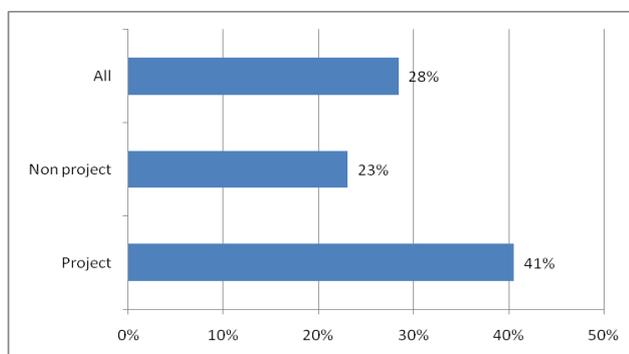


Figure 58 Practice of restricted grazing in the project area

The increase in restricted grazing is possibly reflected in the results to the survey question about changes in livestock damage to crops in the last four years . About 44% of all respondents said it had decreased while 32% said it had increased Figure 59.

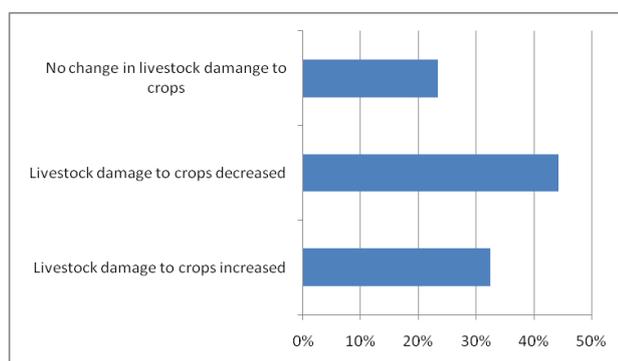


Figure 59 Changes in livestock damage to crops in last four years

For respondents who used FMNR, 47% said that livestock damage to crops had decreased while 42% in the group that didn't use FMRN said it had decreased.

5.2.9 Income

A key indicator of the project's contribution to improved wellbeing of families in the project area is income. Women who participated in the FGDs were asked about change to income as a result of the project and one group mentioned that FMNR had led to increased in yields which increased revenue which they then used for children's education and health.

Facilitator: What changes have you recorded with respect to your incomes?

Respondents: Improved yields from FMNR had a positive impact on our revenues...This enables us to cover our expenditures particularly those related to child education and health. It has also enabled us to assure food needs for our families.... FGD women]

However, getting reliable estimates of income at the household level is problematic. Proxy indicators and wealth ranking can be used to class sectors of the community to different wealth groups, but to implement these measures requires study, exploration and testing of the associated tools for internal and external validity. Doing this was beyond the time and resources allocated to this evaluation.

To get an idea whether there had been any change in income, respondents in the household survey were asked to state whether their household income had increased, decreased or not changed over the last four years . According to the results a clear majority (62%) said income had increased, 12% said there was less income and 26% said there had been no change. For all subgroups there was a majority view that income had increased, but the proportions varied quite a bit depending on the group (Figure 60).

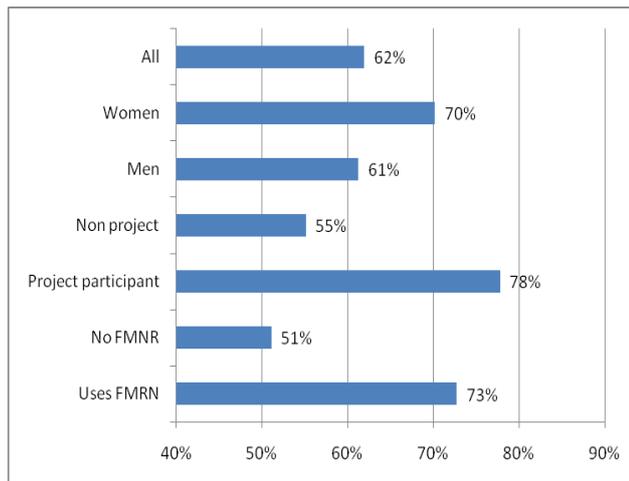


Figure 60 Perceptions that household has increased income in last four years in different groups

These results suggest that being a direct participant of the project, practicing FMNR and being in a woman headed household means you are most likely to have experienced an increase in income over the last four years. The apparent association between gender and experiencing improved income was explored using Pearson Chi-square test and the association was significant at 95% level. Increasing women's income has a direct positive benefit for children – whose nutrition, health care and education are often totally dependent on their mother's ability to pay cash for these things. Associations between being a project participant and observing increased income, and for practicing FMNR and observing increased income were both significant ($P < 0.001$). Therefore it would seem that the project activities are likely to have contributed to increasing income at the household level.

When data were disaggregated for the four project ADPs, there was quite a bit of variation with respondents in Nguer and being much more likely to say income had increased than those in Ndiognick Thiappy and East Kaolack (Figure 61).

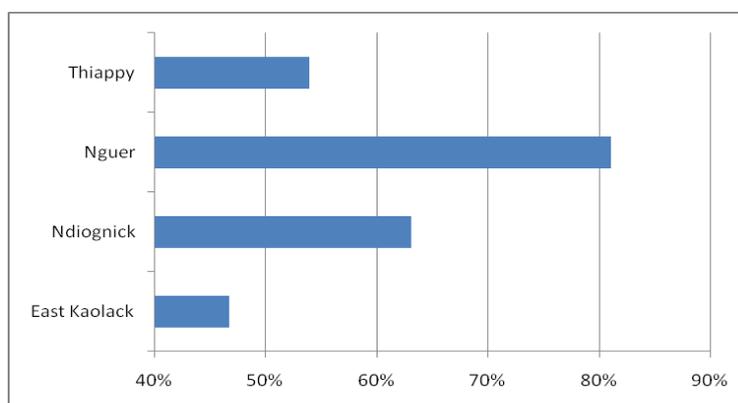


Figure 61 Increase in household income in project ADPs

When we look at the levels it is likely that there has been more project activity in Nguer than in the other ADPs. This is supported by the high rates of participation in the project and levels of training in Nguer.

The project design incorporated accompanying measures to facilitate uptake of FMNR and for the households who benefited there has been indirect but positive outcomes on income levels. For example farmers who have not been able to save seed from year to year due to pressure on food have been assisted by the project and say they are now self sufficient in seed production. Also where small ruminants have been provided women have multiplied the numbers and this translates to a

significant increase in stored assets.

.....for some time it has been very difficult for farmers to survive on their own seeds but with the one seed supply by the project we have been able to multiply and now all farmers have their own seed. The sheep that were given to women, from one some now have 2,3 or 4. [Lead farmers, Thiappy]

5.3 Unanticipated outcomes

One aspect of program evaluations which must never be ignored is identifying and describing the unanticipated outcomes, both positive and negative. All key informants in the qualitative exercises were asked whether the project and the promoted technology, namely FMNR, that were not expected. Some community members said that there were no negative outcomes at all.

Facilitator: Have there been any negative effects?

No, not one at all. (both the female and the male farmers state this) Every tree is a blessing. If one tree can bring so much, imagine how much benefit there will be with many. [Lead farmers Kongheul]

However the issue of limited access to firewood in the early stages (also explored in 5.2.6) was identified by both male and female lead farmers and in FGDs with.

The first disadvantage is that since there is now restricted access to the trees the women now have trouble finding wood in the beginning. So one of the challenges is to find short term solutions so that people are not tempted to steal wood from the trees.... Another problem is protection of the trees in our fields from theft. [Lead farmers, Thiappy]

However, such comments were qualified with an explanation that this disadvantage was necessary and likely to be short term, and that accompanying measures, such as fuel saving stoves and help to develop livestock raising for example, were helping to lessen the pain. As shown in section 5.2.6, the following comment came from women in a FGD.

Today the research for fuel wood is quite difficult. Because the forest is now protected and cutting trees is forbidden. Earlier the access to the forest was not restricted and we could cut wood in a chaotic manner. Now we know that without the trees the soil will become poor, and the rainfall will reduce. There are difficulties in finding firewood but the advantages of restricting access to wood outnumber the inconveniences. We can remedy the situation of fuel wood shortage by using fuel efficient stoves. We received a training session in this regard. [FGD Women]

Theft of trees on fields was also identified as a disadvantage. However this is not unique to the practice of FMNR - it is endemic in the region and indeed all rural areas where wood is in short supply. The solution requires collective action by communities and pastoralists, good knowledge and application of bylaws by community with support from the relevant government departments and agents.

There were several important technical outcomes that had not been previewed in the original project design. According to project staff several technical interventions were introduced during the lifetime of the project and evidence of the benefits to community participants was mounting. One particular success was that trial of a new crop in one of the project areas – which has promising results and clear benefits for women.

Nobody ever thought about cultivation of rice in the valley of Diasoum but the project trialled the 'rie de plateau' we gave them 600kg of rice and they harvested 1000kg (women). This was during the trial period. They had this performance despite the fact they didn't know how to cultivate rice so there were a lot of losses. This is the first time this has been done here. More than 100 women participated in this rice production trial. [WVS Project Manager]

Another promising intervention in the SFLEI project was the introduction of Biogas Digesters to replace firewood for cooking. The system captures gas from fermentation of a bovine manure and water slurry. The slurry can then be used as a nutrient rich organic fertiliser.

Another unexpected outcome was the introduction of the biogas digester. The project stimulated the interest and now for lighting and cooking it is well respected. [WVS Base Manager]

This intervention will not be suitable for all households as it relies on an ability to own and to keep cattle penned up for manure collection, and is most profitable when there is space for a market gardening.

Farmers are livestock raisers and so they all have the raw material for the biogas, but it is difficult to have two bulls in each household. Most don't have enough cattle. [Lead farmer, Thiappy]

However the desire from community members - who discussed this intervention during interviews - was for assistance from the ADP to enable farmers with suitable resources to set up biogas digesters.

This is what pushed the [SFLEI] project to meet with biogas project to see if they could find an alternative. We have seen the cost and know how much the govt can subsidise but until now the costs it too high. So we are talking to ADP managers to see if WV can contribute a subsidy so that farmers can afford to get biogas with a small contribution.... [Lead farmer, Thiappy]

Biogas may look trivial but I feel it has potential to explode [take off] and I would recommend that this is integrated within any new project proposal. It is an intervention that would really help women. [Lead farmer, Thiappy]

We want the ADP to get involved – we really need to ADP to integrate this into their programs. We can't just have it as an add on. [Community facilitator]

A local consultant was very supportive of the idea given that this is an intervention which has multiple benefits and was a self sustaining system.

Biogas could be one of the best interventions ever. It is a perfect example of an integrated system – with crop residue fed to cattle, and cattle dung feeding the biogas plant, and the biogas slurry feeding the compost pit, and compost going on the crops growing even better and more crop residue for the livestock. [Consultant]

Other unanticipated benefits of the SEFLEI project were the introduction of beekeeping for honey and grafting an important local species, *Ziziphus Mauritania*.

Also the production of honey and of the grafted ziziphus which has ended up being very important. I thought it would be difficult for the farmers to adopt this technique but in some years time all of them will be doing it. [WVS Project Manager]

In summary, the issue of reduced access to firewood in areas where farmers implement FMNR is highlighted in the evaluation fieldwork. However the community have been able to leverage project resources to help get around this. Accompanying measures that enabled women to use less firewood (e.g. improved stoves), earn more income to purchase firewood (e.g. small ruminant raising) and replace wood as the major fuel source for cooking (e.g. with biodigestors) have been the key to success in the SFLEI project. Future project design and planning will be informed by these lessons.

5.4 Partnerships

Quality of partnerships with and between local stakeholders is paramount to program success. Partnerships were explored in SEFLEI through specific questioning of lead farmers directly involved in the project. Such questions were also included in discussions with men and women in the broader ADP communities, local government agents, project staff and primary school teachers. Questions were around partner participation in project design, monitoring and evaluation and about the roles each partner performed, and their satisfaction with those roles.

Community key informant feedback suggested there was a high level of commitment and participation by community in the conception and implementation of the project. They understood their role within the partnership well, and they actively participated. Community partners (among others) were involved in setting the agenda for the end of project evaluation.

When we came to Thiappy that stimulated the conseil municipal (local council) and othersand we created a team, so every month we meet here to provide feedback and exchange information and we evaluate everybody with respect to their roles. So instead of just letting the technical services report to WV, we, as the community have to verify what is being sent back and provide our inputs. Eau et Forêt, IDEN, and the rural council. This comes from the understanding that since we are the beneficiaries we need to take the lead. Every time we leave a meeting like this, since we are leaders, we have to go back to the village and provide feedback. At the village level we've involved all the influential people. We've gone to the religious leaders, the griots [traditional community storytellers and poets], once they get involved the word that they say, people will do it without question. So we have also involved them in training. The local communications are the griots. Just to show you how important it is [community participation], when we heard about the [SFLEI] evaluation, we met and submitted all of our questions. [Lead farmer, Thiappy]

A community facilitator explained how the history of failed tree planting projects put the SFLEI project at risk and how they managed this risk by engaging potential partners early on, including education, government department and the rural council and others. They were fully cognisant that the only possibility for success lay in collective action.

We have done so much replanting in Senegal which has just not worked. The biggest risk was the past events of forestry which have not worked and this was a potentially huge obstacle. So we called a round table of teachers Eau & Forêt, ANCHAR, IDEN, rural council... We asked Eau & Forêt to bring the technical expertise. In SFLEI, each partner has their own role. We consider everyone around the table to take part in lifting the stick to hit the environmental problem. It is an enemy that we have to kill but we need everyone to lift it and kill the enemy. This is a key part of the success. [Thiappy Community facilitator]

The signals from community partners were very positive – for example one group of lead farmers explained that all farmers were partners and when asked if they felt like equal partners, their response affirmed this. There is a robust partnership between community, government Eaux et Forêt Department staff and WV.

Apart from the formal structure [project committee] every household is a partner because we all have farms, so we are all implicated.The partnership is with WV, the community and Eaux et Forêts. This has increased the openness and confidence. They have seen their interests recognised by the protection supported by the Eaux et Forêts. [Lead farmers, Kongheul]

Farmers and other community members were asked specifically about the place of Peul (who are nomadic herders) within the partnership – given that these farmers often cut down trees to feed their livestock and so are a potential threat to FMNR. The feedback from lead farmers indicated that they were proactively engaging with the Peul farmers in a constructive way, both face to face and via local radio broadcasts.

We have created a welcoming committee who explain to the visitors [Peul] that this is FMNR territory and the trees are marked and cannot be cut. There are also radio broadcasts to explain the changes in the zone. [Lead farmers, Kongheul]

Interpreting the feedback from farmers it appears that they are well organised and are taking a diplomatic and strategic approach to negotiate new social values around trees with the livestock herders. Because livestock must have a vaccination card to be able to enter the village territory, and must approach the chief to request permission – this opportunity is used to explain the rules regarding use of trees.

We decided that each visitor who visited the village, because they are also Senegalese, they need to report the village chief, show their identity card and the vaccination card of the livestock to the village

chief. So bringing livestock from elsewhere into the community without vaccination is a source of infection for our livestock. Once the village chief has been sure the ID is done then we explain to them the bylaws. So the key thing in the convention is no cutting of trees, but what they can take off the ground is OK. The nomads always have a contact person and this person is now responsible for the behaviour of the visiting nomad. [Lead farmers Thiappy]

Considering the history of and potential for resource conflicts between sedentary and nomadic farmers in fragile Sahelian ecosystems this could have been a significant obstacle to the success of FMNR. The feedback above indicates a major achievement by the local community and their partners.

Community members were asked to describe the responsibility of each of the stakeholders in management of the environment and the response indicates that responsibilities are understood, and that the systems and processes they are meant to support are working. A case was described where location of livestock trail in a FMNR protected area was resolved with the government *Eaux et Foret* Department playing a pivotal role.

The rural council manages public land and distribute farm land to community members who apply for [it]...Volunteers from the FMNR are identified by the project...Recently during the course of tracing livestock trails, FMNR protected areas were disturbed. It took the intervention of Eaux et Foret to arbitrate between the two rural communities. This made us realize that public authority has a crucial role to play in this field. [FGD men]

When asked to evaluate the role of the rural council in managing the environment community respondents knew that the authority for environmental management was at local government level and they described the responsibilities of the Lands Commission and the *Eaux et Foret* as taking care of forest management issues.

We know that the authority for environmental management has been transferred by the state to the local government. The Eaux et Foret is taking good care of the forest management issues within the communities. Land management is the responsibility of the land's commission. The fight against bushfires; we have not used the services of Water and Forestry department. Whenever a bushfire is declared somewhere, the entire population is mobilized to put it out immediately. The Water and forestry departments once showed up after a bush fire, but it was to conduct investigations as to the origin of the fire. [FGD men]

Under the auspices of the SFLEI project the partnership between the community and the *Eaux et Foret* department has progressed to the point that community wish to take a formal role in protection of FMNR trees and was working with the department to refine their own set of rules and regulations they wished to enforce.

We now have people who are so interested there are people who have undertaken to be vigilantes of the land and they would even like uniforms so that people can recognise that they are the custodians of the land. So now the E&F and project staff are working on designing a badge and how to make it official.

Community in the project area view their forest as an asset to protect – this shift from individualistic exploitation of resources to unified management of collective resources is radical shift in the mindset in this area. It is also crucial to the long term success of rural livelihoods in the region. Project farmer participants were able to articulate the approach to protection of tree resources and the way community participation in the design of local bylaws. They highlighted the strength of the partnership with government services.

So we have already called together the whole community and designed self regulations which is already in a draft form and which describes the rules and regulations regarding the management of the environment. We have deposited this with the local authorities and we are waiting for the approval and once the approval is achieved we now have a way of enforcing these rules with the entire community. We have a very good partnership between all the services. [Thiappy lead farmers]

A key informant from the government department of *Eaux et Foret* explained how the community , through the Rural Council was involved in designing a code of conduct with regard to exploitation of

local tree resources and a role in enforcing these codes. However, there was some uncertainty about the ability of community to actually enforce the code.

The rural council is involved at two levels. The first is the at the level of the code of conduct, they are supposed to establish the code of conduct. Once the process is done the next role is that application of the code of conduct and it doesn't appear that the rural council has the tools to enforce the code of conduct... [Departmental Forestry Officer]

Despite some concerns, a quality partnership between community and the key department of *Eaux et Foret* has developed. There is also evidence of a quality partnership between the community and the project. Feedback on the partnership between WV and the *Eaux et Foret* Department was more mixed. While there was tremendous support for the project from both WVS and the *Eaux et Foret* key informants and good evidence of project staff and government partners actively working together on reforestation through promotion of FMNR, it was apparent that the quality of the partnership needs to be strengthened – both WVS and *Eaux et Foret* need to increase their investment in communication and planning.

The biggest challenge is the lack of communication and planning.....At the level of Eaux et forest and staff of Beysatol [SFLEI]. The responsibility has to be reciprocal, Beysatol [SFLEI] has to be able to stimulate communication and so should E&F. It has to be both ways. [Departmental Forestry Officer]

Part of the difficulty of this is a clear tension arising from the fact that the desired divisions of labour and responsibility for each of the partners may not be reflected by the level of resourcing and authority available to each of the partners. For the government partners to play the role they need to play requires advocacy for increased investment in these services by the government. This is an important issue to pursue in the new *Beylene Sen Tol* project.

5.5 Sustainability, integration and cross cutting themes

The preceding section explored partnerships which are a key element of sustainability in programs. This section considers sustainability in terms of steps taken towards transition, the knowledge and attitude of tomorrow's farmers (children) and performance against relevant sustainability indicators mentioned in the project design. This is followed by an exploration of sustainability through the LEAP lenses of integration and cross cutting themes.

5.5.1 Sustainability – stakeholder views and ideas

Ideally preparation for WV's transition from leading to supporting role occurs gradually throughout the life of the project, to avoid dependency and the disruption of a sudden withdrawal. In practical terms transition is evidenced by assumption of responsibilities and decision making by community and their local partners.

Transition was discussed with the major partner *Eaux et Foret* and the response suggests that it is definitely occurring. A key informant thought that it had started and went on to cite the example of the involvement of the head of this department in the evaluation as being evidence of this.

Yes we can say it has started.....For example during this evaluation the head of the core team, is the head of the Eaux et foret. This position makes it feel as though [Eaux et Foret is] the ... most important ... in the project. [Departmental Forestry Officer]

Project staff described a high level of ownership by community of the SFLEI project especially among the rural councils.

All the rural councils in the target ADPs actually showed proof of the..[ownership].. of the project. All the ADPs not involved with SFLEI, have started adopting FMNR.... [SFLEI project manager]

In addition, after the SFLEI project was implemented so many other ADPs expressed their interest in FMNR that WVS ended up creating a new project – *Beysatol*. According to the project staff the

farmers themselves have become the strongest advocates for FMNR and for better environmental management such as avoiding burning.

One of the best proofs of community ownership was that in the beginning SFLEI had limited coverage, but the demand for intervention in other [ADP] areas was so large that we thought about looking for an additional project and this was the origin of [the] Beysatol [project].... We can see the ownership demonstrated in individuals. For example [at] one of the farms we visited ... the farmer was so convinced he could convince anyone [about] why burning was such a waste. [ADP base manager]

The WVS staff were keen to see promotion of FMNR applied more broadly in WV ADP programs rather than being delivered through grants projects. To this end, a new program, *Beylene Sen Tol* has been approved by WVA to commence in FY12.

Some concern was expressed about the SFLEI project model of FMNR promotion with 'accompanying measures' because it may yet prove that these are more influential in the high participation and ownership by community than learning FMNR.

We need to change the accompanying measures. The way we do it now....once the [accompanying measures] disappear, the motivation may also disappear. We need to find a way to avoid this.... [ADP base manager]

The training, per diem, food for work and assistance with assets provision are contentious issues in general in WV programming because they can be the major driver for communities desire to participate. In some cases incentives will achieve participation only and not the desired behaviour change in the long term, despite a significant investment. However, there is evidence that such accompanying measures are not an issue – they can be an effective means to an end. Ultimately a good idea will always take hold and the exposure to the idea is all that is needed. Some people may well participate to access the incentives, but in doing so, they change behaviour and become advocates for change in their own community. This is especially the case in SFLEI because of the obligation for trained community members to then train others.

Comments from lead farmers and community during FGDs suggest that it is the belief in FMNR and the access to technical support from the project that farmers really valued. The accompanying measures are much appreciated because they do assist participants in practical and meaningful ways (e.g. see Section 5.2 and 5.3) and they would like these to continue. But they are prepared to continue with FMNR with or without the project and feel strongly about the need to promote this idea all over Senegal.

Even if the project would not continue, we are ready to keep on going with FMNR. Even when we renew some [participants] are pulling out so that new people can come on board, because we are ready to keep going by ourselves. We have set up our own account and are ready to take off.We admit that we have a way of doing it [FMNR] but the technique of the project is much better. If we had our way we would ask you to extend the project not only in our department but to the whole country. [Community leader and lead farmer, Thiappy]

The following comment from one lead farmer shows just how much the SFLEI project is valued and highlights that some farmers at least feel the idea is so important there isn't any need for other motivations.

... there is no need to motivate us with sheep and etc... we should be paying you, we should be compensating you over time. Because the project itself gives so much. [Lead woman farmer, Thiappy]

Another farmer pointed out that a health project had been effective in changing their behaviour because they were still using the promoted practices. However, for this key informant the strength and uniqueness of the promotion of FMNR was the fact that aside from technical knowledge and support, the only other investment of resources that was needed came from the community themselves.

The health project was interesting because even though it is finished we are still practicing what we learned. Same with hygiene and sanitation. But what is particular/special about FMNR there is little resources needed – because it is the community themselves who do the work. [Lead farmer, Kongheul]

One topic where there unanimous agreement among community stakeholder groups was the desire to see the project continue for at least another four years and preferably longer. The farmers who have already change practice need continued support and more time is needed to realise the full benefits for food security and livelihoods.

We all agree that the project is very useful but it could be even more useful because 4 years is not long enough. Our prayer is that God helps us to get an extension because it can take about 10 years to get to a point where nobody can destroy it. [Lead farmer Thiappy]

We are very grateful because by introducing the trees they have helped us increase the livelihoods sustainability. At my place the social awareness has been well done so at my village there is good awareness, compared to before when women and children were not aware...I really encourage an extension of the project. We see the link but we need more years to the point that the yields are increasing. [Lead farmer Thiappy]

Commenting on sustainability of FMNR and accompanying measures the *Eaux et Forêts* key informant stressed that their department would soon become the leading partner with the community, while the role of NGOs would reduce over time.

As I said the department of Eaux et foret has a leading role to play. The department of Eaux et foret should be the first to own the project without any interventions. As the project progresses, the intervening NGO should become less visible. Their presence should be reduced. [Departmental Forestry Officer]

The key informant for the major partner *Eaux et Forêts* stressed that reform to the local laws governing wood cutting was required to ensure that FMNR would be sustained as a practice. At present farmers who want to sell the produce from an FMNR tree need special permission and this was a significant constraint. If farmers were free to manage the FMNR wood for profit this will ensure sustainable outcomes.

The results and importance of FMNR is a given in the equation, but the mechanism that we need to make this sustainable, is related always to the fact of making the farmers benefit. If they could sell the coppicing product without being harassed that would be a good deal and there is a convention so when the concerned farmer see his interest that is what will ensure sustainability and as I said the department of Eaux et foret has a leading role to play...

I repeat that there are lots of silvicultural strategies that have to accompany the program in terms of maintenance and in terms of knowing when to do the coppicing. The product resulting from coppicing, what value would that have to the farmer, would the farmer have the opportunity to go and sell it. So if in the very near future it is confirmed that the farmer can sell the products of the coppicing, this will enable us to render the outcomes of the project sustainable. Apart from the results in terms of improved crops, the advantage of selling the coppicing products is equally important. They could sell it in Louga for example. [Eaux et forets partner]

Project key informants feel that a key requirement for sustainability of FMNR will be building knowledge and capacity among not only government but non-government agencies who work in the Kaffrine zone.

The next thing to do is to extend the partnership to all NGOs in the region so that it is not monopoly of WV but is a vision shared by everyone working in the zone. [ADP base manager]

A second action needed to underpin sustainable outcomes is to build more capacity at the level of community by organising community based organisations (CBOs) in each village location.

We need to put in place CBOs responsible for FMNR. Also we need to make sure that the locals have regulations and these become official and are effectively applied by the rural council. [SFLEI project manager]

Creating an association of farmers is a strategic starting point as even without the project they can just take over [the activities]. [Project facilitator, Thiappy]

In discussions with community the conversation around project sustainability centred on the need for continued support at this stage. Project sustainability was a key theme in discussions with lead farmers in the different ADPs. The responses were consistent and intimated that withdrawal of support by WV would mean a big step backwards for the community and risked losing ground, but at the same time they were prepared to keep on trying with FMNR. The following conversation is a good example of this and highlights the intergenerational element of the behaviour change that is needed for successful restoration of trees and farming in the region.

Facilitator: Sustainability?

Respondent: We are just beginning to learn. If the project leaves now it will be very hard. We still need to learn about new species. We know the partnership with Eaux et Foret will help us. We are ready to keep protecting. This is our duty from now on.

Facilitator: What else is needed besides the technical support?

Respondent: Once we get to the point when we really appreciate the interest ourselves, we will no longer need the partnership.

Facilitator: How long will it take?

Respondent: 3-4 more years. It is for the future generations – in 25 years most of the work will be done and it will be done by the children.

[Respondent - Lead farmer from Kongheul]

The following comment from a lead farmer, stating they would have increased their efforts long before now if they had known the importance of FMNR and *Faidherbia albida*, highlights community ownership of responsibility for making the required changes.

*There are many advantages of FMNR. If we had known this sooner we would have increased our efforts long before now. The lifecycle of the tree is 20-30 years before it becomes a mature tree. If the project leaves now our fear is that our children will not have the time to understand the importance of the Kad [*Faidherbia albida*]......We are now all aware that the best yields come from around the Kad [*Faidherbia albida*]. So we notice the decline of the tree population in the environment. If the support[from the project] stops now we are scared we will go back to the starting point. [Community leader and lead farmer, Thiappy]*

Also the comment above highlights the importance of including children in the efforts to induce behaviour change, and the fear of returning to the starting point if the project phases out now. Another farmer in a FGD felt that the food assistance was still very important, and the number of FMNR animators (trainers) needs to be increased in order that there is scope to train and educate the children.

I think it is desirable that food assistance be continued initially for some years. For monitoring it is necessary to increase the number of people now because the number of contacts is minimal - only one animator for 87 villages that does not allow time to correct, educate and train the youngest in this respect [FGD men]

During discussions about sustainability with lead farmers the conversation turned to whether, as in many rural regions in the Senegal, families were leaving farming because it was no longer possible to make a living (as explained in Section 2). Among the Kongheul lead farmers the consensus was that with good management farms can be profitable and farming is increasing seen as a respectable business, so fewer people are leaving and if they do, it is mainly temporary migration, rather than a permanent exodus.

There are those who leave the village and abandon their farms, they go for a short time only, but they come back. It is preferable to migration now. Yes farming is becoming very respectable business and people are asking for land. [Lead farmer, Kongheul]

Perhaps the most meaningful and exciting statement about the SFLEI project came from a female lead

farmer who had visited Niger, and had seen the change FMNR can make and was making to her own surrounds. She concludes with a comment about the importance of the FMNR facilitators and with a wish that they will continue to be supported and to work together. The comment here is also shown on the title page of this report.

Thousands of projects have come through here but this there is no comparison, if we are the judges. We have nothing but our environment. Since we started working with FMNR we have already started seeing the benefits that we have not seen with any other project. The type of benefits we see pushes me sometimes to leave my home and just walk through my field to appreciate the trees and environment. When things get to where they need to we will see more yields and the path will be clear. The work of facilitators was persistent and we are so grateful and we pray to God that we can stay together for a long time. [Thiappy lead farmer, who had visited Niger]

Feedback from the major partner Eaux et Foret was succinct, the results of the promotion and uptake of FMNR are evident in the project area and this in itself demonstrates that outcomes are very likely to be sustainable.

Without trying to pronounce the % of success the fact that the results of the FMNR are quite visible, it is sufficient to draw the conclusion that it is sustainable. [Forest agent Eaux et Foret]

5.5.2 Children the FMNR farmers of tomorrow

The project focus is to achieve practice change by today's farmers. However, tomorrow's farmers will soon be the custodians of the land and building their capacity is vital. In addition it is children who provide much of the labour for clearing fields prior to sowing and they can feed knowledge gained at school into decision-making on their own farms.

When the student has the knowledge we believe that they can influence because it is the children who do the farm work. Despite the age of the child, because they do the work, they have a big opportunity to do FMNR. when the children are clearing the fields ... this is where the work of the FMNR begins. [Teacher, Kaffrine]

The SFLEI and Beysatol projects targeted capacity building of children via teacher training in FMNR. Key teacher informants explained that they had had a reforestation project for about five years, and were teaching various environment topics as part of the normal school curriculum.

We have courses concerning environmental studies – 'Science and Technology'. 'Living in your environment.' In this course we teach different types of trees, their life cycle and production techniques. We also teach how to raise trees in the garden, the importance of manure and organic matter... organic value of leaves and branches. The trees bring rain, shade, food, wood and the children also use the trees for their recreation so they can see already the usefulness of the trees... [Teacher, Kaffrine]

The department of education and teachers were brought into a partnership with the community, WVS and the Eaux et Foret and teachers were trained. Consequently the school curriculum was changed to include FMNR.

The Eaux et Foret have established a rural committee in each village, so we are doing a partnership between the school, E&F, the committee and WV.We were trained (all the teachers) over 2 days and we transferred the training to the students. We did a report to WV.We modified the school curriculum to accept training on FMNR. So it became a cross cutting theme on studies of plants and civil education – behaviours that people have to adopt to protect the environment. [Teacher, Kaffrine]

The work of the SFLEI and Beysatol projects has expanded teacher knowledge and enabled them to introduce FMNR and associated ideas and activities and the presence of FMNR in surrounding farmlands has presented a new learning opportunity during field trips.

This project has been very good and last year we harvested Ziziphus. We also harvested eucalyptus though coppicing and we were able to build a makeshift class room with this wood. We have courses that oblige us to go into the forest to teach. Before the project we had to go to the forest but not with ...

FMNR, now we can do it [teach FMNR] in the school program. ...In terms of what we can practice at school it is tree planting – the yard is now full of trees. [Teacher, Kaffrine]

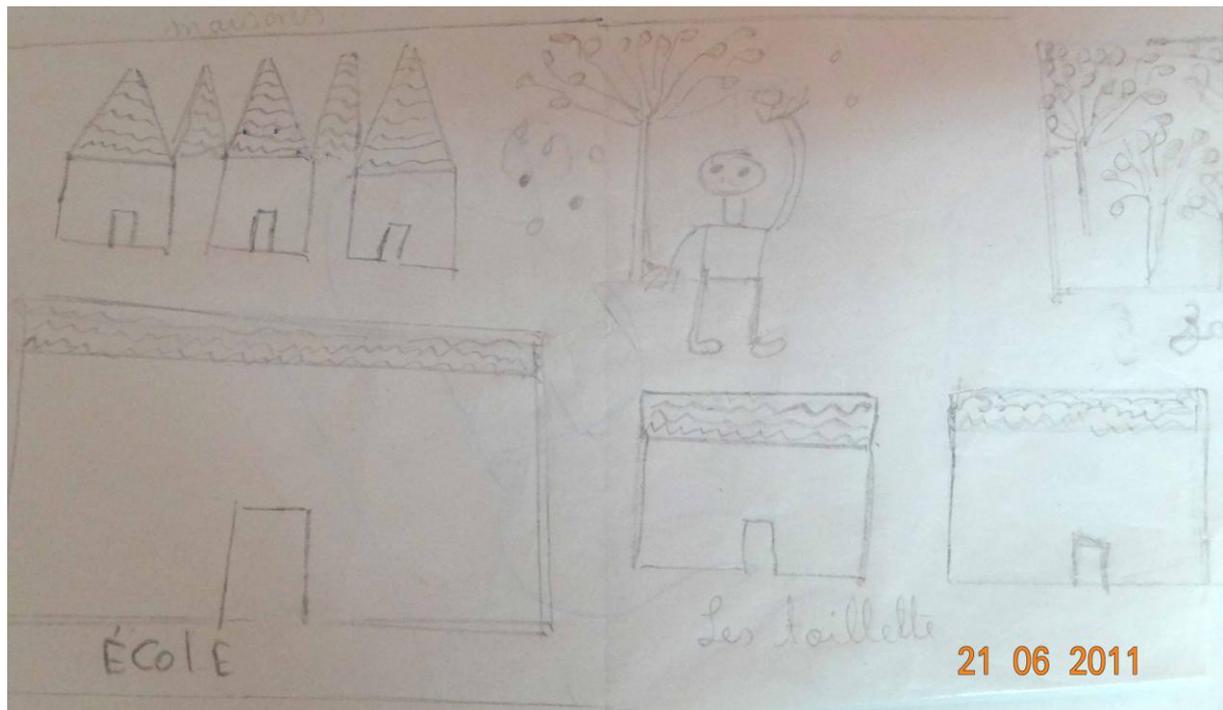


Figure 62 Child's drawing showing importance of trees in home and school

Four groups of primary school children from the project area participated in a drawing and discussion activity as part of the evaluation fieldwork. Working with teachers and facilitators the children were asked to talk about what they knew and felt about trees and farming. Drawing materials were provided and children were asked to depict the positive and negative aspects of trees.

The four separate activities generated numerous pictures and conversations and there were some common themes that emerged. It was clear that they were well informed about trees and FMNR. They described the role of the *Eaux et Forêt* department and stated that it is everyone's responsibility (including themselves) to take care of the environment. When facilitators asked children how the environment of today compares with yesterday, they described degradation of land and soils and how they envisaged that this would improve due to implementation of FMNR.

The environment today is degraded This is due to the impoverishment of the soil....drought, wind and water erosion, as well as the disappearance of fauna and flora. With the advent of the FMNR nature will again flourish....[Children in Ndiognick]

When another group of children were asked what they wished their environment to be in several years time, they responded that they wanted a regenerated landscape with animals and trees – most especially fruit trees.

The environment is regenerated - Return of the animals (of fauna) - Many trees especially the fruit trees: mango trees, orange trees, banana trees, jujube trees...[Children Keur Aly Lobe]

Talking about the benefits and uses of trees the children drew and described the following:

- Regenerates the environment and the soil
- Improves soil fertility (leaves dropping from trees)
- Reduced soil erosion from wind (slows down the wind)
- Improved precipitation/rainfall

- Wood for heating and making furniture
- Medicinal uses
- Source of food e.g. fruits from trees
- Source of income from sale of fruits and wood
- Improved biodiversity and the return of fauna
- Shades for resting



Figure 63 Collection of children's drawings showing positive aspects of trees



Figure 64 Child's drawing showing protecting, marking (red paint) and watering of a tree

Through their conversation and drawing activities children described the positive and negative practices associated with FMNR. Positive practices included:

- Growing live tree fences
- Watering trees
- Growing tree seedlings
- Marking trees to avoid cutting
- Use of organic manure as fertiliser
- Building enclosure for animals to avoid grazing trees
- Pruning and staking of trees
- Discouraging bushfires
- Avoid cutting trees
- Avoid digging out roots of trees

The key themes emerging from the discussions and pictures about negative practice were cutting trees and setting fire to fields. The negative practices depicted in the drawings by the children included:

- Free grazing animals that ravage trees
- Cutting down trees for livestock, wood and heating
- Uncontrolled bushfires
- Burning grass and shrubs on fields
- Termite nest build up on trees
- Breaking branches by climbing trees

Each of the groups of children were asked for their recommendations to the project and to their parents and community regarding their environment. The responses show a desire for change and a clear understanding of the links between achieving this change and their future wellbeing.

One needs a healthy environment equipped with many trees... [Flora and] fauna should be cultivated... It is necessary to have a fertile ground, to have a good rainfall... It is necessary to avoid cutting trees, the main cause of tree species disappearance...It is necessary to avoid polluting the environment with plastic bags... Have agents of National Forestry Commission to protect the environment to help us to preserve nature... Support the peasants so that they can manage their environment well. Increase the trees to improve the incomes...[Children of Loumen, Ndiognick, Keur Aly Lobe and Ida Mouride]

Their comments also show recognition of the crucial supporting role played by the agents of *Eaux et Forêt* department and the potential to increase farming income in a healthy, treed landscape.

When the teachers reflected on the participation of children in the project itself they suggested that there was room for improvement. For example just as adult farmers have been strongly influenced by the visits to FMNR regions in Senegal, children would equally benefit from this.

The participation of children is not very effective. Just as we take adults to Niger, just as we provide motivation for adults, we must do the same for children. They need to see and be convinced..... [Teacher, Kaffrine]

Towards the end of the interview with teachers it emerged that they felt their participation in the project could be more meaningful. They emphasised the importance of the school and of teachers as the major change agent within the community.

The truth is actually the teachers are not a very active part of the partnership, all they get is the training and that is it. They don't feel like they are a useful part of the project. ... The school is the mirror of the community. Anything that goes through the school reflects back into the community. [Teacher, Kaffrine]

When asked for recommendations for the project they reiterated that children needed direct involvement in the project and teachers needed to be given genuine opportunities to see, learn by doing and become key community advocates for FMNR. They suggested that this could be part of their professional development and they could assist with monitoring of FMNR within their communities.

We recommend that we involve the teachers very actively into the partnership and bring the children in to enable them to discover nature. In each school we should have a "M. FMNR" - we need a teacher who specialises in the FMNR so they can pass on all the technology and knowledge.... This specialist teacher should be submitting reports about what is going on re: FMNR in the community. So it is a question of providing motivation and expectations. If a teacher could visit Niger we could achieve just as much as other farmers. It should be very motivating to get teachers and everybody committed to the project. [Teacher, Kaffrine]

Evaluation activities with teachers and children served to highlight the level of investment that has been made within the SFLEI project to educate children about trees and more specifically the benefits of FMNR. However, many school children have no plan to go into farming as a career because there are better income opportunities off farm. It is the children who don't go to school who are most likely to be the farmers of tomorrow. Inclusion of children who are not in school in the FMNR outreach activities will be a priority moving forward. The teachers recognised this and proposed that they could assist by actively recruiting unenrolled children to participate in the FMNR activities.

We will go door to door for recruitment of children for this next year. Maybe you'll be back and will see the difference. [Teacher, Kaffrine]

In summary a key driver to successful and sustainable community development projects is active participation by children, their parents and teachers and local forestry agents. In this regard, teachers appreciated very much the contribution of the SFLEI project to date but wished to highlight a need for more direct child participation, inclusion of children not in school, and support for partnerships between teachers, parents, communities and other stakeholders to maximise benefits of FMNR.

5.5.3 Achievement against indicators for sustainability included in the project design

This section gives brief statements about the extent to which indicators of sustainability outlined in the project design have been met at this stage.

- Strengthened ability and confidence of poor families in natural resource management

There is good evidence that the targeted beneficiaries have grown in their confidence to manage natural resources – this is evident in the increase in knowledge of three or more FMNR practices from 38% to 50% and the increases in different practices shown in Table II. Focus group respondents expressed an ability and willingness to continue implementing the new practices beyond the life of the project.

- Demonstrated capacity of the communities and their leaders to accomplish self-reliant, food production

The inclusion of this as an indicator of sustainability is ambitious because self reliance in food production hinges on many factors not just uptake of FMNR. Certainly there will be an increase in capacity to produce more food once FMNR is well established and crop yields increase and tree products become reliable income source. This is likely to take 5-10 years. . The addition of accompanying food production supports like improved crop seeds, establishing market gardens, jatropha hedges, fruit trees, rice crops and cassava, helped to increase production in the shorter term.

- Effective use of networks and CBOs, to communicate changes in the quality of life of families with respect to vulnerability mitigation, respect of human rights and conflict resolution

At this stage the networks are mainly supported by the SFLEI project and government partners – the foundations have been laid for formation of FMNR CBOs who should be supported to do outreach and become effective agents of change within and outside their communities. This is included in the project design for *Beylene Sen Tol*.

- Enhanced capacity of creating effective systems to expand the range of choice without compromising the ability of future generations to meet their own needs

Evidence is ample that where farmers are successfully incorporating FMNR and effectively leveraging the project accompaniments, their capacity is being built in a sustainable manner. Examples include testimonies of increases wood stocks, wild fruits, honey production and some references to being able to harvest traditional medicines again.

- Reduced vulnerability and improved disaster coping systems

A successful mature FMNR farmed plot provides fruit and leaves for human consumption and fodder for livestock consumption during periods of drought when crops typically fail, and environmental protections such as reducing wind speeds and soil moisture evaporation. Thus there is reduced vulnerability. However the majority of the trees in the SFLEI area are still young - another 5-10 years with good FMNR techniques will be needed to achieve this indicator.

In Thiappy, the lack of residual tree root systems and dominance of seed generated *F. albida* means that progress with FMNR is very slow. In Thiappy it will be necessary to complement FMNR with other methods such as live hedges composed of multi-purpose, nitrogen-fixing, desert trees. Species already naturalised in West Africa may include Australian acacias, thorny African acacias, Central American mesquite (*Prosopis* sp.) and leucaena. Inside the fields, crop production and soil quality will be improved by application of soil and water conservation techniques such as *Zai* or half moon planting pits with organic fertiliser and mulch.

5.5.4 Costs of FMNR and tree planting

The project design was broadly comprised of three operational outputs:

- Promotion of environmental management of farms
- Training, resourcing and facilitation of tree seedling planting on farms
- Training and facilitation of FMNR on farms.

Achieving an appropriate density of favourable tree species on crop land in Kaffrine will restore soil organic matter, increase fertility and moisture retention and will result in better crop yields. Among the myriad of factors that underpin the development of viable farming systems and sustained food security - increasing crop yields is one of the most important. Increasing trees on farms can be done using FMNR and by tree planting – and it is interesting to consider the relative cost benefit of each approach.

The tree seedling distribution component of the SFLEI project led to planting of 890,498 seedlings, although it is estimated 15% had survived by the end of the project¹⁵. Thus, about 133,575 new trees are growing in the project villages and the total cost of this was approximately USD\$297,160 (see Appendix 4). Therefore the financial investment was roughly USD\$2.22 per living tree.

In comparison, based on project records FMNR in 9,126 hectares of farm land has led to the regeneration of approximately 264,654 additional indigenous trees. The cost of this was USD\$382,000 therefore the financial investment was about USD\$1.44 per regenerated tree. So based on these calculations it is clear that in terms of donor investment promotion of FMNR represents much greater value for money than tree planting. In addition, trees regrowing from mature root systems grow faster, are more resilient to drought, and yield wood and other benefits much sooner than planted tree seedling.

Combined, FMNR and tree planting has returned a total of 398,229 live trees to the project area by the end of the project.

Looking to the future, if FMNR continues to spread as it has been doing in the project area over the last four years, using an estimate of 33% increase in the number of regenerated trees per year for three years, and then a 20% increase per year for another three years, the project will have generated roughly 1,076,000 additional trees since its inception, and the financial investment per tree returned to the landscape will be only USD\$0.36 (Appendix 4).

It is clear that FMNR offers a much greater return per donor dollar invested than the traditional tree planting programs. The same is true for farmers – FMNR gives an excellent return for a modest labour investment. However, the two approaches are highly complementary and should be used together for rapid restoration of degraded crop lands. Both naturally regenerated and planted tree species can restore viability of crop land, yield valuable firewood and timber, provide leaves, bark and fruit, and provide shelter, for both humans and livestock.

5.5.5 Integration

SFLEI project has filled an important gap in the project region – while all ADPs and their counterpart organisations were active in the domains of health, education and potable water, in the domain of Natural Resource Management (NRM) with the exception of the Senegalese government – there were few interventions. The project approach is well integrated with other sectors of health and

¹⁵ Nzale M, personal communication, World Vision Australia. 16 Feb 2012.

education because it addresses a systemic issue – low crop yields that lead to malnutrition and a lifelong impact physical and intellectual development.

The project is also working with the schools to ensure that children also envisage the benefit of FMNR – so there are educational outcomes. Finally, a well managed agroforestry system will increase infiltration of rainwater, which in turn replenishes ground water supply which has a positive impact on local aquifers and hence potable water supply.

The SFLEI and Beysatol project designs may also be seen as an example of integration of relief and development. Restoration of the environment is a slow process - leaving useful tree types on fields begins to significantly increase crop yield within 3 years, but the food and firewood shortages continue to plague households throughout this time. In fact for some women in particular the options for finding firewood may decrease. So it is important that during start up phase there are accompaniments which enable the community to get by, and to avoid cutting down trees.

We really pray that the project would be renewed with funds because women depend only on their husbands. If the husbands don't have means, we will need to exploit the environment, but with some assistance we can be patient and keep protecting the environment. [Thiappy lead farmers]

The types of accompaniments included food for work – which proved an effective means of ensuring survival of both trees and meeting the nutritional needs of the families who had run out of food.

We were getting food for work. The fact that this project approach gave us compensation, gave us food at a critical time of year, we could have the patience to wait for the crops to be fully mature before harvesting. [Kongheul lead farmers]

The advocacy component of the project design was also crucial – the local government services had to be engaged and supported by WVS to enable government extension staff to be convinced of the value of FMNR and to take up and spread the message. There is evidence of successful advocacy by the project staff and partners – because roll out of the FMNR to all ADPs has been accepted.

5.5.6 Gender

The following paragraph quoted from the project design document clearly explains the link between the project outcomes and direct benefits for women and girls, who do the cooking and collection of firewood.

Women and young girl children in the three ADP's spend a considerable amount of time doing firewood chores. This can result in health hazards or dangerous encounters in the bush. Fierce competition for dead wood results in conflicts and tensions. In some places where firewood is not easily available, the recourse to always more expensive gas bottles puts pressure on the family budget. This FMNR project will considerably reduce tensions and time in firewood gathering, as the firewood place (family-owned field) will be easily identified for each household, at short walking distance from the dwelling place. This will free women's time for income generating activities and possibly release girls to go to school..... Fuel wood harvested from FMNR plots and diversified crops will provide women with additional income and with opportunities to process the by-products without jeopardizing the family subsistence stock. Children and women can also use the residues of the trees and crops to raise pigeons or rabbits that constitute a permanent food source. [Project design document, section 3.1, page 19]

However there is a time element in this – all of the above will be true once healthy vibrant FMNR trees are present on well managed and productive farms, which is still 5-10 years away. When trees are still small and slow growing as in the case of *Faidherbia albida*, bringing fields into a regime of FMNR will exacerbate the problems of finding firewood as noted by the community respondents in Section 5.2.7. The following comment from a FGD with women once again highlights the initial constraints posed by imposition of FMNR management on fields they traditionally exploited, although there is recognition that this is temporary.

The difficulty of finding firewood and service wood is because of the ban on forest species exploitation in protected areas. Note, however, there is hope that problems will be resolved in a few years with the use of plants regenerated through FMNR. [FGD Women]

When asked about the positive changes from the practice of FMNR women cited the fact that once pruning is done by their husbands, the women can use the wood.

Good changes result from the fact that women collect dead shrubs from the field for firewood after men do the pruning. [FGD Women]

The gender outcomes of the SFLEI project have been significant according to direct project beneficiaries (lead farmers interviewed). The obvious intention of the project staff to include women as equal partners was beneficial in many ways, such as instilling a sense of pride and expanding opportunities.

The project has provided equal benefits to women as to men and this has actually increased the social standing of the women. When you take 5 women, you take 5 men and this has given us pride. Even women were given seeds for example Moringa seeds and this has improved our cooking and the materials that have been given have improved the situation of women.

In my association of farmers in the whole ADP there are some positions for women, treasury account supervisor and secretary and they are now part of the decision making process. We have really respected gender – in terms of credibility women are more trustworthy than men that is why they are given this position the most crucial in the committee – we trust them more. [Lead farmer, Thiappy]

When lead farmers were asked explicitly whether women's position within the community had been improved as a result of the project – in other words had there been a shift in the balance of power between men and women – the response from a female farmer who had been directly involved in the project was that due to the project women had been given access to land and they now are able to prune FMNR trees, whereas before all tree cutting was prohibited.

Facilitator: Are women empowered by the outcomes of this project? Have women been left in a better position than before?

Respondent: Now women have access to land. Cutting was completely prohibited but because of FMNR the Eau et Foret has decided to allow women to cut (prune) even close to home so this is a real benefit. [Woman lead farmer Kongheul]

This is in contrast to the comments in FGD stating that women were unable to harvest wood due to imposition of FMNR protection. The topic of any shift in the balance of power between genders was explored in the FGDs with mixed responses coming from within and between groups. For example when asked about involvement in decision making women in one ADP the response showed that women felt supported and included and are taking the responsibility for protection seriously.

Facilitator: How have you been involved in decision making and in the protection of the environment?

Respondents: The village chief and the religious leaders invite us to all the meetings and encourage us to speak and express our opinions.....We are organized to watch over the environment.....Some of us have plots planted with eucalyptus and market gardens.....We are encouraged to report to the village chief all instances of abusive tree cutting. [FGD with women]

In another ADP questions about gender in terms of responsibilities and decision making revealed the continued imbalance where women are underrepresented in the management but still shouldering the major responsibility to do the required protection work.

Facilitator: What do you think of the level of sharing of responsibilities between men and Women?

Respondents: Management is not democratic; the women are not well represented in management structures concerning the environment. We Women are underrepresented and are totally dependent on men and yet are involved in all actions against bushfires.

Facilitator: Is there a change in the decision-making power of women?

No, we ask to be more empowered. A lot remains to be done because the [roles in] committee set up for men should be similar for women too. [FGD with women]

This is a common outcome in projects where lack of a strategic approach to gender balance results in women having all of the responsibility and none of the power. However, this response from women

in one FGD is an exception because in the others, responses were positive. For example in the third ADP there was a suggestion of a change in the role of women - with them sharing in decisions regarding FMNR activities and the project.

Facilitator: Is there a change in the power of decision making between men and women with SFLEI?

Respondents: Yes, following sensitization and training conducted by the project, decision-making between men and women are [now] shared....[FGD with women]

In a fourth ADP women said that responsibilities were shared and there is more equality in decision making.

Responsibilities are shared between men and women in terms of sustainable management of the environment...It is the same in the power of decision-making between men and women. Thanks to the project SFLEI, there is equality between men and women in decision-making powers. [FGD with women]

On balance the approach taken in the SFLEI project has resulted in a shift in the balance of power more towards women which is to be congratulated. In some communities there will need to be continued efforts towards this.

5.5.7 Disability

Overall 14% of respondents said there was one or more children in the household who had a disability, but this varied quite a bit between the different ADPs – with Ndiognick skewing the average upwards. East Kaolack, Nguer and Thiappy recorded approximately 10% while in Ndiognick the value was 3 times higher at 30% (Figure 66).

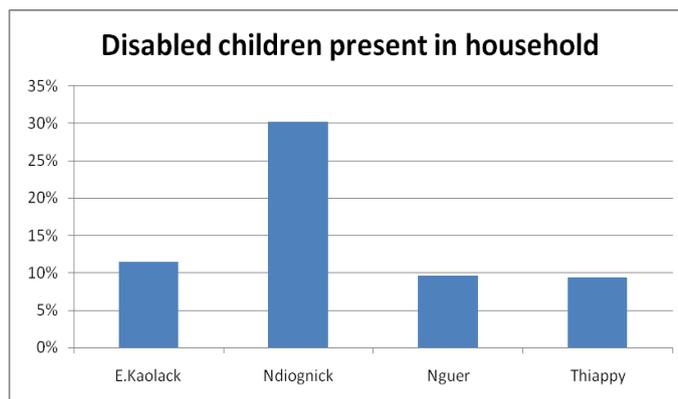


Figure 66 Proportion of households with one or more children with a disability

This may be an artefact of the question construction – or it may be the reality. This should be verified by the ADP staff and if it is found to be true, there needs to be follow up with local disability support services in Ndiognick ADP.

It should also be noted that the initial decrease in access to firewood that women experience will also have a profound effect on disabled women and girls if this means they are needing to travel further to look for wood.

The question remains to what extent could the project directly engage with farmers and children who are disabled, to assist with uptake of FMNR and to ensure that their access to wood from trees during the dry season does not become more difficult at the outset? At a minimum, the opportunity to explore these questions should be sought in the Beylene Sen Tol project design.

5.5.8 Environment

This project will be implemented in an environment considered to be on the verge of an irreversible degradation. It responds to the concerns outlined by the UN Convention on Combating Desertification. Environmental assessment results confirm that there will be positive results and no negative environmental effects from this project. [Project design document, section 3.1, page 19]

The results of this evaluation support the above statement in the project design; many agricultural lands in the project area are severely degraded and the successful promotion of FMNR is bringing these lands back to life. An experienced forestry officer stated that the evidence of benefit is undisputed.

I will confirm that the objectives of the project have been accomplished in some areas. Without trying to pronounce the % of success, the fact that the results of the FMNR are quite visible.....areas I visited 4 years ago you could observe up to 300-400 meters of completely bare land. Today we see trees all over the place and that is the truth....[Eaux et Forets, Kaffrine]

The only question remaining in terms of the project contribution to the environment is what level of resources will be needed to scale up the success from 'some areas' to the majority of farmland in the region.

5.5.9 Peace building

Where there has been good community engagement, the SFLEI project is effectively contributing to minimising conflict between the sedentary and nomadic herders, between farmers and government forestry agents, and between farmers who practice FMNR and those who don't.

5.5.10 Protection (including child protection and participation)

While there are no direct child protection activities in the project design there are indirect positive outcomes. The project capacity building of school teachers in FMNR will stimulate children - who do much of the farm work – to begin to question traditional practices. Removal of the need to slash every shrub and blade of grass on fields and to burn it prior to sowing will reduce child labour and remove the risk of serious burns injuries and smoke inhalation.

6 Conclusions

There was a national program that really emphasised mechanisation and they really pushed people to destroy the traditional systems and this is why we ... cleared all the trees. When we realised that this was not taking us anywhere...we thought about going back and this coincided with the start of the [SFLEI] project. ... The beauty is that it just stimulated a very good journey to the extent that even villages not part of the project are interested in FMNR. Every farmer depends a little bit on farming and livestock and trees satisfy both ... So trees are a treasure and a wonderful thing. [Thiappy lead farmer and president of association of farmers]

The SFLEI project set out to improve natural resource management to secure the long-term viability of semi-arid farming systems in central Senegal. The principle methodology was promotion and training in Farmer-Managed Natural Regeneration. This technique was complemented with tree-planting of fruit and leguminous trees, and short term food and cash crop support such as improved cereal seeds, establishment of market gardens, cassava plots and experimental crops such as rice. During the project's early years, food for work was applied to motivate farmers to establish FMNR and help them resist resorting to detrimental coping mechanisms like early harvest and tree chopping. To reduce the need for high volumes of firewood, the project also trialled fuel-saving technologies like fuel-efficient stoves and biogas on a small scale.

In SFLEI there has been a very positive response by farmers to promotion of FMNR. The promotion of agricultural and forestry technologies in smallholder farming systems doesn't often result in this level of response – farmers tend to ignore new ideas or only a few take up the new ideas in the long term. But in this case the practice of managing trees in a cropped landscape is also a traditional practice - and farmers tend to go back to old ways when things start going wrong.

The efforts of the project and partners were perfectly timed with the recognition by farmers that they had to change what they were doing. The promotion of FMNR by World Vision and government forestry department strongly validated what farmers were wanting to do, and gave them courage to make a change. Prior to the promotion of FMNR farmers had to 'go it alone' and risk being viewed as a bad farmer or as being 'a bit mad'.

In a village there was a guy who dared to create his own forest and people called him a fool but he persisted and now there are a lot of animals in the forest and it attracts tourists and he is making a decent living out of ecotourism. There are fruits and the women are harvesting and they bring bags of fruit for the tourists. He had a lot of difficulty and [he] even sent his younger brother to prison because he was cutting his trees down. [Lead farmer, Thiappy]

The SFLEI project model also embodied the principles of community participation and farmer to farmer extension in the technology promotion process. The development of localised project networks that included *Conseil Rurale*, *Service Eaux et Forets*, schools and lead farmers as well as World Vision staff, are contributing to create systems that will enable World Vision to withdraw.

Project staff expressed a strong confidence that these groups are already leading the processes and can manage independently: particularly the *Conseils Rurales*. Farmers and officials testified to a new spirit of "unified management of collective resources" (p.64) that did not exist before the project. A number of representatives from these organisations expressed that they could continue without World Vision. FMNR now seems to be embedded in the accepted wisdom of the farming community in the project areas and is likely to remain in practice and expand over time. By design, the project has reached a minority of all the villages in each ADP. Much room exists for a dedicated project to continue to bring other areas into a Region-wide FMNR-led on-farm environmental restoration movement.

This end of project evaluation has presented evidence on the key themes of project outcomes, unanticipated outcomes, quality of partnerships and likely sustainability of achievements. The result of uptake of FMNR, the return of trees in crop land, is apparent in the project area and this demonstrates that outcomes are likely to be sustainable. However, the evaluation has also highlighted that there much more work to be done. This section explores the findings of the evaluation and highlights the strengths and challenges for the project going forward.

6.1 Contribution to improved NRM, household food security and income

Through the work of SFLEI and its partners the number of hectares under FMNR expanded from 742ha in 2008 (6 months into the project) to 9,124 by 2011. This resulted in regeneration of an estimated 264,654 trees in the project area. Households in the target area also planted 890,500 tree seedlings of which about 133,600 survived. Overall the project achieved an average tree density of 33 indigenous trees per hectare in FMNR areas. Given that tree density on crop lands of at the start of the project in most areas was negligible, this is a major achievement.

Combined, FMNR and tree-planting restored 398,229 additional trees to farms in the project zone.

Project participants planted an average of 117 trees (including *Jatropha*) compared with an average of 33 in non project households. Tree planting was appreciated by farmers for introducing new species and replacing trees where no stumps remained, but they observed that unlike tree planting, benefits of FMNR far outweighed the costs to the farmer. In terms of cost to the project, the financial investment for planted trees was roughly USD\$2.22 per live tree. In comparison, the financial investment for naturally regenerated trees was about USD\$1.44 per live tree. Assuming a much slower rate of adoption of FMNR after project close, after six years from project closure, forecasting estimates that a total of 1,076,000 FMNR trees will have been added to the local agro-ecosystem, at a project cost of \$0.36 per live tree (see Appendix 4 for calculations).

Knowledge and practice of FMNR have improved due to the project. Feedback from key informants during FGDs highlighted a robust understanding of the function of trees in the farming system and the very positive experiences farmers are having with FMNR. Less than 10% of the population still believe a common misconception that trees on fields will shade out crops and compete for water, and that trees harbour birds that attack crops.

Since the baseline was done in 2008, farmer management of new shoots (thinning/protection of new shoots) has increased from 20% to 48%, the practice of tree pruning increased from 31% to 53% and 39% farmers mark their protected trees compared with 16% in 2008. The majority of farmers who use FMNR observed an increase in soil fertility (85%), less erosion (62%) and increased yields (59%). Other benefits cited were increased wildlife (35%), and increased access to firewood (30%) and timber (17%). Increased shade, fruits, rain and beautiful greenery were also mentioned by a few individuals. Survey results showed a project participants were also more likely to practice restricted grazing, which decreased animal damage to crops.

A number of traditional food security indicators were measured during the household survey but they didn't reveal any effect of the project, or of use of FMNR - on a household's vulnerability to food shortages. The survey data revealed a small increase in average millet yield from FMNR compared with non FMNR farms, but also showed that FMNR farms on average produced lower peanut yield than non FMNR farms. Unfortunately, (and despite the large sample size) the high level of variability and possible error in recalled estimates of crop yields, the practice of mixed cropping and intercropping, the multiple field locations and lack of data on actual areas sown to different crops, reduces the reliability of crop yield data. However, the potential of FMNR to improve food security in Central Kaffrine is well supported by research conducted at ISRA on impact of FMNR on millet yield (Section 5.1.7). In addition, the effect of *Faidherbia albida* on cereal crop yields of

smallholder farms has been conclusively proven in studies elsewhere in Africa (e.g. see Dennis Garrity's 2011 paper on Evergreen Agriculture). Other species such as *Piliostigma* have been shown to increase cereal crop yields (ISRA 2012).

According to the results of the household survey, 62% of all respondents felt that income had increased in the last four years, while 78% of project direct participants said that income had increased. This demonstrates the contribution of SFLEI to improving household incomes through adoption of FMNR and providing access to accompanying agricultural activities.

6.2 Strengths of the SFLEI project

Behaviour change model: a multi-faceted communication strategy that promoted genuine dialogue at and between many sub-groups in the project area: farmers from different locations, government services, *Conseils Rurales (rural councils)*, school children and teachers, religious leaders and *griots* (traditional story tellers or orators), radio programs, promotional caravans and theatre, exchange visits in and outside Senegal, initial material incentives, and engaging women as well as men promoters.

Timing of the project – The project concept emerged at a time when community recognised the link between poverty and the environment and could already see the potential of FMNR. The pre-existing interest in FMNR was a key factor in the high level of engagement with the project.

Training visits to Niger – ‘Seeing is believing’ and farmers believe other farmers, extensionists believe other extensionists etc. This was a crucial project activity.

Training of trainers – Training lead farmers in FMNR and this was a key feature of SFLEI which community key informants said was not present in many other projects. It was viewed as a key strength.

Reducing risks to farmers - The project provided food assistance to project participants during food shortage which meant they were able to wait for crops to mature before harvesting and did not have to consume or sell their seed.

Using farmers' existing resources - Unlike many agricultural interventions the practice of FMNR does not rely on access to assets and resources that farmers do not have. This was seen as a key strength by community respondents.

Investing in partnerships – Investment in developing partnerships between WVS, *Eaux et Forêts* and community members has underpinned the outcomes of the project.

Recruiting women in FMNR – Women's role in collection of firewood means that they are a crucial change agent for FMNR.

Development of bylaws – Local bylaws that govern FMNR has been pivotal to uptake of the practice.

FMNR facilitators - FMNR facilitators provided both technical and moral support to farmers who decided to try FMNR and was much valued.

Local FMNR trials and research – Project support of FMNR trials conducted by ISRA showed conclusive evidence of increase millet yield, which corroborates observations by FMNR farmers that millet yields were increasing.

6.3 Technical and social challenges identified

Technical

Practice of FMNR technique needs to expand – There is still limited practice of FMNR within the project region and an urgent need to scale up efforts to new communities.

FMNR techniques – fieldwork revealed that FMNR techniques were often poorly carried out and did not maximise the regrowth potential of coppiced shoots. Many farmers practising FMNR did not mark trees and they pruned regrowth too hard leaving trees spindly and vulnerable to breaking. Field burning to clear fields continues to be a practice that has negative effects on soil health in the project area. Figure 49 shows that 73% of farmers continue the practice, with little difference between those using FMNR and those not. Burning kills off young trees and new shoots and releases carbon while destroying organic matter. Most farmers still remove tree species which have the potential to transformed near desert conditions into vibrant forested farming systems. Promotion of FMNR best practice and refresher training is required to overcome this issue.

Scale of the problem in Thiappy - the current approach to FMNR and natural resource management being applied in Thiappy ADP is insufficient in view of the scale of desertification and previous removal of most tree stumps in this area. FMNR alone will not be enough to restore environmental health and fertility to farmland. Future approaches must include tree planting and land and soil restoration and soil and water conservation methods suitable to the agroecology and farming systems of the area. Examples from elsewhere in the Sahel include support for community generated tree seedling supply, live hedges with multipurpose trees, *Zai* and half moon sowing pits with mulching and improved compost, infiltration dykes, contour bunds with elephant grass and tree lines to manage runoff in heavy rains, works to restoration of upper catchments etc (e.g. see

Regulations for tree and timber harvest - At this point, farmers still need special permission from Service *Eaux et Forêts* to harvest and sell regrowth timber from their own fields. This is a sensitive issue, given the Service's historical role in policing tree-cutting. FMNR contacts in Niger (Maradi and Zinder regions) who overcame this challenge some years ago, may be able to provide guidance to World Vision Senegal and Service *Eaux et Forêts* to make this transition.

Prevalence of burning - Observation of preparation of farmland during the evaluation highlighted a serious threat to the success of FMNR in the project area. The vast majority of farmers clear tree, shrub and grass regrowth from their fields just prior to sowing and they burn all of the collected organic matter. Future FMNR project designs for this region MUST address this issue.

Removal of potentially useful trees - Almost all respondents (93%) in the households surveyed said they removed trees from their crop land and many of the species removed are valuable FMNR species that have helped transform desiccated landscapes in Niger into viable farming systems. The FMNR outreach in Kaffrine needs to include material (e.g. short mobile phone film clips) that shows how these tree species are contributing to farming systems in Niger.

Reduced access to firewood – the fact that FMNR initially reduced access to firewood was highlighted by community and lead farmer key informants, both women and men. This was also highlighted in the survey results – in disaggregated data for women, and in some ADPs where the majority of respondents said access to firewood had decreased in the last 4 years. The gender dependent patterns around firewood must be taken into consideration in the development of training, management and the development of local bylaws governing access to trees and wood. Accompanying measures that enable women to use less firewood, earn more income and replace wood as the major fuel source for household needs will be the key to success in the project region. Future project design will be informed by the valuable lessons from SFLEI.

Energy systems - Overall improved stoves were present in about 20% households which is encouraging, but half of this group also still used the traditional open fire as well. Further support for promotion of improved stoves in the project area would be highly beneficial. There was much community interest in biogas digesters but this system has not been implemented in more than a few households and is dependent on farmer resources (land and oxen) and requires technical supervision.

Livestock management - Although camping livestock do deposit valuable nutrients below the tree canopy area, heavy pressure from grazing livestock can also result in ringbarking of trees, breaking branches and trunks and destruction of seedlings. Restricted grazing has increased through the project but just over a quarter (28%) of farmers in the project area practice restricted grazing (Figure 58). Future promotion of FMNR needs to support uptake of restricted grazing especially in the early years of FMNR when trees and seedlings are very vulnerable.

FMNR influence on local crop production - increased yields in millet (supported by the ISRA field trials) contrasts with reduced ground nut (peanut) and maize yields. Whole farm trials and additional research on crop effects in local FMNR system are urgently needed to quantify these changes at field level and in terms of food security outcomes.

Tree density and species mix - The project achieved an average tree density of 33 trees per hectare but the optimum tree density and mix of species for local farming systems is not yet known. Additional work with lead farmers and with local research institutions is needed.

Social

The role of Food for work and other incentives in uptake of FMNR - Early in its life cycle, the project was able to take advantage of a food-for-work program to reward farmers for implementing FMNR on their fields. This phased out quickly, being replaced by the accompanying food production assistance. In isolation, we cannot be clear from this project whether the food for work program was a major catalyst for farmer adoption of an idea as novel as FMNR. If circumstances permit (e.g. no major food shortages) future FMNR outreach needs to be done without this component to establish the real uptake of this practice.

Children outside education system - Children who don't go to school or who drop-out of school often go back to the family farm and they represent a large segment of the farmers of tomorrow. The current project design doesn't directly engage this group.

School children and farming - Currently the SFLEI project is engaging school children through training teachers in FMNR and this is being incorporated into school curriculum and fieldwork. However the majority of school children in the evaluation FGDs expressed negative views of farming – they considered this as an occupation of last resort. This needs to change to inspire in them a vision of viable and profitable, treed farming systems.

Teachers as agents of change – although the SFLEI project is training teachers in FMNR teachers felt that their influence extended beyond the classroom and suggested they take formal responsibilities for promotion and monitoring of FMNR in their local communities. Outreach would include children both within and outside the school system and adults in their communities. This type of partnership under the right conditions has great potential – but will take time and resources to scope out and develop.

Government's role as major agent of change - *Eaux et forets* is preparing for a lead role in the promotion of FMNR in Kaffrine but is currently not well resourced. It is not the WV's role to fill this resource gap, but WV can be a leading advocate to ensure that Government resource allocation to *Eaux et Foret* is adequate for the community services it needs to provide.

7 Recommendations

7.1 Moving forward with FMNR in Senegal

Build on the strengths of the SFLEI project model – FMNR training and visits to established FMNR landscapes and inclusion of all relevant change agents. Agents of change include lead men and women farmers, community facilitators/*animateurs*, traditional and faith leaders, story tellers, agricultural and forestry agents, local teachers and local research partners working in NRM. The project approach model also endorses *farmer-to-farmer* extension and the *train-the-trainer* approach. Use of incentives that stimulate uptake of FMNR and reduce risks to farmers is also effective.

Promote best-practice FMNR in the current project ADPs – The evaluation revealed the dominance of poor practices where for example FMNR trees are incorrectly pruned, are not marked and are still being harvested for wood despite being marked. Also removal of tree regrowth by burning fields is a widespread detrimental practice. Ignoring the poor practices will not achieve the results anticipated by farmers and may result in their abandoning FMNR.

Incorporate wood saving technologies into project design – Ideally the next phase of the project will be linked with promotion of locally appropriate and cost effective wood saving stoves to women and feasibility studies on biogas digesters for households with sufficient capacity to take up this technology.

Promote complementary soil and water harvesting techniques - For arid zones with few surviving live tree stumps, such as Thiappy ADP (Fatick Region), experiment with and introduce additional NRM techniques that complement FMNR. We recommend including the use of multi-purpose leguminous trees to hedge in fields (e.g. Farmer-Managed Agroforestry System (F-MAFS)¹⁶ and *zai* or *demi-lunes* sowing techniques.

Continue linking FMNR research on crop yields to FMNR projects – Local rainfed crop production is entirely dependent on seasonal conditions and on the diverse practices of farmers, who are balancing risks and opportunities with their scarce resources. Effects of FMNR on crop yield are marginal compared to the effects of the weather. It is difficult to show a contribution of FMNR by relying on farmer recall of cropping inputs and outputs, as is typically done in project evaluation. Also it is expensive and impractical to directly measure crop inputs and outputs on a statistically representative number of FMNR and non FMNR farms. In the case of SFLEI crop yield trials by ISRA were absolutely invaluable – the evidence of increased millet yield in FMNR plots compared with non FMNR plots provided a valuable proxy for concluding that farmers who practice effective FMNR will get a better millet yields. The evaluation survey data supported the idea that millet yields were greater on average for FMNR users than for non-users, but the opposite was true for peanut production. Additional field trials are needed to determine whether increased millet yield is associated with decreased peanut production and if so, whether this is a favourable outcome for farmers.

¹⁶ F-MAFS was also developed by SIM in Niger, emphasising the use of hardy Australian acacias with edible, highly nutritious seeds for human consumption, rich leaves for fodder, as well as their wind-shielding, anti-erosive and nitrogen fixing and firewood providing properties.

Link FMNR projects into the wealth of research on *F. albida* in Africa – in some parts of Africa farmers view this tree as a ‘miracle tree’ and there is no doubt as to its potential to restore the soil for improved crop yields – optimise tree density and management of this species this has been the topic of research in various institutions including ICRAF. Projects need to be informed by the results of this and other research on potentially useful tree species for Sahelian farming systems.

Target education partners – The SFLEI project has made an excellent start by working with local schools and teachers and Imams to promote the benefits of FMNR. Teachers and children, given appropriate support and incentives, can be effective actors in the struggle to change the way trees are valued on farms. Making teachers formal partners with a specified role in the project may be an option to explore. For example, they may be contracted to do additional FMNR outreach activities with children who are not in school.

Bring nomadic herders formally into the partnership – currently sedentary farmers try to ensure that the nomadic herders are informed about protected FMNR trees and areas. Finding a way to formalise their role in the protection of trees under the auspices of the project is worth exploring.

Advocate for a national approach endorsing and incentivising FMNR – e.g. using modern and traditional forms of outreach. Signage, advertising on radio and TV, newspaper, farmer visits, competitions and prizes, theatre. Advocate for development of bylaws to change the conditions around the rights to sale of pruned wood for FMNR farmers. Advocate for *Eaux et Forêt* for a major investment in FMNR given that they will take on the major role going forward.

Expand accompanying measures - Plan an expansion of accompanying measures that enabled women to use less firewood (e.g. improved stoves), earn more income to purchase firewood (e.g. small ruminant raising) and affordable technologies to replace wood as the major fuel source for cooking. Future project design and planning can be informed by experimentation in this SFLEI project.

Community based organisations - build more capacity at the level of community by organising community based organisations (CBOs) responsible for FMNR outreach, liaison with local partners and progress monitoring in each village location.

New learning approaches - among farmers and children, develop learning approaches that move beyond ‘see and copy’ into valuing and knowing how to research and conduct their own trials in agriculture. E.g. where to seek help and advice in the community, more widely in Senegal and in literature; and how to conduct and assess trials of new techniques or genetic stock without risking the farm.

Establish a community-located FMNR learning centre(s) - with Kaffrine now the lead location in Senegal for FMNR, it is appropriate to establish bases of experiential learning that bring in other farmers, officials and NGO staff from around Senegal and the wider West Africa and World Vision staff and participants from other ADPs. The facilities may be managed by local farming women and men, and lessons run by either or a combination of local community, WV and Waters and Forests Service. Such centres could form an additional stream of revenue generation into these communities. Exchange visits under an extension project may provide initial experience to learn how to refine the learning centre model.

7.2 Further research ideas

Scale of change - How big must a FMNR/NRM project be? A change in mind-set that challenges conventional practices (such as promoting trees on crop-land) probably requires a certain 'critical mass' or 'economy of scale' in project size. Community-wide movements generate faster adoption of new ideas than isolated innovators, who, by definition, go against a community's accepted wisdom.

The point at which the uptake and practice of FMNR reaches a 'critical mass' and becomes entrenched in local farming systems would be a useful topic for additional farming systems studies. In addition a historical study of farmers in Niger describing how they overcame the problems and prejudices associated with FMNR such as those identified in the SFLEI project would be useful. Their stories would have real currency among farmers and extension staff in Senegal about the potential of FMNR.

Faith as an agent of change - The project heavily engaged with Muslim and Christian leaders in the project areas, to motivate them as important change agents in the community. Project monitoring documents suggest they became very active in raising their congregations' consciousness about the spiritual obligation to be stewards of God's gifts of Creation. The effect they had on catalysing farmer households' commitment to environmental management approaches was not explored in the evaluation but is well worth exploring.

Effects on staple crop production - Whilst the ISRA field trials demonstrated that FMNR fields in the project produced more millet per hectare than non-FMNR fields, this research did not quantify the multiple nutrient and moisture effects. These include a reduction soil moisture evaporation due to shade, contribution of organic matter from leaf and berry drop and from livestock manure and urine deposits. Agroforestry and Conservation Agriculture research in Africa has quantified the effects of trees in agriculture including for species such as *F. albida*. An in-depth literature search and a formal literature review on this subject will complement the field trials within WV projects and is warranted in 2012.

8 Lessons Learned from the Evaluation Process

Evaluation reporting – this was a well resourced evaluation with a budget that enabled the hire of good local consultants to support qualitative and quantitative data collection. However the majority of analysis and all reporting was done by WVA evaluation lead. Due to many competing work tasks and the time consuming nature of data coding and analysis – there was a long delay in publication of the report. In retrospect additional budget to engage a consultant for the analysis and reporting would have been preferable.

Depth and reporting - It is almost impossible to incorporate transparent credible evidence and fulfil all of the LEAP priority areas and keep a report short, accessible and useful. There is no question that evaluators need to be accountable for their work and findings and so there are no shortcuts. However, each of these in-depth studies MUST be accompanied by a short, high quality summary tailored to different audiences – research and academic, donor, supporter and programmers in NOs and in SOs. This needs to be available in English and French and in the local languages to ensure access by farmers, CBOs and FBOs.

Pictorial evidence - Sometimes the simplest forms of evidence have the most impact on a report audience. In the case of FMNR – digital photographs taken at baseline should be GPS tagged and kept in project records. This needs to be repeated annually with a short interview with the landholder recorded to find out what has happened to the field in the previous year.

Budget for mapping services and satellite images - For more formal evidence it may be possible in some cases to obtain high resolution satellite imagery for areas with and without FMNR in the project region, and in some cases there will be ways to interpret these images that show an increase in tree density over time, and to link this information with Geographical Information Systems that also contain cropping data. This will be expensive but could be minimised by strategic partnering with research and education institutions, and formally linking with those who do this work in the region such as Mr Gray Tappin who works for the US geological survey.

9 References

Ndour B, Sarr A, Mbaye A, (2011) Projets Beysatol/SFLEI: *Rapport d'Activités*, Institut Senegalais de Recherche Agricoles, Decembre 2010, p.14-15

Garrity, D. (2011) Making Conservation Agriculture ever green. World Agroforestry Centre (ICRAF), Nairobi Kenya

ISRA (2012) *Etude comparative de l'effet Piliostigma reticulatum et de l'engrais minéral sur les rendements trois variétés de mil. Projets Beysatol/SFLEI rapport d'activités trimestriels (Octobre – Décembre 2011).* Institute Sénégalais de Recherches Agricoles

10 Appendices

Appendix 1 Cluster selection spreadsheet and data summary



SFLEI cluster
selection.xls



Resultats_complets
24 June 2011.xls

Appendix 2 Household survey tool



Questionnaire SFLEI
11 Juin FINAL.pdf



Guide de l'enquêteur
SFLEI.docx

Appendix 3 Group discussion and key informant interview tools



SFLEI Qualitative
question templates 1:



FMNR words
qualitative SFLEI.doc:

Appendix 4 Calculation of project cost of planted vs. naturally regenerated trees

By Peter Weston 2012

The project investment per live tree for planted trees was \$2.22.

The project investment per live tree grown via FMNR was \$1.44 by the end of the project. With ongoing spontaneous adoption of FMNR as a result of the project, this cost per tree is forecast to drop to \$0.36 after ten years from project inception (i.e. six years after project close).

The above cost figures include the cost of project management and project promotion and education.

The total number of live trees as a result of tree planting is 133,575, due to the low survival rate of just 15%.

The total number of FMNR trees by end of project was 264,654 spread over 9126 hectares. The number of trees is forecast to grow to 1,076,000 after ten years from project inception.

Calculations for these costs and forecasts used the following formulae:

FMNR Cost calculator			
# Ha. By end Yr 4	9,126		
Trees per Ha.	33		
Trees/Ha.at baseline	4		
Additional trees/ha.	29		
Total additional trees	264,654		
Cost of FMNR technical output	\$248,278	A	
Cost of all promotion	\$161,736	B	
Cost of all management	\$105,706	C	
Number of non-FMNR technical outputs	1	D	
Mgt and promotion cost per tech. output	\$133,721	E	
Total cost of FMNR project (A + E)	\$381,999		
			Pjt investment per hectare at end of project \$41.86
total Trees 1 year ex-post	351,990		Project investment per tree at end of projec \$1.44
total Trees 2 year ex-post	468,146	Yr 5	Project investment per tree 1 year ex-post \$1.09
total Trees 3 year ex-post	622,635	Yr 6	Project investment per tree 2 year ex-post \$0.82
total Trees 4 year ex-post	747,162	Yr 7	Project investment per tree 3 year ex-post \$0.61
total Trees 5 year ex-post	896,594	Yr 8	Project investment per tree 4 year ex-post \$0.51
total Trees 6 year ex-post	1,075,913	Yr 9	Project investment per tree 5 year ex-post \$0.43
(i.e. Year 10 for a 4 year project)		Yr 10	Project investment per tree 6 year ex-post \$0.36
Assumes a spontaneous uptake of 33% per year in first 3 years, then 20% after that			
Spontaneous uptake is a combination of farmers increasing tree density plus new fields coming under FMNR			

Tree planting Cost calculator			
Trees planted	890,498		
Survival Rate	0.15		
Total trees	133,575		
Cost of tree planting technical output	\$163,438	A	
Cost of all promotion	\$161,736	B	
Cost of all management	\$105,706	C	
Number of non-planting technical output	1	D	
Mgt and promotion cost per tech. output	\$133,721	E	
Total cost of planting project (A + E)	\$297,159		
Investment per living tree at end of proje		\$2.22	
Value is fixed over time as the hypothesis is that no further tree planting will occur spontaneously in the absence of the project and project sponsored nurseries.			

